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Summary

Training and support material (O2.1/A1.1) contains guidelines and support materials for covering users' needs (presentations, online materials and tutorials) created in 4 different languages (EN, GR, FR, RO) available in conventional and electronic format.

1. Introduction to VISTE

Spatial thinking is a blending of knowledge and skills that supports people in identifying, interpreting and visualizing location, distance, movement, change patterns and trends through space. For VI students access to the geographic world is limited and the environment they are able to perceive has relatively few, unique location clues. Spatial thinking is considered as a critical compensatory skill for VI students to foster their mobility and independence, as well as their academic progress in curriculum subjects. Therefore, spatial thinking constitutes a crucial skill both for sighted and VI students and presents an excellent case for cultivating collaborative learning of sighted and VI students across different subject, grade level, curricula and learning scenarios.

VISTE is addressing to the unique needs of VI students in enhancing their spatial skills and it is cultivating these skills within collaborative activities with sighted students to foster inclusion within mainstream education.

VISTE provides an innovative methodological framework, a technical infrastructure (in terms of an educational platform and augmentative reality tool), and a knowledge infrastructure (in terms of resources, educational scenarios and learning activities) to support teaching spatial thinking in collaborative, inclusive settings.

The VISTE project proposes a methodological approach that will support learners (sighted and VI students and teachers) to apply spatial thinking and purposefully address spatial concepts, across all curricular areas and at any developmental level. This approach will help them grasp the interdisciplinary character of fundamental spatial concepts to facilitate inclusion.

2. Visually impaired population in Europe

The European Blind Union (EBU) estimates that there are over 30 million blind and partially sighted persons in continental Europe[1]. This translates that almost 3.5% of Europeans experience any kind of sight loss.

On the other hand, the World Health Organization (WHO)[2] estimates, in figures dating from 2010, that in Europe there are: 2,550,000 blind people and 23,800,000 low vision people, resulting to 26,350,000 visually impaired individuals.

2.1. What is VI?

European countries have different registration criteria of what constitutes blindness and partial sight. The term "visual impaired' indicates blind plus partially sighted people together. Criteria used by ophthalmologists constitute the following[3]:

- A person is registered blind if they can only read the top letter of the optician's eye chart from three meters or less.
- A person can register as partially sighted if they can only read the top letter of the chart from six meters or less.

Sight loss can affect any kind of people regardless of background, education and social status. People experience this disability in a unique way; however, support, rehabilitation, prevention mechanisms, social benefit system and above all **education** can make dealing with sight loss easier.

There is commonality in the impact that vision loss has on the ability of the child to participate within the educational environment. Vision is a distance receptor allowing the child to access visual information beyond arms' length. Without this information, children are not able to organize their environment or develop concepts that are important in understanding how things are connected in their world. Students who are blind or visually impaired need to access this information through direct experiences and hands-on, tactile exploration provided by a qualified professional who understands the significance of and strategies for addressing these unique needs.

Accessing mandatory curriculum that is presented to all students in a public school classroom is problematic for students with visual impairment (VI) or blindness. In order to participate fully within this educational environment, students who are blind or visually impaired require instruction in disability-specific or compensatory skills such as Braille literacy skills, assistive technology skills, use of low vision devices, career and life management skills, social interaction skills, independent living and personal management skills and orientation and mobility skills. This disability-specific

[1] http://www.euroblind.org/resources/information/
[2] http://www.who.int/en/
[3] These definitions are approved and used by the WHO.

curriculum for children and youth who are blind or visually impaired is known as the Expanded Core Curriculum[4,5].

3. Education of students with VI

The trend in Europe, regarding education of children with VI, over the last 30 years, has indicated a shift from special schools towards inclusive education in mainstream schools, with many European countries showing success in this endeavor of adopting and promoting inclusive educational approaches[6].

For UNESCO, inclusion is a human right. It is "a dynamic approach of responding positively to pupil diversity and of seeing individual differences not as problems, but as opportunities for enriching learning (…). All children and young people of the world, with their individual strengths and weaknesses, with their hopes and expectations, have the right to education. It is not our education systems that have a right to certain types of children. Therefore, it is the school system of a country that must be adjusted to meet the needs of all children"[7].

The premise behind inclusion is that students with any kind of VI have the same academic and developmental goals as sighted ones. Nonetheless, their education differs in the following:

- Students with VI may require materials in an alternative format, such as Braille or enlarged print, and adaptive equipment, such as a talking computer or a magnification device.
- In addition to the subjects in the regular curriculum, students with VI master specialized skills, such as Braille reading, cane travel (orientation and mobility or O&M), and the use of adaptive technology[8].

Furthermore, the European Disability Forum (EDF)[9] declares that persons with disabilities have the right to receive education of the same quality as any other person, in an environment that takes into account their needs. To this end, many European countries started to consider reforms in education, rehabilitation and social services provided for students with VI towards inclusion.

To change the system and ensure inclusion in mainstream schools, EU started to implement strategies for changing the status of educational systems of the member countries. Salamanca Declaration and the framework for action adopted in 1994 provided a good starting point by stating that inclusive education means that the

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[4] Hatlen, P.H. ,1996, Core curriculum for blind and visually impaired children and youths, including those with additional impairments. Austin, TX: Texas School for the Blind and Visually Impaired.

[5] Koenig, A. J., & Holbrook, M. C., 2000, Foundations of education: Instructional strategies for teaching children and youth with visual impairments. (2nd ed.). New York: American Foundation for the Blind

[6] P. Rodney, Does inclusion of visually impaired students work? http://www.icevi-europe.org/enletter/issue48-07.pdf

[7] UNESCO, 1994, The Salamanca Statement On Principles, Policy And Practice In Special Needs Education, http://www.ecdgroup.com/download/gn1ssfai.pdf

[8] C. Castellano, A Brief Look At The Education Of Blind Children, *Future Reflections*, Spring/Summer 2004, https://nfb.org/Images/nfb/Publications/fr/fr13/fr04ss07.htm

[9] http://www.edf-feph.org/

school must and can provide a good education to all pupils irrespective of their varying abilities, the school is also the opportunity to educate all children on human rights and respect for all. According to it, “regular schools with inclusive orientation are the most effective means of combating discrimination, creating welcoming communities, building an inclusive society and achieving education for all[10].”

Every school has to be prepared to fulfill the need and particularities of every visually impaired child. Similar to the targets set by the American Foundation for the Blind, education systems in Europe must prepare specific strategies to[11]:

- Support a full array of options to ensure appropriate placement for all students. These options must include residential and special schools, as well as special classes, resource rooms, and itinerant teaching services in regular education classes.
- Provide sufficient funding to prepare an adequate number of teachers in all educational settings who are qualified to provide the specialized communication, literacy, academic, mobility, daily living, social, and career education skills that visually impaired children need.
- Provide access to the latest technology so every blind or visually impaired student benefits from computer-based educational programs, such as those delivered via the Internet or multimedia educational software.
- Ensure that parents and families of children who are blind or visually impaired are provided with the information they need to determine the best educational option(s) for their child

Inclusive education involves changes and modifications in resources approach, content, approaches, structures and strategies, with a responsibility based on the conviction that it is the responsibility of the regular system to educate all children. The development of inclusive education is a process, which requires that enabling conditions are established and that specific requirements of blind and partially sighted pupils and students are identified.

In most of these countries the educational opportunities for children with VI still reside predominantly in residential special schools and resource bases, but these specialist settings have a key role in promoting and facilitating the changes that inclusive practice requires. Ironically, special schools are key players in promoting the inclusion of children with visual impairment in local schools, and releasing their expertise is their great challenge.

In what follows, details on several European countries concerning the situation of educational practices, services, and approaches regarding children with VI are given. In Annex I, additional information can be found.

[10] UNESCO, 1994, The Salamanca Statement…, Art. 2.

[11] American Foundation for the Blind, Specialized Education Services for Students with Vision Loss, http://www.afb.org/info/programs-and-services/public-policy-center/specialized-services/specialized-education-services-for-students-with-vision-loss/1235

3.1. Education of students with VI in France

The schooling and rehabilitation of visually impaired children in France has been undertaken for a long time by specialized institutions often in the form of boarding schools. In the last few decades, there has been a shift towards the ordinary system of schooling so that children enroll in mainstream schools.

The law of February 11, 2005, "for equal rights and opportunities, for the participation and the citizenship of people with disabilities" gave responsibility for the schooling of all disabled children to the services of the Ministry of National Education. The underlying principle was that any child or adolescent with disability must be able to attend the school nearest to their place of residence. If special organization is needed, which does not exist in the vicinity, the pupil can be registered in another school, whether mainstream or special.

As a result, a single centre was established: the departmental house for disabled people (Maison Départementale des Personnes Handicapées –MDPH) which offers centralized access to the rights and services planned for disabled people. For children with VI, the plan of compensation is discussed within the MDPH and with the family of the child. Thus, the parents play an important part in the development of the personal plan of compensation and in the choice of the institution or service which will help them.

The schooling of visually impaired children

When children are 3 years old, they can enroll to the nursery school. To meet the particular needs of disabled pupils, a personal project of schooling is developed, with measures of support decided by the Commission for Rights and Autonomy (C.D.A.), such as, support from a specialist service, assistance from a school auxiliary etc.

When in elementary school (at 6 years of age), school integration can be individual or collective:

- Individual schooling consists of providing education for disabled pupils in an ordinary class. At all levels of teaching, individual schooling is the first requirement.
- Collective schooling: consists of including in an ordinary school a special class with a limited number (in general 10 to 12) of visually impaired pupils, who pupils receive adapted teaching and share some activities with the other pupils.

At the secondary level, when the requirements of an individual schooling are too large, pupils with a disability can be provided with schooling in an UPI (Unité Pédagogique d’Intégration). This system is provided for children from 12 to 16 years who are not able to profit from ordinary teaching. Taught by a specialist teacher, they can receive adapted teaching, which implements the objectives of the personal project of schooling, including as much as it is possible, participation in the activities of the class to which the child would have belonged. However, these collective classes do not exist in all French regions (départements). In such cases, the choice of a specialist institution is the only one available. Thus, the specialist institutions propose adapted schooling for the children or teenagers who cannot continue their schooling in the ordinary system.

Institutions and Services

In France, many institutions are spread out over the whole of the territory which in cases, can accommodate children or teenagers, can also provide schooling services in boarding or semi-boarding establishments, with initial or vocational training, for children with multiple disabilities.

In the majority of the French regions (départements), local services have been created to support the children and their families in their schooling and their everyday life such as SAFEP (Service d'Accompagnement Familial et d'Education Précoce) for children from 0 to 3 years old and SAAAIS (Service d'Aide à l'Acquisition de l'Autonomie et à l'Integration Scolaire) from 6 to 20.

3.2. Education of students with VI in Greece: Trends and prospects

Educational perspectives in Greece regarding the education of students with visual impairments (those who are blind and those with low vision) continue to show an upward tendency for inclusion. The models adopted for the inclusion of Greek blind students in primary and secondary regular schools are mainly two. The first model refers to the usage of resource rooms, which are located/ included in mainstream schools, while a special education teacher is responsible for the students with special needs who are enrolled in the resource rooms. The second one describes a context, which consists of two teachers in the same classroom: the general teacher and the special education teacher who is normally qualified in issues pertinent to special education. The theoretical perspectives of the latter model are underpinned by the notion of co-teaching or team-teaching, a teaching model that occurs when two or more professionals collaborate to plan, decide, and deliver instruction to a certain number of students in the same physical place. This model is also called "parallel support"[12] model and has become dominant among the current educational reformations regarding the education of students with visual impairment in Greece. Therefore, special education practices are moving from special schools into the regular/ ordinary ones through an approach known as "mainstreaming", "integration", "inclusion", or "co-education".

Schools and local educational authorities have to undertake responsibilities in order to establish well-accepted educational settings for all students with principles such as "the chance to be equal and the right to be different". Essentially, the main challenge for inclusive education is that in order to achieve its goals it must be accompanied by changes regarding school and class management, curriculum and teaching strategies.

Educational Overviews – Trends and Contemporary educational issues

Inclusion for students with visual impairment in Greece is the result of much effort the last twenty years. This relatively new educational situation was implemented by European programs such as "Helios" I & II with the support of pioneer teachers and today it is expanding progressively in every place of Greece where students with partial or total loss of sight live.

[12] With the notion "Parallel support" we mean two teachers in one class; one for the student with special educational needs and one for the other students.

The number of special schools, which up to now constituted the pillar of special education, is progressively decreasing; the students who are enrolled in the special educational settings are persons with multiple disabilities.

Education in Greece is compulsory for all children from 6 to 15 years old; namely, it comprises Primary and Lower Secondary Education. The school life of students, however, can start optionally from the age of 2.5 years (pre-school education) in infant schools/ crèches (private and public). Children are usually enrolled at Primary Education at the age of 6. Apart from the regular kindergartens and Primary schools, there are also, all-day primary schools, which have an extended timetable and an enriched Curriculum[13]. Post-compulsory Secondary Education, according to the reform of 1997, consists of two school types: Unified Upper Secondary Schools (Lyceum) and the Technical Vocational Educational Schools (TVES). Along with the mainstream schools of Primary and Secondary Education, Special kindergartens, Primary, High school, Lyceum and upper secondary classes are in operation, which admit students with special educational needs. Data from the Ministry of Education (Table 1) shows that despite the fact that the number of special schools for students with sensory disabilities is progressively decreasing, year by year more children with disabilities, who were not able to attend school in the interim, are now studying in one of the existent special educational frameworks.

In many mainstream schools, as mentioned in the introduction, there are resource rooms located in the general schools and operate as tutorial classes for students with special learning difficulties and mental disabilities. These students attend a corpus of courses in these resource rooms and other courses in the regular classrooms.

Recently, the co-teaching model (or the ‘parallel support model’) is gaining ground. A co-teaching model allows general and special education teachers to share their skills and knowledge, to face difficulties and solve problems together enabling them in such a way to respond more effectively to the diverse needs of their students, facilitate their access to learning[14,15] and as such promote “inclusive thinking”.

In total, there are five special primary schools for students who have visual impairment, spreading across the country in relatively big cities. As a result, the students who live in these cities have the opportunity to attend at a mainstream setting or at a special school whereas, for students that live in other parts of Greece, inclusion is the only way for their education. The two special schools, which are located in Athens and Thessalonica, are also boarding schools and some students live in during the school term. However, this is not the case for those who live in provinces, but when the conditions of inclusion are poor, families and children themselves become very frustrated, and in the end, they decide to move in the two cities to attend the special school.

What follows, is an account of the main characteristics of the two educational settings within which the children with visual impairment attend in Greece.

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[13] Information from the official web page of the Greek Ministry of National Education and Religious Affairs www.ypepth.gr

[14] Argyropoulos, V. & Stamouli, M. (2006). A Collaborative action research project in an inclusive setting: assisting a blind student. *The British Journal of Visual Impairment*, 24 (3), 128-134.

[15] Jiménez-Sánchez, C. & Antia, S. (1999). Team-teaching in an integrated classroom: Perceptions of deaf and hearing teachers. *Journal of Deaf Studies and Deaf Education*, 4, 3, 215-224.

Special School Environment vs. Inclusive Environment

The conceptual frameworks of the two educational settings provide distinct theoretical underpinnings. Specifically, the framework of a special school is focused on the individual who has the disability whereas; the framework of an inclusive setting is focused mainly on the environment and the interactions between the individual and its environment[16].

The interpretations on educational issues differ because they depend on different theoretical perspectives. For the special school many problems may have roots in the individual's characteristics while from an "inclusive perspective" the roots of the problems are most likely embedded in the environment.

The factors that influence students' cognitive and psychological development in both educational settings are:

- The Curriculum
- The teacher
    - Instructive environment
    - Teaching methods
    - Social interaction
    - Instructive – teaching aids
- The learning environment

The Curriculum

The curriculum in an inclusive environment for a student who is blind or partially sighted is the same with that for sighted students without any adaptation. In special schools for the blind and visually impaired, an expanded curriculum is applied with significant support provided by psychologists and special auxiliary personnel, which includes the following extra subjects:

- The Education of Mobility of Orientation and everyday living skills
- Occupational therapy
- Physiotherapy
- Specifically adapted gymnastic
- Health Education

The teacher

Pre-primary and primary school teachers are degree holders from a four-year university-level course, primarily from Pedagogic Schools. Lower and upper secondary education teachers hold university degrees in their specialist subject and take an introductory teacher-naming course upon appointment.

In special schools, both teachers and special educational personnel are usually qualified or highly experienced. According to the law N. 3699/2008 it is prerequisite for someone to know the Braille code in order to teach.

In regular schools, when there is no vacancy for specialized staff, supply teachers are usually appointed. For example, when a special education teacher is placed in a school in order to support students with learning or sensory disabilities, this does not presuppose that he has experience in teaching Braille code. Thus, if there is a need to

[16] UNESCO (2005) Guidelines for Inclusion: Ensuring Access to Education for All. PARIS

support a blind pupil, the teacher is not efficient. The same holds for all the other specialties such as English teachers, musicians, gymnasts.

With regard to Secondary education, the situation is worse, unpleasant and unsatisfactory making students and their educators very frustrated. Not until recently, a small number of specialized teachers have been appointed to Secondary Education but the needs are numerous.

From 2000 onwards, in every educational region in Greece, Diagnosis-Evaluation-Support Centers (KEDDY) for students with SEN have been established. These are responsible for screening students and recommending the most appropriate program for them. The teachers and counsellors of these Centres must also provide a range of specialized support services for the students and the school units. However, the great need for responding to the current demands of the population of the students with special needs have resulted in hampering the Centers' operation because of the large number of applications for evaluation of special learning difficulties.

The learning environment

One of the most important advantages of an inclusive educational setting is the social interaction between blind students and sighted ones, which would entail:

- Mutual Acceptance
- For sighted students, an understanding of the restrictions that visual disability imposes on the students and to understand the possibilities they have and an acknowledgment of the educational chances that the blind or visually impaired students have in the school environment.
- An understanding of the notion of equity and differentiation in the school environment.

The Special school for the Blind in Athens collaborates with two neighboring regular schools, by suggesting to some students to attend classes in regular schools with the support of a special education teacher (model of "parallel support"). The up to now experience has shown us that the achievement of the aims of inclusion depends on how severe the visual problem is and on the idiosyncrasy of the person as well. Most students who are included in regular schools are usually socially isolated. For example, during breaks in school, students who are visually impaired are usually alone without participating in activities such as football, basketball, hide-and-seek and so on. This situation however, does not happen only in primary schools, it also happens in secondary schools and this is one of the reasons that students with visual impairments request the establishment of a special High school and Lyceum for the blind.

With regard to teaching aids and assistive technology, special schools have better assistive equipment since it is used on a regular basis. On the contrary, students who are visually impaired and are enrolled in regular schools do not often use assistive technology. This situation has resulted in restrictions of government funds regarding the equipment that a regular school needs to support a student with visual impairment.

Another important issue that influences significantly the education of the Greek blind students is the lack of Braille textbooks. Recently, all the textbooks of primary and secondary education have been changed. However, not all of them have yet been transcribed into the Braille code. The problem is bigger for the students who study in an inclusive educational setting than for the ones in special schools who can still use their old books until the new ones are transcribed into the Braille code.

Conclusions

Taking into consideration the above, it is argued that a blind or visually impaired student, who is studying in an inclusive educational setting, acquires the same academic knowledge with a student of a special school, but the former may be deprived of the opportunity to acquire basic dexterities through a developmental and complementary curriculum.

In contrast, students who attend a special school acquire a big range of skills apart from the academic skills such as:

- Learning of orientation, mobility and everyday living skills that will render them independent in their life.
- Rehabilitation and acquisition of various dexterities of haptic and acoustic perception via intentional activities, which help the student in the school and social adaptation.
- Improvement of the gross and subtle mobility
- Exploitation of functional vision
- Sensitization of touch and
- Dexterities that concern the use of specialized assistive technology.

The achievement of all these needs is accomplished with the guidance of specialized educational personnel that works in special schools. On the other hand, teachers who work in an inclusive framework do not usually know the Braille code and they are deprived of training and experience. Students also do not have the support of specialized educational personnel and an interdisciplinary approach in sectors that are too important for them.

The instructional methods that are applied today in regular schools as well the teaching aids, which are used, do not allow the satisfaction of particular educational needs, which are determined by the nature of the students' disability.

After the above reconnaissance of the contemporary education of the blind students, it is argued that, on one hand, there are special schools in Greece, which constitute a well-organized infrastructure that corresponds so far satisfactorily to the particular educational needs of the students who are visually impaired. On the other hand, inclusive educational settings are functioning, within which student and teacher are facing a great number of difficulties; that is, no adapted curriculum, lack of supporting means and special teaching aids, insufficient training, absence of interdisciplinary teams and in most cases isolation from social/ recreational activities.

3.3. Education of students with VI in Romania[17]

In Romania, children with visual impairments receive educational services from residential and special schools specifically designed for children who are blind or partially sighted and multiply disabled, special classes, resource rooms, and itinerant teaching services in regular education classrooms within the child's community.

Based on the individual needs of the child as well as input from parents and educators, specialized schools or classes are appropriate educational options for certain students. Specialized schools also frequently provide outreach support and technical assistance to public schools in their respective areas.

Furthermore, the perception still exists that residential and special schools for blind and visually impaired students are too costly, or worse, unnecessary. This fallacy persists despite that education experts who work with VI students and MDVI students agree that special schools are the best environment for some children who are not able to face the core curriculum, or cannot adapt to regular classes, and that not all mainstream schools are ready to fulfill all the VI or MDVI child's needs or particularities.

Whereas a child's neighborhood school may be the most integrated, mainstream environment, frequently such schools cannot or will not provide the full array of services and skills training that the child with VI needs. A mainstream school in Romania does not have enough specialists to work with the students with visual impairment. Lack of specialists is doubled by the lack of services and the minimum of materials, tools and instruments used to cover VI students' needs. Moreover, resources for VI students in inclusive education system are limited. That is the situation in big and developed cities. In small cities in the country, services for VI students from the inclusive education system are missing. That is why specialized schools for children with vision loss may be the best choice at the moment for a child to both receive all necessary educational services, and to interact regularly with student peers on terms of genuine equality.

The education process in Romania started to change over last 15 years. The Romanian Government and local authorities were forced to assure the necessary conditions for the education of all children. In the last years, reforms in education took into account children with disabilities and/ or those who are at risk. For these children, the Ministry of Education and Scientific Research developed and realized projects/ programs on their education. Such programs are "Second Chance", "Access to education for disadvantaged groups", "Along the same school", "National Strategy Community Action".

Providing equal access to all individuals with disabilities is the key element of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992. Access involves much more than providing ramps. Access is also the key element of inclusion, which involves much more than placement in a particular setting. The relationship of access and inclusion may not be obvious to individuals who are not familiar with the

[17] Synthesis Report of Chapter 8; Romania, in Education Policies for Students at Risk and those with Disabilities in South Eastern Europe: Bosnia Herzegovina, Bulgaria, Croatia, Kosovo, FYR of Macedonia, Moldova, Montenegro, Romania and Serbia - https://www.oecd.org/edu/school/38614298.pdf

educational and social impact of a vision loss. Placing a student with a visual impairment in a regular classroom does not, necessarily, provide access and the student is not, necessarily, included. A student with a visual impairment, who does not have access to social and physical information because of the impairment, is not included, regardless of the physical setting. Students with visual impairments will not be included unless specially trained personnel in appropriate environments address their unique educational needs for access and unless these students are provided with equal access to core and specialized curricula through appropriate specialized books, materials and equipment.

The EU promotes active inclusion and full participation of disabled people in the society, in line with the EU human rights approach to disability issues[18]. Disability is a rights' issue and not a matter of discretion. This approach is also at the core of the UN Convention on the Rights of People with Disabilities (UNCRPD), to which the EU is a signatory.

The education system for visually impaired students is starting to change once with the national policy of integration and stimulation of the inclusion process according to the European Commission's European Disability Strategy 2010-2020, adopted in 2010, built on the UNCRPD and takes into account the experience of the Disability Action Plan (2004-2010).

In 2011, the EU ratified the UN Convention on the Rights of Persons with Disabilities (UNCRPD). This addresses disability as a human rights issue – not from a medical or charity perspective. It covers civil, political, economic, social and cultural rights, and a wide range of policy fields: from justice to transport, employment to information technology, and so on. Article 9 of the Convention contains the obligations for State Parties on accessibility to ensure to persons with disabilities access on an equal basis with others.

All Member States have signed the Convention and 25 have ratified it. Finland, Ireland and the Netherlands are preparing for ratification. This means that the EU, as well as those Member States that are parties to it, are committed to uphold and protect the rights of persons with disabilities as enshrined in the UN Convention, within their respective competences.

The United Nations Convention on the Rights of Persons with Disabilities document was ratified by the Romanian Parliament in 2010, and recognizes the right of persons with disabilities to live independently in the community and obliges States Parties to take measures to ensure that those persons living conditions in equal with others. Under the Convention, the country is obliged to recognize the equal right of all persons with disabilities to live in the community on an equal footing with the others. The National Authority for People with Disabilities (Autoritatea Naţională pentru Persoanele cu Dizabilităţi[19]) was the invested mechanism for coordinating the implementation of the Convention on the Rights of Persons with Disabilities.

The Romanian Government adopted on September 2016, the National Strategy ''A society without barriers for people with disabilities'' for the period 2016-2020 and Operational Plan, addressed to over 752 000 people with disabilities. According to the strategy, the Romanian Government will stimulate active participation of people with

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[18] Persons with disabilities, http://ec.europa.eu/social/main.jsp?catId=1137&langId=en

[19] http://anpd.gov.ro/web/

disabilities in the community through increased accessibility to the physical environment, information and communications, the quality of social services and through better monitoring of respect for their rights.

Also, in 2016 the Romanian Government approved the program of national interest in protecting and promoting the rights of persons with disabilities "Establishment of type social services day care centers, respite/ crisis centers and protected dwellings to deinstitutionalization of people with disabilities in institutions and prevent institutionalization of people with disabilities in the community". The program aims to develop network-based service, day centers, rescues centers and protected housing for adults with disabilities to achieve institutional transition from the current system of social protection, to one based on services included in the community

Currently, in Romania, the institutional system of social protection is still predominant and approximately 2.5% of all people with disabilities lives in a public residential institution from the social system care for people with disabilities. To this end, there are a total of 260 centers for adults and 90 classical foster homes or modulated for children with disabilities. This program is expected to increase housing protected by 75, increasing to 76 daycare centers, increasing the number of respite rescue centers to 8. Social services that will be newly created shall be located to allow user access to all resources and facilities of health, education, employment, culture, leisure, and social relationships. Regarding the inclusive education system in Romania there is a constant preoccupation for the development of services and methods so the school offers adequate educational scenarios and learning settings and teachers use the best practices so students with visual impairment develop spatial thinking abilities.

Software used by students with VI in Romania

To compensate for the lack of hardware devices such as Braille printers and Braille displays, equipment, which is not affordable because of the high prices, combined with the lack of a governmental program targeted to the acquisition of accessibility technologies, students use a wide area of software programs.

The desktop environment

People with VI use two major types of software that enable them to efficiently operate a computer. First, there is a special software program called screen-reader that transforms textual information from the computer screen into voice or Braille. A screen reader can read the menus, the document text or the links from a webpage and send it to the user in audio or in Braille. In order to transform the information into Braille the user's computer needs to have attached a special device called a Braille display, which can output the text as Braille characters by means of some very fine electromagnetic cells. Nonetheless, such a device is very expensive; few people in Romania afford it, most of them get hold of it through different sources of funding. The other, more common way in which a screen reader can send information to a blind user is the auditory way, by means of a special program called a software synthesizer or software synthetic voice. Most of these synthesizers are, large databases of sounds associated with syllables or word fragments. Thus, the computer can, read aloud the textual information presented on the screen.

The wide majority of students with VI in Romania use Microsoft Windows as an operating system and Freedom Scientific Jaws as a screen reader for the desktop/laptop environment. In this way, they can perform day-to-day tasks such as reading emails, writing Word documents, listening to music or searching for information online. In special schools such as the High School for Visually impaired in Cluj, students are taught to use the keyboard and to perform small tasks with a computer running Jaws screen reader software.

The first computers that used Jaws in Romania, around 2000, were equipped with a software synthesizer called WinTalker Voice, which included a robotic Romanian voice that was widely used until around 2008, being the only Romanian synthetic voice available in the market at the time. Since 2008, more companies tried to build Romanian synthetic voices, not especially for VI users but also for other talking software such as GPS apps and devices. Nowadays, only Ioana[20] is available on all the major platforms and devices.

Another screen reader software developed by the open source community and available free of charge to desktop users is Non Visual Desktop Access[21] which provides a good alternative to Jaws. One major advantage of this screen reader, alongside the price criteria, consists in the fact that it uses less computer resources and it is able to run very well on slower computers. Being a free screen reader NVDA includes voices from the eSpeak synthesizer, which are rather robotic, but compensating by a high accuracy of speech. Users can also purchase the Ioana voice synthesizer and add it to NVDA.

Mobile devices

The fast development of smart mobile devices in the latest years turned out to be a real advantage for users with VI.

The first mobile operating system that used a screen reader was Symbian OS used on smartphones produced by Nokia. At that time (the first decade of the 21st century) for the first time, blind users could experience the full features of a mobile phone assisted by voice. They could add or edit phonebook numbers, use a music player and even browse the web on a mobile device. The screen reading software used on Symbian called Talks was powerful giving access to all the phone's features. Talks did not come free of charge and there was no Romanian voice available at that time.

To date, the most powerful and accessible smartphone for blind users is now the iPhone which has a built in powerful screen reader called Voice Over. The main advantage is that it comes with voices preinstalled for all major languages, including Romanian so it is very easy for a VI user to enable accessibility features on any iPhone without the need for installing additional software. Almost all iPhone apps are accessible for VI users who benefit from the ease of use and full accessibility of its operating system. A small drawback for Romanian users is the fact that Siri, the voice assistant on Apple devices does not have the Romanian language included yet but there are more and more rumors that Romanian will be added to Siri in future versions of the iOS operating system. In addition, the price issue comes into discussion when talking about iPhones, which are high priced, compared to other smartphones. Not all of blind people in Romania can afford then but the ones who use them are very pleased in general. Other products from Apple that use the same operating system

[20] http://harposoftware.com/en/romanian/241-Ioana-Nuance-Voice.html

[21] http://www.nvaccess.org/

are also accessible for blind users: the iMac – the Apple computer series - the iPod, the iPad and even iWatch has a screen reader included with the same characteristics.

On the other hand, Android phones are a good alternative to iPhone when it comes to accessibility for blind users. Although Android was not very accessible until the 4.1 version, in the latest editions of its operating system Google fixed a lot of things and the screen reader from Android phones is more and more powerful. Talkback, the android screen reader comes with voices for all the major languages. The Romanian voice Ioana is not available by default but it can be purchased for a small fee. Many of the apps on Android phones are accessible for blind users via talkback. Android phones have decent prices ranging from 50€ to 1000€ and more; usually a blind person needs a good android phone because the screen reading software uses a quota of extra resources. A major advantage of the Android phones is the fact that the user can widely customize it, even install alternative variants of the operating system for more experienced users, and the wide variety of applications available in the play store.

The development of mobile devices encouraged students with VI to use them in a wide area of orientation and mobility related tasks, like GPS navigation, space orientation and identifying addresses on the street, the availability of bus schedules, and so on. There are blind people that even have the courage to listen to a book read by the phone while walking on the street, especially on well-known areas of the town.

Online services

Because of the development of accessible computer technologies users with VI are more and more oriented towards using online services, like Facebook, YouTube, and Skype but also services dedicated to their special needs like GPS apps and online libraries.

The Romanian Association of the Blind [22] has made available online for its members an audio book library, which was recorded first on audio tape and then digitized in mp3 format. Users can download their favorite audio book and listen to it on their preferred device (mp3 audio or computer).

Another NGO from Romania, the Pontes association[23] developed an online library of scanned books that are available to blind users in electronic document formats. Users can search and download books and can even contribute their own books to the library. A volunteer keeps everything in place and organizes the books on various sections. There are also labels regarding the content of the book and the scan quality. Now there are over 23.000 books available for download organized in 3 major sections based on their language: Romanian, English and French. Any blind person can apply for an account to this library by proving that he/she has a sight problem. Similar to the library, the same NGO has an online collection of theatre plays recorded mainly from the national radio station by volunteers and available online for listening and downloading by blind users

Another nice initiative is the Tandem Navigator project implemented by the Tandem Association; a small NGO from Bucharest, which made a GPS-based orientation and mobility app guiding blind users on the street from a mobile phone running Android or iOS operating systems. This application allows users to create and

[22] http://www.anvr.ro/

[23] http://pontes.ro/en/index.php

share their own routes and points of interest with other users, thus encouraging other users to find addresses or go from one point to the other in the city.

4. Education of students with visual impairment regarding spatial thinking and inclusion

When we relate spatial thinking and education strategies to enhance spatial thinking of VI students it is important to consider that spatial thinking is developed within regular classes: Math, Literacy, Geography, Science, History, Biology, but also thought specialize services or therapies for VI students like Orientation and Mobility therapy.

Through spatial thinking, students will be able to acquire knowledge that is necessary in deciphering real or abstract problem in school activities, and everyday life in general. Spatial thinking is a multi-dimensional, transversal ability that cross-cuts several subjects and grade levels and can be cultivated through formal education with substantial results. Spatial thinking is not a single ability; it is a blending of knowledge and skills, it supports people in identifying, interpreting, and visualizing location, distance, relationships, movement, change, patterns, and trends through space.

How VI students move every day, the way they interact with the environment, how they adapt and solve everyday problems depends mostly on spatial thinking. The way in which spatial thinking of VI students is developed and stimulated depends on the activities taking place in the family, and especially in schools, in educational activities or extracurricular activities. General competences that are pursued in primary and secondary classes related to learning competencies that can develop spatial learning of VI students are:

- Use numbers in elementary computations;
- Highlight the geometrical properties of objects located in the surrounding area;
- Identification of phenomena/ relationships/regular structures/ patterns in the immediate environment;
- Generate simple explanations by using logic elements;
- Solve problems from sorting and representation of data;
- Use of conventional standards for measurements and estimates;
- Orientation and movement in space relative to benchmarks/ directions specified using phrases such as: in, on, over, under, beside, in front, behind, above, below, left, right, horizontal, vertical, oblique;
- Locate objects by setting coordinates in relation to a given reference system using phrases;
- Identification of plane geometric shapes (square, triangle, rectangle, circle) and some geometric solids (cube, cuboids', sphere) in children and manipulated objects in the environment;
- Recognition of geometric figures and objects in the immediate environment and flat representations (including drawings, reproductions of art, schematic);

- Highlight some specific features simple geometric forms and planar geometric bodies identified in different contexts;
- Explore the characteristics of objects, phenomenon and processes, environment investigation using specific tools and processes;
- Solve everyday purchases capitalizing on their bodies and the environment;
- Presentation of observable reality, using general and specific terminology;
- Use the significant elements of mathematics, natural sciences and social disciplines in understanding the surrounding reality;
- Set-up the surrounding reality with its cartographic representation;
- Develop interest in knowing the local horizon, country, and contemporary world.

Specific educational activities for enhancing spatial thinking of VI students – regular activities according to the core curriculum

The following activities help VI students to understand, conceptualize, and develop the concepts of space such as:

- Space, space-time, object/field, place;
- Primitives of identity: [object, container, boundary, shape, texture];
- Primitive spatial relations: static [location (distance, direction, distribution); connection]; dynamic [motion, flow, force, intersection/collision.

Orientation and mobility (O&M)[24]

Movement is a building block for learning. As a child explores his world and has physical contact with it, learning takes place. Developing O&M skills should begin in infancy starting with basic body awareness and movement. O&M has frequently been described as "knowing where you are, knowing where you want to go, and knowing how to get there".

Orientation and mobility training (O&M) helps children with VI know where they are in space and where they want to go (orientation). It also enables them to carry out a plan to get there (mobility). O&M training encourages students with VI to develop essential skills, build confidence in their ability to travel, and take responsibility for their decisions. O&M training began after World War II when to help veterans who had been blinded. In the 1960s, universities started training programs for O&M Specialists. In the 1980s, the benefit of providing O&M services to preschool-aged children was recognized. Nowadays, O&M specialists have developed strategies and approaches so that O&M training may begin in infancy. When planning an O&M program for children the focus of training may include such things as:

- sensory awareness: gaining information about the world through hearing, smell, touch and proprioception[25]
- spatial concepts: realizing that objects exist even if not heard or felt, and understanding the relationships between objects in the environment

[24] C. Martinez, Orientation and Mobility Training: The Way to Go, Texas School for the Blind and Visually Impaired, See/ Hear, Fall 1998 ,Volume 3, Number 4, http://www.tsbvi.edu/seehear/fall98/waytogo.htm

[25] Meaning "one's own", "individual", to take or grasp, is the sense of the relative position of neighbouring parts of the body and strength of effort being employed in movement. https://en.wikipedia.org/wiki/Proprioception

- searching skills
- independent movement
- sighted guide
- protective techniques: specific skills which provide added protection in unfamiliar areas
- cane skills: use of various cane techniques to clear one's path or to locate objects along the way

The development of these skills allows students with VI to more fully participate in the life of the school and community. Most O&M skills are taught within the school setting, with the ultimate goal being the ability to travel independently in all environments. **O&M training has to be a part of the Individual Education Plan (I.E.P.) for every student with VI, including those with multiple disabilities**.

Sensory awareness

When vision is anyhow impaired, children must learn use their other senses more effectively. Systematic instruction is needed to develop the other senses so that they can be used for O&M purposes. Sensory stimuli (sounds, smells, and textures) may be permanent and others temporary. Children with VI need to learn to differentiate between the two and use the former as permanent markers (landmarks) and the latter as (clues).

Sounds, when clear visual information is absent, can be very confusing. Sighted people assume that sounds which get louder and louder are coming towards them because of their visual knowledge of the world. A child with a VI may not make the same assumption. Moreover, the ringing of the telephone may mean different things to a sighted person that to a person with VI. Persons with VI need help in learning to use their hearing to interpret the world around them. If their hearing is impaired even to a small degree, that task becomes much more difficult. Children need to learn to localize sounds and use sound clues for orientation, straight-line travel, and safety.

Though people may not be aware of it, much of the world is conceived through touch. However, touch alone may not be helpful in identifying an object if the whole object cannot be touched once. Developing the tactual sense will help children with VI ranging from finding a toy dropped on the floor to feeling the difference between the curb and the street with their cane.

Normally people do not pay much attention to smells unless they are extremely pleasant or offensive, but they might use that kind of information to help us know exactly where we are in certain environments. Smells can also serve as landmarks and clues for environmental awareness. No sighted persons use smell, especially combined with other clues and landmarks, to help them know where they are.

Joints and muscles give people feedback about where body parts are positioned. This constitutes the proprioceptive sense. Proprioceptors located in the muscles and joints tell us if we are bending or standing up straight, if our fingers are curled or extended, etc. The proprioceptive system and vision work closely together. Therefore, in case of any kind of VI, proprioception is also impacted. Children with VI generally need help to learn where their bodies are in space, and in relation to things in the environment. The physical and occupational therapists, along with the O&M specialist, can work directly with the child, and they may suggest specific activities for the family, so that children with VI develop the proprioceptive sense.

Independent movement

A primary goal of O&M training is to help each child with visual impairments achieve independent movement as much as possible. Most children with VI are capable of learning routes in familiar environments. They learn to use landmarks and clues to help them know where they are along a particular route. Independent movement is tied to progress in other areas, such as communication and socialization.

Spatial Concept Development

The importance of establishing a foundation of basic concepts is fundamental to O&M. The necessary basic concepts related to mobility are called **body concepts**. Concepts necessary for orientation are **spatial** such as **position, relation, shape, measurement, action** etc., and **environmental** such as **topography, texture, temperature** etc.

Body concepts include **body image** (a person's subjective experience of their own body), **body schema** (unconscious knowledge of the body), and **body awareness** (the knowledge the person has of their body). Body concepts can be divided into five components: **identification of body parts, body movement, body planes, laterality,** and **directionality**. For children with VI, it is particularly important to learn how body parts are positioned and how they relate to one another so that the concepts can be transferred to the external environment.

The knowledge of objects in space and their relationships to each other are essential for maintaining or regaining orientation. Once students with VI understand the body and body parts by developing a clear body image, they are then better prepared to explore the objects in the space around them. Other spatial concepts relate to **shape, measurement, actions,** and **movements**.

Human echolocation I

Human echolocation is the ability of humans to detect objects in their environment by sensing echoes from those objects. This ability is used by some people with VI to navigate within their environments. They create sounds themselves, either by tapping their canes, or by stomping their feet. By interpreting the sound waves reflected by nearby objects, a person trained to navigate by echolocation can accurately identify the location and sometimes size of nearby objects and not only use this information to steer around obstacles and travel from place to place, but also detect small movements relative to objects.

Many people with VI use echolocation unintentionally. The only thing that echolocation requires is some sort of sound. Many people with VI claim to receive information about their surroundings by tapping their cane on the ground. This tapping sound is something they become very familiar with and can be a very effective sound for echolocation.

The reason echolocation is taught using mouth clicks is simply because the sound emitted from mouth is very close to the ears, which means that the sound is basically travelling in a straight line out from the head and directly back to it. This helps to control the signal better and eliminate various sound reflections that may occur when the sound is emitted from other places, like snapping fingers or the tip of your cane.

Tactile maps

Persons with VI have the potential to acquire representations of space, and tactile maps can be an effective means of providing spatial information. Tactile maps can give a greater spatial understanding than a direct experience of moving through the environment or one supplemented with verbal explanation. Furthermore, they may form an essential component of O&M instruction[26]. Relevant information is presented clearly with relative simultaneity, and without other difficulties associated with travel in the real environment[27].

The earliest known tactile diagrams were published later in the early nineteenth century approximately at the same time that schools for blind children were established. The development of tactile teaching material offered these children a comparable curriculum. The design of tactile maps generally follows the same guidelines as those used in visual maps, but technically the pictures must be simple and the basic image must be edited for tactile exploring[28].

Desirable characteristics of tactile maps are durability, sharpness of borderlines, surface texture, recognizable symbols, and availability. Maps should endure abrasive use, chemical exposure and adverse weather conditions. At the same time, they should be pleasant to touch, consistent in symbol representation and they should have distinguishable lines to trace. One of the important issues is whether tactile maps should attempt to reproduce visual maps in a tactile format, or whether they should seek to represent the environment in ways that are more compatible with the visually impaired user's sense of spatial awareness. It would be sensible to produce maps readable by both VI and blind users[29].

A tactile map cannot be a mere translation of visual information into tactile form. The production guidelines that are important in visual maps are not necessarily appropriate in tactile maps. How the map feels is a more important aspect in a tactile map than how the map looks. The important aspects to be considered when preparing tactile maps are: "the ability to discriminate lines, textures, size, labelling, and use of color"[30]. Tactile maps typically use technology consisting of raised lines, shapes, textures and symbols. Recent development in the production of tactile maps includes the harnessing of several sensory modalities, including the visual, auditory and tactile senses. They are produced using a number of different technologies, and it is important to reduce information complexity, to emphasize the meaning of point and line symbols, and to choose textures and colors carefully in order to distinguish them from the background.

Unfortunately, tactile maps are not sufficiently available. There is a lack of producers and skillful tactile map-readers, with the result that there is minor demand

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[26] Ungar, S., Simpson, A., & Blades, M. (2012). Strategies for organising information while learning a map by blind and sighted people. In M. Heller & S. Ballasteros (Eds.), Touch, Blindness and Neuroscience. Madrid: Universidad Nacional de Educacion a Distancia.

[27] Papadopoulos K., 2006: On the theoretical basis of tactile cartography for the haptic transformation of historic maps, e-Perimetron, Vol 1(1), 81-87

[28] Gardiner, A., & Perkins, P. (2009). 'It's a sort of echo...': Sensory perception of the environment as an aid to tactile map design. The British Journal of Visually Impairment, 23(2), 84–91.

[29] Ibid.

[30] Ibid.

for maps of good quality and not enough instruction in map reading skills. It would be essential to create coherent guidelines and specifications for tactile map design. The guidelines should take into account the differences in age, vision and other abilities of the potential users. The design should include the map size and format, the choice of symbols and the scale[31]. If this were achieved, it would be possible to have globally standardized maps.

Types of tactile maps

The earliest versions (Fig. 3) of tactile maps were collage maps made of built-up displays of string and handicraft materials glued on a substrate to create a variety of heights, textures, and shapes.

Fig.3 Collage Map

Fig.4 Thermoform Map

Thermoform maps (Fig. 4) are two-and-a-half dimensional maps; they are widely used for educational purposes. A thermoform map requires a master or a model, and a thin plastic sheet that is placed over the master and vacuum shaped into a tactile map. Thermoform plastic is available in a variety of thicknesses, which makes it possible to produce varying heights. It can be pre-printed with colour to allow use by partially sighted persons or to enable sighted assistants to help the person with VI use the product. Thermoform maps do not usually have visual aspects, which are important for the readers with low vision. In any case, thermoform maps are a one option in public places because they are durable and easy to clean.

Microcapsule or swell paper maps (Fig. 5) are either hand-drawn or printed figures, which are copied onto heat-sensitive microcapsule paper that runs through a tactile image enhancer. The marks on the paper covered by black ink are raised above the paper surface, creating a raised-line drawing. The swell paper drawing can be achieved by a combination of computer drawing programs and Braille fonts, or by simply drawing a figure on a piece of white paper[32]. The pictures are two-dimensional and all marks are of equal height. Tactile pictures and maps made of microcapsule paper are top-rated among users although they are not as crisp as Thermoform maps[33].

[31] Ungar et al, 2012.

[32] H. Hirn, 2009, Pre-Maps: An Educational Programme for Reading Tactile Maps, Academic Dissertation, Helsinki

[33] Ungar et al., 2012

Fig.5 Microcapsule or swell paper map

Fig. 6 German film or Ritmuff-sheet

German film or Ritmuff-sheet (Fig. 6) is a semi-transparent plastic sheet, which is placed on a rubber mat. Figures can be drawn using a stylus or an ordinary pen that leaves a raised line on the sheet. The main advantage of this method is that it can be used interactively to create a graphic, which children can feel at different stages of the production. They can also make their own drawings. The main disadvantage of this method is that there is little variation in line height, and graphics get worn quickly as the film is a delicate and fragile material (Ungar et al., 2012).

New inkjet technology (Fig. 7) is all the latest. It produces raised tactile print using a printer that produces raised ink surfaces on a variety of substrates by laying down a polymer via an adapted jet head, which is then cured under ultra violet light. This process makes it possible to produce symbols of different elevations, textures and profiles[34]. Thus, it allows maximizing haptic contrast by printing maps directly from electronic copy and to create different tactile maps for a variety of personal needs. The inkjet process can offer advantages and possibilities when producing tactile maps and graphics. Users also benefit from the new technology, which offers easier use and more alternatives with more details in the graphics[35]. Inkjet technology, however, is not yet available for wider production.

Fig. 7 Multiple layers of black UV-cured ink

Fig. 8 Embossed paper tactile printing

Embossed maps (Fig. 8) are created from patterns of raised dots, using a computer-controlled Braille printer. The images can also be pressed on a paperboard or metal foil by using inexpensive tools. This is not an efficient type of tactile map, though it is a cheap method[36]. One development in tactile maps has been the use of the spur-wheel to create drawings on Braille paper. Computer graphics embossed by Braille printers uses Braille graphics software programs with Braille graphics printers to achieve a master of printed dots. The master can be thermoformed for multiple copy production or the Braille graphics file can be embossed multiple times for paper versions. In some cases, small scale models can be more realistic tools than maps or verbal explanations for introducing spatial concepts to students who have difficulty with abstractions. The quality of the substrate, such as the roughness of the paper, is significant for the reader in terms of the sensitivity and reading rate.

[34] H. Hirn, 2009
[35] Ungar et al., 2012
[36] H. Hirn, 2009

In what follows, some examples of how to develop math skills of elementary school students with VI, in comparison with practices used for sighted students.

Number Sense, Numeration and Arithmetic

The number line (Fig. 9a) can be an effective tool in fostering students' number sense since it provides a useful spatial representation of quantities and relationships among them. For students with VI the number line in Braille (Fig. 9b) is used for the same purpose.

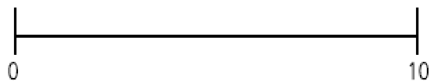

Fig 9 a The number line

Fig 9b The number line in Braille

Furthermore, appropriate Pre-Braille materials can be used (Fig. 10) to answer questions such as the following: How many butterflies must fly from the first to the second flower, so that the two flowers have the same number of butterflies?

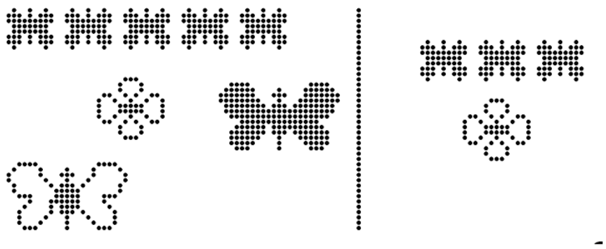

Fig 10 The Pre-Braille materials to teach simple arithmetic

Geometry and Spatial Sense

Geometry and spatial sense can be enhanced through puzzles and games. Tangrams and pentominoes[37] can be used to develop skills, such as composing or decomposing shapes, get acquainted with transformational geometry (flips, transformations, rotations), visualization and congruence. For students with VI, pre-Braille or tactile tangrams (Fig. 11) can be used for the same purposes.

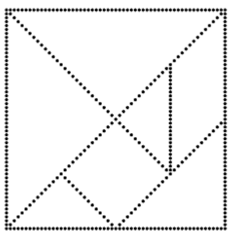

Fig 11 Pre-Braille tangrams

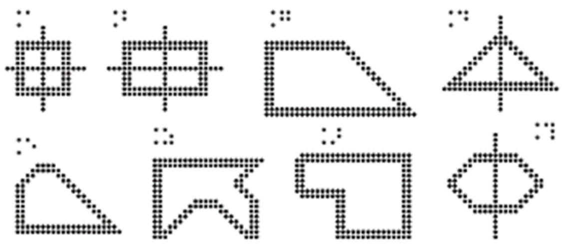

Fig 12 Pre-Braille shapes

Furthermore, pre-Braille shapes (Fig 12) can be used for teaching the concept of symmetry

Patterning and Algebra

Early patterning experiences require both visual-spatial and numerical reasoning either to identify a simple pattern or a mixed pattern. Pre-Braille materials (Fig. 13) are used for the same endeavor.

[37] A pentomino is a plane geometric figure formed by joining five equal squares edge to edge. There are twelve pentominoes, not counting rotations and reflections as distinct. They are used chiefly in recreational mathematics for puzzles and problems.

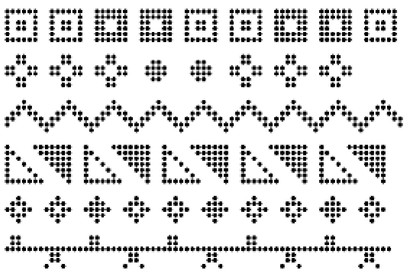

Fig 13 Teaching patterns with Pre-Braille materials

Graphing

Graphs allow creating visual displays of data; students with VI use graphs in Braille to understand data (Fig 14).

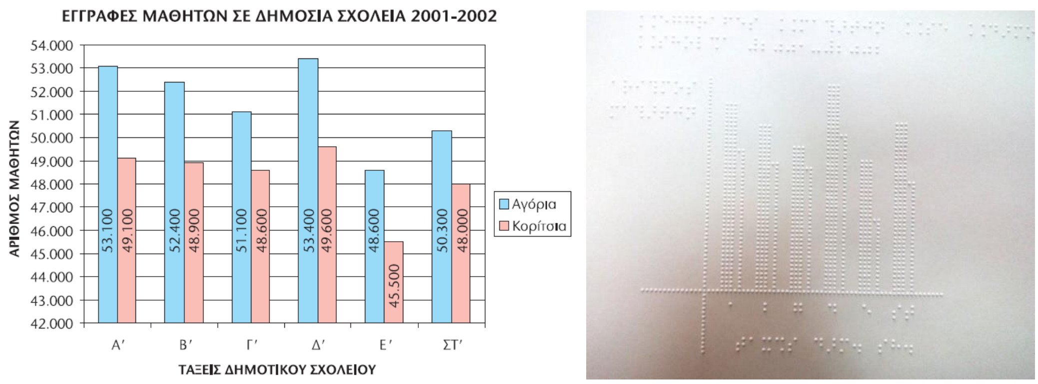

Fig 14 A graph and its Braille equivalent tables

Observing the grid, find the positions located icons therein (Fig 15).

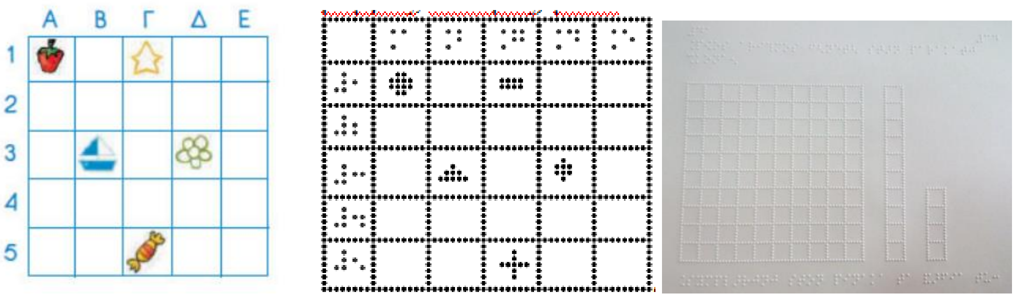

Fig 15 A table and its Pre-Braille and Braille equivalents ***Operations***

The Nemeth Code for Mathematics and Science is the standard code for representing mathematical and scientific expressions in Braille. A thorough understanding of the Nemeth Braille Code by students is essential for success in mathematics. The operation of addition in spatial arrangement is presented in Fig 16.

1. 35

\+ 2

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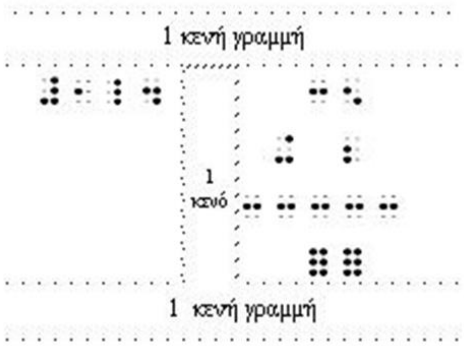


Fig 16 Addition in Nemeth Braille Code

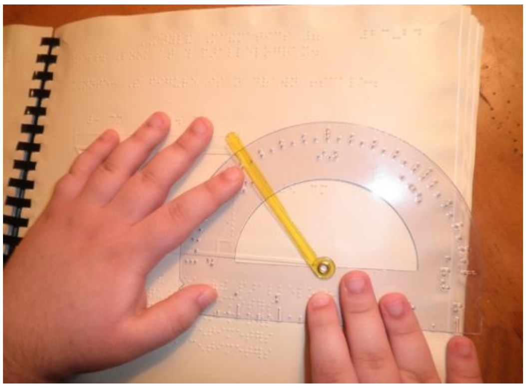


Fig 17 The Braille protractor

Geometry

Using a Braille Protractor (Fig. 17) to Measure an Angle in a Braille Mathematics Textbook

Additional curriculum materials and auxiliaries developed/used by teachers from Liceul Special pentru Deficienti de Vedere, Cluj-Napoca, to enhance spatial thinking of VI students

Tactile world maps/Tactile graphics

Tactile graphics are a way of conveying visual information/ or information that can be obtained only be the sense of seeing, for the people who are blind or visually impaired. So blind people "see" with their hands, what others see with their eyes. This way of representation may include tactile representations of pictures, maps, graphs, diagrams, and other images. A person with a VI can feel these raised lines and surfaces in order to obtain the same information that people who are sighted get through looking at pictures or other visual images.

Tactile maps and diagrams (Fig. 18) represent a system based upon touch that conveys information relative to spatial relations. There are used tactile cues so students with visual impairment develop cognitive maps and understand new concepts. Usually, these kinds of materials are used when the blind person cannot have access to the real objects, or the educational learning content needs abstract concepts and unfamiliar phenomena.

Fig. 18 Tactile map (left) and diagram (right)

Botanical atlas with tactile diagrams for VI students

Botanical Atlases (Fig. 19) are auxiliary books used by teachers in classes along with other materials to teach VI students the concepts from Biology and Science. These tactile diagrams help VI students make a cognitive map and a clear representation of the new and intangible concepts, since they substitute the image of the object or phenomena that cannot be touched, or understood without a structure's model and thus allow the process of cognitive learning based on logical and clear/accurate representation, not on mechanical learning.

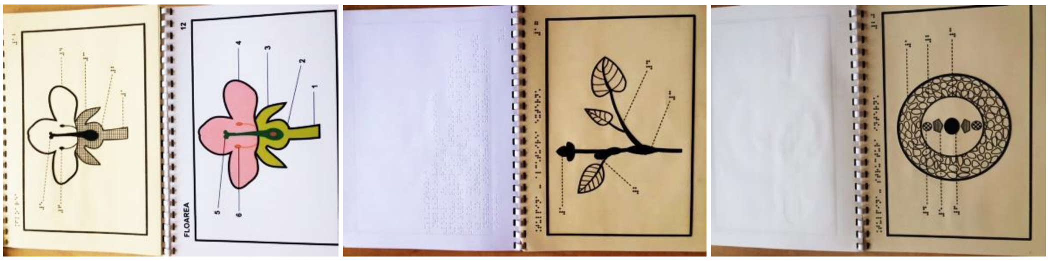


Fig. 19 Botanical Atlas with tactile diagrams

Tactile album with geometry forms/ Mathematics

These tactile albums with geometry forms are used to develop spatial thinking of students with VI, which is necessary in the process of understanding abstract concepts like geometry forms, the position in the space, angles and shapes, areas of measurement, etc.

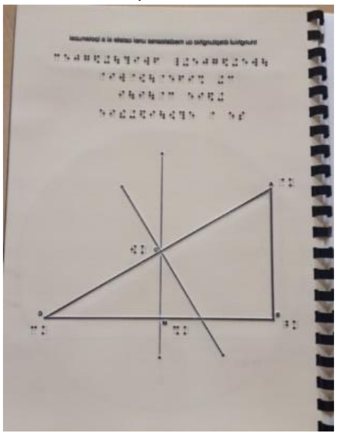


Fig. 20 Tactile geometrical forms

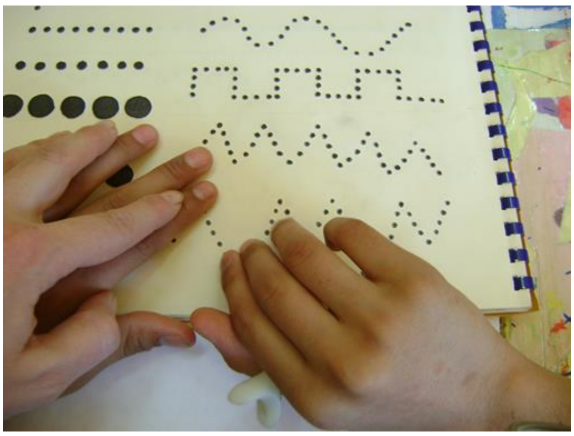


Fig. 21 Pre-Braille auxiliaries

Pre-Braille methodological framework

There are special auxiliaries used by teachers with young children with VI as a first step to start the exploration process in the pre-learning literacy activities. In this process may lay the base of the development of spatial thinking at VI students. Pre-Braille auxiliaries contain different types of lines, in different directions, and shapes like circle, square, and combined forms.

Tourist city guide for VI visitors **Inclusive Education**

The tourist guide was developed due to the Project “Terra Mirabilis- Tourist tracks for visually impaired young people”[38]. It was created and developed by Babilon Travel Association (NGO), the Special High School for Visually Impaired, and City Hall of Cluj – Napoca. The Guide includes adapted images (tactile images and large print images- Fig. 22) along with the description (audio, Braille and large print) of the most important touristic sites and monuments from Cluj-Napoca city.

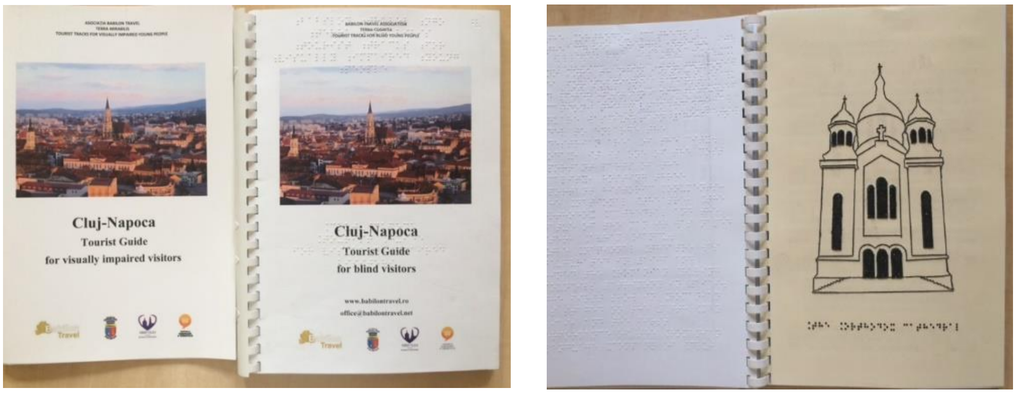


Fig. 22 Cluj-Napoca city guide tactile images

Students with VI have to use concepts about space, directions, and reasoning processes (extract spatial structures, performing spatial transformations and drawing functional inferences) by making structured and sequentially movements of their hands on the surface of the picture with the major propose to acquire a clear and accurate representation of the object from the picture.

Project “The sky in your hands

The “Sky in your hands” is a project designed by The Astronomical Complex from Baia Mare Romania for the period: February – November 2016. The purpose of the project was to develop tactile diagrams (Fig. 23) to make the sky and the constellations accessible for visually impaired population and to allow casual visitors capturing a special sensory experiences.

[38] http://english.babilontravel.ro/projects/terra-mirabilis-tourist-tracks-for-visually-impaired-young-people/

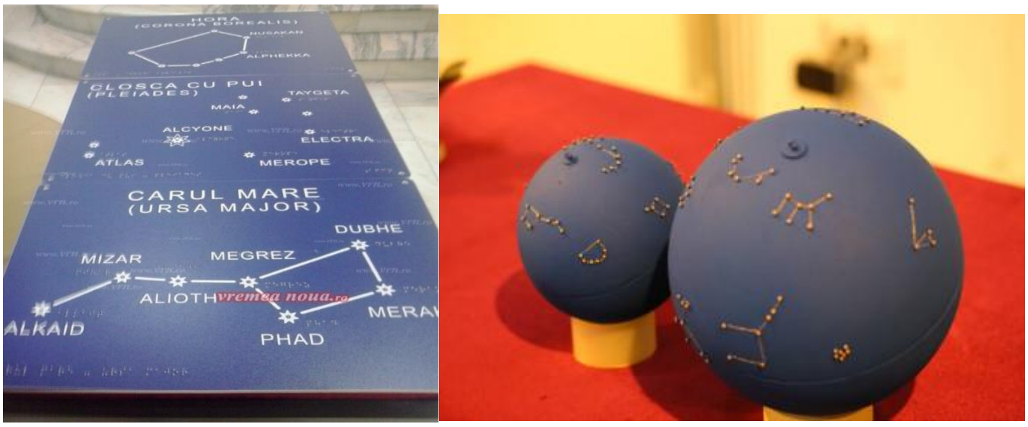


Fig. 23 Tactile constellations representation

The GEOTHNK Project

GEOTHNK[39] was a 2-year project under the Lifelong Learning Program Erasmus of the EU (1/12/2013-30/11/2015). The project aimed at enhancing spatial thinking through an innovative ICT-based approach and an open, collaborative educational environment and at offering a methodological approach, which allows the interdisciplinary organization and semantic linkage of knowledge. The project's innovation lies in the following: (i) transversal character (different target groups of educators and learners), (ii) transfer of recent geospatial research on semantics, ontologies, and knowledge visualization, as well as, innovative teaching methods, (iii) integration of knowledge (development of integrated blocks of knowledge), and (iv) interdisciplinary approach (semantic linkage of knowledge components from different disciplines).

Liceul Special pentru Deficienti de Vedere in collaboration with Teachers Training House from Cluj-Napoca, Romania was involved in the GEOTHNK Project to develop adapted scenarios and activities in order to identify the impact of the project on VI students. Visually impaired students together with the Geography teacher have traveled a route from a point to another using a GPS guide for directions and distance. This learning scenarios approach helped the students to use interdisciplinary knowledge and to apply theme in daily activities.

[39] http://www.geothnk.eu/index.php/en/

5. Geothnk & VISTE

5.1. Introduction to GEOTHNK

The GEOTHNK project proposes a methodological approach that will support learners to apply spatial thinking and purposefully address spatial concepts, across all curricular areas and at any developmental level. This approach will help them grasp the interdisciplinary character of fundamental spatial concepts. On the other hand, it will ground the coherence of the curriculum, reveal interrelations among disciplines and apply fundamental reasoning and thinking to everyday life developing problem-solving skills of the target groups. This approach particularly invites users to create, exchange, and re-use educational materials in the form of Educational Pathways. The Educational Pathways are modular, consisting of elementary educational building blocks (activities), so that they facilitate a “mix and match” re-usability scheme. The Educational Pathway Authoring Tool helps the teacher and the museum educator to prepare easily for the Pre-visit, Visit and Post-visit stages of their students’/visitors’ interaction with the GEOTHNK collection (the visit may be virtual or physical), to prepare a full educational scenario with ease, to re-use existing components, and to share the output of their work with colleagues all over Europe. Importantly, users contribute their content into the same digital repository that hosts professionally produced content. This manual aims to guide users through the process of authoring Educational Pathways using the relevant authoring tool of GEOTHNK.

5.2. Corelation Geothnk with VISTE

- VISTE project will introduce essential strategies to cultivate spatial thinking skills of VI students; new and functional approaches will be developed; inclusive educational settings and proper learning scenarios will be created to stimulate the development of spatial thinking skills of VI students from special and inclusive education system. The development of essential skills in different domains and the stimulation of the collaboration between sighted and VI students is the right direction to foster inclusion.
- There is need of trained and specialize teachers to help VI students in inclusive education settings to develop all the abilities necessary to face the educational challenges which appears with all the new concepts studied in different disciplines or school subjects at Math’s, Geography, History, Science, Biology, Geometry. Spatial thinking is a key concept which helps VI students to understand concepts, to reasoning about formal and intangible things, to be independent in orientation and mobility through the space, to create connections and make valuable judgments on things.
- The process of inclusion is at the beginning in both Greece and Romania. Erasmus+ projects are valuable resources to develop new and indispensable tools, instruments and methods so students with VI have the same opportunities with sighted children to understand, make clear representations, develop valuable cognitive maps, use cognitive learning and

accede the new and formal concepts so they build up all the abilities required by the curriculum and develop knowledge of the world.

- Students with visual impairments need an educational system that meets the individual needs of all students and fosters independence. Students with VI from inclusive education system are capable of cognitive learning and are of good learning results; only the teaching methods, materials, tools and instruments are doing the difference. VI students have to have access to proper ways of understanding of abstract concepts and learning. The right process of understanding is measured by the success of each individual in the school and community.
- Vision is fundamental to the learning process and is the primary basis upon which most traditional education strategies are based. Students who are visually impaired are most likely to succeed in educational systems where appropriate instruction and services provided in a full array of program options by qualified staff to address each student's unique educational needs.
- All partners involved in the project have identified the complexity of children with VI daily living skills to gain the independency and autonomy, the need of ICT tools and new educational methods so children from inclusive education system feel confident, use modern tools to understand abstract concepts and to develop the most important ability of the VI students – spatial thinking.
- The VISTE project comes with an innovative idea, which applies, to all VI students within inclusive educational system: a modern ICT toolkit and an educational framework developed based on a practical and real analysis of the VI students' needs along with a guide of best practices for teachers with the major purpose of enhancing spatial thinking of VI students.
- VISTE project offers to the partners involved the opportunity to give precious support to inclusive education system. Teachers from special and mainstream school from Romania and teachers from special and mainstream schools from Greece will collaborate to enhance spatial thinking of VI students from both special and inclusive education system. Teachers from special and mainstream school from both countries will change ideas, experience and knowledge. There will be a bidirectional exchange of practices
- The project VISTE project will offer to the teachers from inclusive education system to enhance their abilities, to enrich their methods and knowledge in the field to work with VI students, and support in better ways their need and particularities in learning. Furthermore, the project also offers opportunities for the exchanges of good practices in the field of spatial thinking at VI students for teachers from Romania and Greece who work in special and mainstream schools.
- VISTE is also good starting point to create learning scenarios to develop spatial thinking of VI students and to enhance current educational practices in Romania and Greece.
- The specialists considered that structurated scenario it fitts the needs of visual impaired students.
- The scenarios will be uploaded on the Geothnk platform.

5.3. The concept of Educational Scenarios

Educational Pathway in the GEOTHNK project describes the organization and coordination of various individual science learning resources into a coherent plan so that they become a meaningful science learning activity for a specific user group (e.g. teachers, students, other museum visitors, etc.) in a specific context of use. Further, Educational Pathways directly serve the priority assigned by the project to the integration of resources scattered in various science museums/centers into the same learning experience rather than the mere selection of resources from a single museum or science center. Those scenarios will be adapted to the specific need of VI students during the VISTE Project.

5.4. Structure of the GEOTHNK Educational Pathway Patterns

In many cases, learning experiences should be ideally embedded in a context which provides the means for the preparation of the learner for the learning experience before it takes place, as well as for facilitating the retention and future exploitation of the outcomes of the learning experience for a longer time after it has taken place. This is a fundamental principle in formal education, but can also be seen as a useful dimension (even if not that prescriptive) in informal learning environments. For this reason, the GEOTHNK Educational Pathway Patterns propose the organization of the science learning experience in three steps:

i) Pre-visit: activities preparing for the interaction with the digital learning science resources;

ii) Visit: activities involving interaction with the digital science learning resources in or outside the science museum/centre;

iii) Post-visit: activities rounding up and concluding the learning experience, after the interaction with the digital science learning resources.

From these, the Visit phase is the core of the learning experience and indispensable in any Pattern. The Pre-visit and Post-visit phases are absolutely essential for the realization of effective connections between school science education with learning activities involving work with science museum/centre content; however these 'auxiliary' preparatory and follow-up phases may well or may not be relevant to and desirable for open visits by any lifelong learner. Indeed, the degree of freedom or prescription in the design of a pathway has proven to be the most debated aspect of the GEOTHNK approach in the consortium, which brings together two considerably separate 'worlds': those of formal school education and informal learning in science museum and centres.

Thus, although each pattern should include sections corresponding to these three phases, in the case of an open pathway pattern the pre-visit and post-visit phases should be seen as possible but not obligatory. In addition to the three phases, there is an introductory section outlining the identity of the Educational Pathway and providing guidance for any preparations necessary before the launch of the learning activity. Each section consists of a number of fields, for each one of which a description and/or guideline is provided. The structurated scenarios better fitts the need of VI students, so VISTE project will develop structurated scenarios adapted to the specifical needs and percetion particularities of VI students.

5.5. Structurated Scenario Pattern

Educational Pattern for a Pre-Structured Visit by the School

A) Introductory section and preparatory phase

The following basic information about the intended learning experience is to be defined at the outset. This information should allow the teacher to assess the relevance of the resource to his/her teaching needs and particular circumstances, and provide him with guidance for the preparation of the learning experience. Note that most of this information can be directly linked to specific elements of the VISTE Profile. The formalisation proposed there for certain elements is to be applied accordingly in this introductory section too.

Title:

Give a title that helps easily recognize the content focus and purpose of the Educational Pathway.

Short description:

A description of no more than 30 words outlining the scope of the Educational pathway, descriptive enough to help the user in the first instance to estimate its possible relevance to her/his interests.

Keywords:

A limited number of words/short phases reflecting the topic and scope.

Target audience:

The intended end user: teacher with students, teacher, students, other…

Age range:

Up to 6, 6-9, 9-12, 12-15, 15-18…

Context:

The places that the Educational Pathway involves: school, science museum/centre, independently on the web.

Time required:

The approximate time typically needed to realize the Educational pathway. This could be distinguished into the amount of time required for school-based work and science museum/centre-based work.

Technical requirements:

Description of any special technologies, infrastructure and/or technical expertise required for the realization of the Educational Pathway.

Author's background:

What was the main function of the person who prepared the Educational Pathway: school teacher; museum educator; parent; other.

Connection with the curriculum:

Reference to the items of the science learning vocabulary mainly covered by the Educational Pathway, and prerequisite knowledge

Learning objectives:

Short description of the objectives of the described science learning experience

Guidance for preparation:

Guidance provided by the creator of the Pathway about any necessary arrangements that will need to be made by the interested teacher before launching the activities described in the following sections.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  Describe ways and materials (resources already available in the GEOTHNK repository or other) that the teacher will present to the students in the classroom to attract their attention to the targeted subject matter. Make sure they are easily available to the interested user in the GEOTHNK repository, and give directions for finding them. Possibly and if appropriate, integrate them into one practical resource in the appropriate format (e.g. a slides presentation).

- **Define questions from current knowledge:**
  Formulate the scientifically oriented questions that the teacher will present to the students to provoke their engagement in thinking about the target subject matter based on their existing knowledge. Make these questions digitally available and easily usable, e.g. by integrating them in the materials described in the previous step.

Teaching Phase 2: Active Investigation

Note: This is a transitional phase on the borderline between the Pre-visit and Visit sections of the Educational Pathway. 'Active Investigation', and in particular the step of 'Planning and conducting simple investigation' can take place either before or during the 'visit', or both, depending on whether the teacher decides to use GEOTHNK resources of an 'exhibit nature' (exhibits, simulations, experiments, etc.) at this stage (on the web or during a physical visit to a science museum/centre). However, the use of physical observation is concentrated mainly in the next Teaching Phase, under the 'Visit' section of the Educational Pathway.

- **Propose preliminary explanations or hypotheses:**
  Describe ways in which the teacher can encourage students to propose possible explanations to the questions that emerged from the previous activity. The teacher should be guided here to identify possible misconceptions in students' thinking. If applicable, locate or make relevant assistance materials available in the GEOTHNK repository, and give directions for finding them. If appropriate, you may consider integrating them in the materials described in the previous steps (e.g. a slides presentation).

- **Plan and conduct simple investigation:**
  Describe ways and materials (resources already available in the GEOTHNK repository or other) that the teacher can use to facilitate the students to focus on evidence as a source of answers to scientific questions. This is the phase in which students are being prepared for the subsequent phase of evidence gathering during observation. Locate or make relevant assistance materials available in the GEOTHNK repository, and give directions for finding them. If appropriate and relevant, it is possible to guide the teacher to use GEOTHNK resources of an 'exhibit nature' (exhibits, simulations, experiments, etc.) at this stage – in which case this activity should be moved to the 'Visit' section of the Educational Pathway. However, it should be noted that the use of physical observation is concentrated mainly in the next Teaching Phase of 'Creation', under the 'Visit' section of the Educational Pathway.

B) Visit

(Teaching Phase 2: Active Investigation)

Note: 'Active Investigation', and in particular the step of 'Planning and conducting simple investigation' can take place in either the Pre-Visit or the Visit phase of the experience, or in both, depending on whether the teacher decides to use GEOTHNK resources of an 'exhibit nature' (exhibits, simulations, experiments, etc.) at this stage (on the web or during a physical visit to a science museum/centre). However, the use of observation for gathering evidence is concentrated mainly in the Teaching Phase of 'Creation' described below.

Teaching Phase 3: Creation

- **Gather evidence from observation:**
  This is the core element of the 'Visit' phase, and can be realized either in the school classroom/lab, by remotely using science learning resources made available by the science museums/centres on the web, or during a physical visit which will involve the use of digital resources. Locate the appropriate resource in the GEOTHNK repository. Explain its use to the teacher, and provide access to any accompanying user support materials. The selected resource (e.g. a simulation, an experiment, an animation, a graph or other exhibit of similar nature) must provide students with an opportunity to collect evidence addressing the scientific questions posed in the previous stages through direct or indirect observation phenomena of the natural world. Provide guidance to the teacher organize and manage the activity most effectively and efficiently. It is recommended to introduce at this stage group work. Guide the teacher to divide students in groups, each of which will be facilitated by the teacher to formulate and evaluate explanations to the scientific questions based on the collected evidence. If applicable, locate or make relevant assistance materials available in the GEOTHNK repository, and give directions for finding them.

Teaching Phase 4: Discussion

Note: This is a transitional phase on the borderline between the Visit and the Post-visit sections of the Educational Pathway. 'Discussion' can take place either during or after the 'visit', or both, depending on whether the teacher considers that the use of the digital 'exhibits' is necessary (or feasible) at this stage. Ideally, 'Discussion', and particularly the step of 'Explanation based on evidence', should take place in front of the 'exhibit', to reinforce the link between the physical experience of using the resource and the mental processing of the observed information by the students.

- **Explanation based on evidence:**
  Guide the teacher to provide the correct explanation for the researched topic. Describe ways and materials (resources already available in the GEOTHNK repository or other) she/he can use to this end, and give directions for finding them. If appropriate, integrate them into one practical resource in the appropriate format (e.g. a slides presentation).

- **Consider other explanations:**
  Guide the teacher to facilitate the student groups to evaluate their own explanations in the light of alternative explanations, particularly those reflecting scientific understanding. Describe ways and materials (resources already available in the GEOTHNK repository or other) the teacher can use to this end, and give directions for finding them. If appropriate, integrate them into one practical resource in the appropriate format (e.g. a slides presentation).

C) Post-visit

(Teaching Phase 4: Discussion)

Note: This is a transitional phase on the borderline between the Visit and the Post-visit sections of the Educational Pathway. Ideally, 'Discussion' should take place in front of the 'exhibit', to reinforce the link between the physical experience of using the resource and the mental processing of the observed information by the students. However, if necessary or preferred, it can also be organized as a post-visit activity leading into the next phase of 'Reflection'.

Teaching Phase 5: Reflection

- **Communicate explanation:**
  Guide the teacher to facilitate each student group to reflect on the previous experiences and produce a report with its findings, presenting and justifying its proposed explanations to other groups and the teacher. Make available or direct to materials (resources already available in the GEOTHNK repository, or other) which the teacher can use to help the students familiarize themselves with and become effective in scientific writing.

Follow-up activities and materials

Describe and direct the user to any follow-up activities or materials that can be used to 'wrap-up' the main 'visit' experience. These could include appropriate learning assessment and/or reminder materials (e.g. quizzes, games, other user-friendly tests), hints for further activities, suggestions for other relevant 'visits', etc.

Sustainable contact

Describe and direct the user to any existing possibilities for maintaining contact with the digital resource and its provider, or with other users of the same learning experience.

5.6. VISTE Implemented Scenarios Phase A

5.6.1. Title: *“Earth’s Relief”*

The Educational Pathway Pattern for a Pre-Structured Visit by the School

A) Introductory section and preparatory phase

This educational scenario aims at giving students with severe visual impairment an effective way to understand the concept of landforms.

Title: *“Earth’s Relief”*

Short description:

Sighted children's learning is constantly reinforced by what they see around them (colors, shapes, objects in use at home, facial expressions, illustrations, digital images, animals, landscapes, skylines, architecture, transport and so on). Children with a vision impairment may have greatly reduced opportunities for incidental learning and the reinforcement of concepts and knowledge of the world around them. Some children with impaired vision may have gaps in their general knowledge and in their development of spatial, numerical and scientific concepts.

In particular, understanding the division of a country into administrative regions is considered difficult for visually impaired students and therefore teaching is a challenge.

Keywords: *Spatial thinking, landforms, relief, visual impairments*

Target audience: *Teacher and students*

Age range: *9-12*

Context: *The educational scenario is implemented in the school classroom.*

Time required: *The approximate time which is needed to realize the educational scenario is estimated to 1-2 sessions of school-based work.*

Technical requirements: *For the implementation of the educational scenario are required: pc, cnc, tactile maps, piaf.*

Author’s background: *School teacher*

Connection with the curriculum:

The presented educational scenario focuses on the ability to understand earth’s relief. The educational program implements scientific elements from geography, history and maths.

Learning objectives:

Through this educational program, students become able to learn the difference between various landforms, to locate them on the map and to recall their names.

Guidance for preparation:

For the indoor activities school teacher uses cnc machine to create various tactile maps and a piaf machine to create swell-paper tactile maps.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  Students, in their groups, freely observe the three-dimensional map and record their observations. They try to talk about different elements of the map. There is a need to use specific, formal terms.

- **Define questions from current knowledge:**
  In order to take advantage of the students' previous knowledge, a questionnaire is given. Students are asked to answer the questions:

  - *What, in your opinion, is the relief of the Earth?*
  - *Can you mention 5 terms - elements related to the relief?*
  - *How do you think this variety of landforms was created?*

Teaching Phase 2: Active Investigation

- **Propose preliminary explanations or hypotheses:**
  Geographic terms are given: mountain, hill, plain, river, lake, peninsula, bay, island, cape, strait, isthmus (in random order), as well as specific definitions and students are asked to match them.

  Then, students categorize terms by:

  horizontal axis

  vertical axis

- **Plan and conduct simple investigation:**
  Students use the three-dimensional map constructed with a cnc engine and try to find out which landforms would fit together in a hypothetical "geomorphological" puzzle.

B) Visit

(Teaching Phase 2: Active Investigation)

Teaching Phase 3: Creation

- **Gather evidence from observation:**

At this stage, students are given a tactile map of Greece on which the most important landforms are marked. Students, in their groups, record the common features of each landform and use them to create their own definitions.

Then a swell-paper tactile map is given on which only the contours (the coastline) are marked. The students compare the two maps. Finally, they record which of the elements of the Earth's relief are depicted on the second map and which are not.

Each group communicates its observations.

Teaching Phase 4: Discussion

- **Explanation based on evidence:**
  Teacher uses the students' observations and integrates them into the scientifically correct definitions for each geomorphological element. In addition, he uses the students' observations on the second map (piaf – swell paper) to define what is horizontal and vertical.
- **Consider other explanations:**
  There is a debate about the difference between strait and isthmus. They emphasize their common features and clarify each concept. They talk about anthropogenic and natural environments.

C) Post-visit

(Teaching Phase 4: Discussion)
Teacher and students discuss how landforms were. They observe seabed's relief to discover that the same geomorphological elements exist both on the surface of the Earth and on the seabed.

- **Follow-up activities and materials**

Students are looking for information of the most important geomorphological elements of Europe. They write about the impact of each country's relief on the lives of its inhabitants.

Sustainable contact
The educational program is presented to other teachers and is uploaded to the school webpage, where educational material is presented.

5.6.2. Title: “Planning and conducting a route”

The Educational Pathway Pattern for a Pre-Structured Visit by the School

A) Introductory section and preparatory phase

Title: *“Planning and conducting a route”*

Short description: *The following scenario aims at strengthening spatial thinking, mental mapping and allocentric thinking of visually impaired students during O&M lessons through the use of tactile maps*

Keywords: *visual impairment, plan (v.), route, street, tactile map, city block, intersection*

Target audience: *O&M instructor and the student*

Age range: *9+*

Context: *classroom, neighbourhood*

Time required: *Estimated duration is 4-5 sessions (4-5 x 45 minutes)*

Technical requirements: *tactile maps, tactile image maker (if available), augmented reality toolkit (if available), toys [e.g. plastic construction games (lego)], Wikki Stix, plastic embossing film*

Author’s background: *The educational scenario was prepared by an O&M instructor*

Connection with the curriculum:

Although this scenario is created for O&M purposes, it also has a cross-curricular approach especially with Language, Math and Geography

Learning objectives:

- the student will be able to follow a route using a tactile map
- the student will learn to plan and conduct a route with the help of the instructor
- the student will learn to compare and relate two or more different points on the map in terms of distance
- the student will be able to demonstrate the representation of a route on a map using yarn with wax (e.g. Wikki Stix)
- the student will be able to verbalize and write down a route using the proper vocabulary

Guidance for preparation:

- *The O&M instructor has to check whether the student has sufficient knowledge of basic directional and positional concepts (e.g. up/down, left/right, top/bottom, next to, parallel/perpendicular, straight ahead, toward, etc.) and if not to reinforce them.*
- *Also, the student:*
  - must be able to use sighted guide techniques at outdoor settings fluently,

- must have a sufficient level in white cane techniques,
- has basic knowledge of crossing streets
- and has a basic knowledge of what a tactile map is.

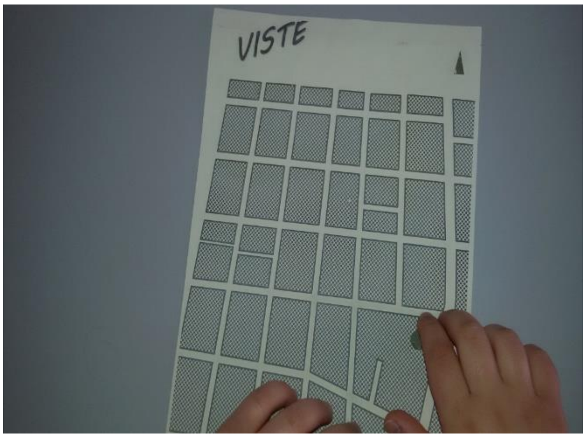
- *Then the instructor chooses the appropriate technical requirements for the student.*

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  The instructor chooses the appropriate technical requirements and provides a tactile map of the school's neighborhood, as simple as possible, made by, either, simple materials

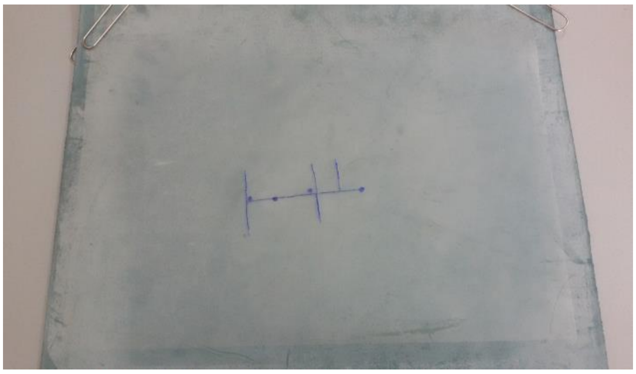
or made by a tactile image maker



Yarn with wax and plastic embossing film would be helpful in order for the student to participate more actively

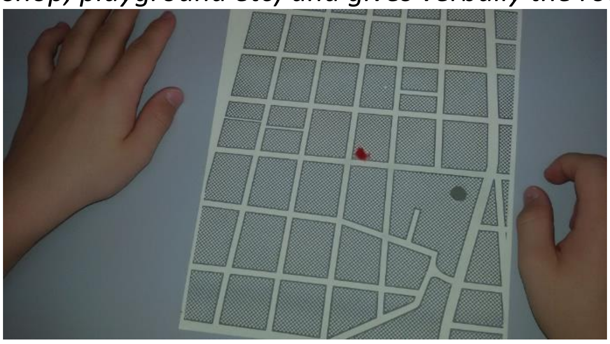
(yarn with wax)

(plastic embossing film)



If the student is capable, other material, more elaborated, can be used such as an augmented reality toolkit so as to incorporate auditory information on the map and make it more fun for the student

- **Define questions from current knowledge:**
  At the beginning the instructor uses a place close to the school (preferably one that they have already visited before) and "interesting" for the student (e.g. corner shop, grocery shop, playground etc) and gives verbally the route to the student.



Teaching Phase 2: Active Investigation

- **Propose preliminary explanations or hypotheses:**
  Memory plays a crucial role in orientation and spatial thinking in general. The child who is blind needs techniques and structured remembering of the space in order to externalize spatial representations. So back at school the instructor provides to the student the tactile map of the area and together they follow step by step the previous route.

This is a good time for the instructor to check whether the student has started creating the mental map of the route making questions like:
- "Where do you have to turn to when you get out of school in order to go to the grocery store?" or
- "When you get out of the grocery store where is school?". Using plastic embossing film they can together create the line of the route, so as the student will have a better understanding of the turns they have made.

- **Plan and conduct simple investigation:**

*The instructor can then introduce a **new** point of interest on the map.*

*It is useful, at this stage, to use the **school as the main point of reference** in several routes so as later the student will be able to compare different points of interest in connection to the school (point of reference) in terms of distance.*

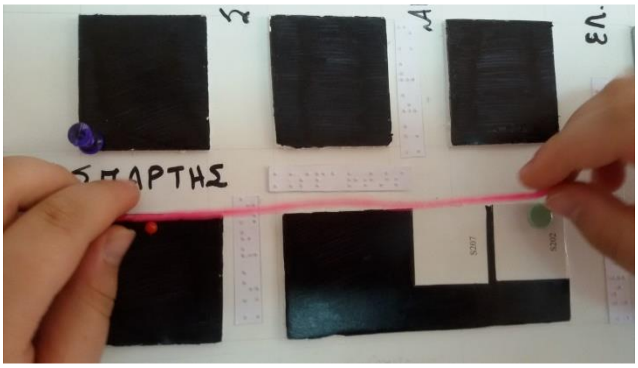
The instructor puts a mark on the map for the school (point of reference) and a different mark for the point of interest. He can then ask the student to find a route connecting the two points and try to describe it in details.

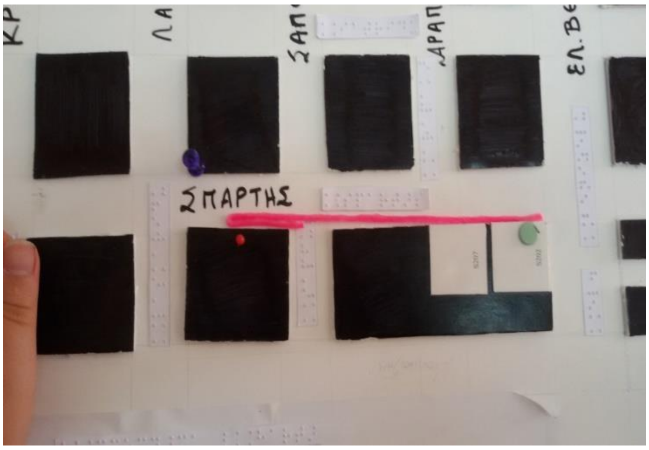
The student has to "create" (with her fingers on the map) the route by herself using the street names, mentioning how many times she has to cross and what kind of turns she will do

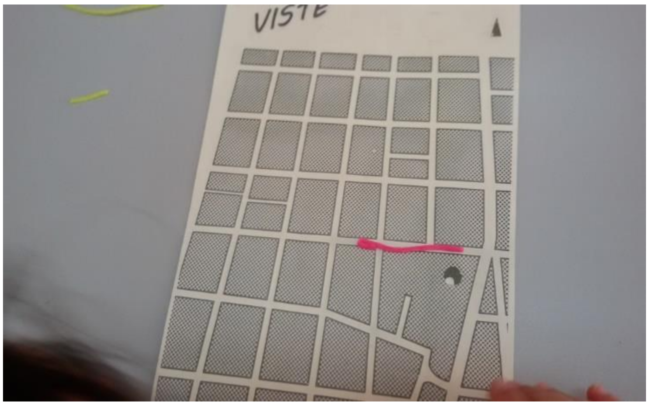
B) Visit

Teaching Phase 3: Creation

- **Gather evidence from observation:**
  At a next stage the student (with verbal and tactual support by the instructor) can use yarn with wax (e.g. Wikki Stix) on the tactile map in order to create a tactile line of the route.



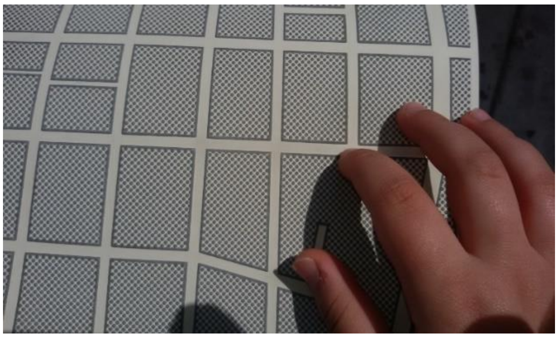




If an augmented reality toolkit is available the instructor can use it so as to incorporate auditory information and give the opportunity to the student to elaborate her spatial thinking through an original and amusing way.
He can also use recorded city sounds of traffic for the same reason (https://www.soundsnap.com/tags/traffic?page=22). If there is enough time they could work on more than one route.

Teaching Phase 4: Discussion

- **Explanation based on evidence:**
  Subsequently the student can start the demonstration of the new route. She can have the tactile map with her so as to check whether she follows the route correctly and to make the proper adjustments if not. The student can use either the white cane technique or, in case of a slow walker, sighted guide techniques.

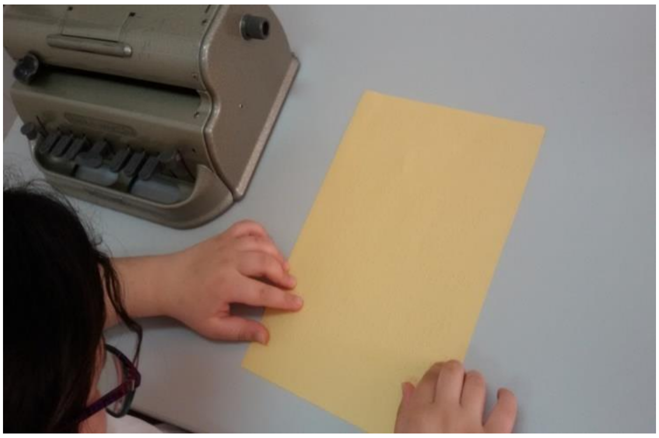


- **Consider other explanations:**
  Since the basic spatial concepts (left, right, front, behind, etc.) have been used and comprehended in depth by the student, the instructor can now introduce the cardinal directions which is something ***permanent*** *and will help the student travel easier in the future. This is an advanced skill, so the instructor can give only the basic information such as the names, how the cardinal directions are related to each other and how they are used (e.g. on the tactile map they already are using or on a geographical map).*

C) Post-visit

Teaching Phase 5: Reflection

- **Communicate explanation:**
  The instructor can ask the student to write down in details the route they have been working in form of a letter to a friend. This will give the chance to the instructor to evaluate whether the student has developed, at this stage, a level of mental mapping and spatial thinking



- **Follow-up activities and materials**

  In order for the instructor to have a follow-up, he can ask the student to play a game with him. They will need to use the tactile map of the neighborhood of the school and directions, but now the student will be the one that will give directions to the instructor to trail a new route on the map. The student, in this case, has to choose a different point of reference than the school and give to the instructor, either verbally or written, the new route

Sustainable contact

O&M instructors

Maria Plastira
O&M and ADL Instructor - Sociologist

5.6.3. **Title:** *Pet Detective – strategic problem solving and planning game for 3rd- 6th grade*

The Educational Pathway Pattern for a Structured Lesson Plan by the SESBA Using VISTE Toolkit

A) Introductory section and preparatory phase

This educational pattern aims at problem solving through logical reasoning process for children with VI (blindness or low vision). Using spatial thinking cues and elements it enhances the ability to combine multiple cognitive processes to recognize patterns, draw conclusions and make decisions.

Title:

Pet Detective – strategic problem solving and planning game for 3rd- 6th grade

Short description:

When interacting physically with the outside world, the child with VI must acquire motor, cognitive and tactile exploration skills. This educational material gives the opportunity for conscious repetition of motor activities; listening and performing a kinaesthetic / tactile activity; challenging planning skills (the ability to think ahead, evaluate options, and choose the best course of action)

Keywords:

VI, spatial thinking, problem solving, logical reasoning, planning

Target audience:

The Occupational Therapist / Ergotherapist and students

Age range: *9-15*

Context: *A classroom, an OT center or independently.*

Time required: *45 min with gradually reduced time*

Technical requirements: *map route, pet models, home models, VISTE toolkit*

Author's background: *Occupational Therapist/Ergotherapist*

Connection with the curriculum:

Pet Detective combines multiple cognitive processes to recognize route patterns, draw conclusions and make decisions. Children with VI are delayed in developing a Euclidean understanding of space, or they are delayed in developing a unitary, integrated model of the environment, and thus spatial organization develops slowly. However, spatial information can be derived from hearing, touch and movement and also a child with VI therefore has the potential to acquire concepts and representations of the spatial domain equivalent to those of sighted children.

As prerequisite knowledge it is important for the child with VI to have adequate proprioceptive sensation arising in sensory receptors in the muscles and joints. In passive touch the child is the recipient and in active touch the child is the source of the movement. The development of the tactile sense is critical when children with VI are learning to read Braille or tactile graphics using spatial thinking notions.

Learning objectives:

VI together with training of tactile acuity and skills indeed leads to improved tactile skills on a broader scale. Improvement of spatial thinking perceptual skills needs systematic training; it improves sensitivity and accompanying changes in cortical representations. Fine motor skills like directed reaching, wrist rotation, grasping, and pushing an object are essential for learning Braille, tactile graphics and map reading, as well as for keyboard technology and O&M skills.

Guidance for preparation:

The OT/Ergotherapist designs the spatial thinking map routes of pets and houses that the child with VI has to follow in order to create a mental map by listening to specific spatial directions from the VISTE toolkit. The OT/Ergotherapist also prepares tasks for the child giving starting and end points for spatial thinking notions.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  In order to get the students interested in learning how to follow spatial thinking directions by the VISTE toolkit, the OT/Ergotherapist offers a preliminary revise of the main spatial thinking notions.

  Define questions from current knowledge:

  The following questions can be answered both verbally or non verbally.

  Which pet or house is the furthest / nearest one?

  Which one comes next?

  Which route is the furthest / nearest one?

  Which pet has to be delivered first/second/third/fourth/last?

(Questions are adapted from the text book "11+ Non-verbal Reasoning and Spatial Awareness exam | Bond 11+")

Teaching Phase 2: Active Investigation

- **Propose preliminary explanations or hypotheses:**
  During the provoke of curiosity the OT has already given the preliminary explanations or hypotheses. The next step is the assessment procedure of the maximum spatial reasoning ability with the child's overall participation and fully contribution. It is a typically pre-defined level of

ability that the child with VI will need to demonstrate in order to continue with the implementation process.

- **Plan and conduct simple investigation:**

1. Encourage active, physical exploration of the real world

Children with VI need raw data. They need to feel tactile routes first, and explore objects and routes hands-on. Children with superior mental rotation abilities are the ones who spend more time handling and investigating routes.

2. Seize everyday opportunities for spatial thinking and spatial talk

Words that will help children with VI reason about spatial thinking properties, like over, under, right, left, straight, straight ahead, turn, up, down, bent and curvy. Common sense suggests that children who learn such terms are more likely to use them when they talk, and that will help them tap into the power of verbal explanation and motor exploration. Studies show that children learn concepts better when they are asked to explain what they discover to other people.

3. Provide kids with tools for building structures, and boost enthusiasm by getting involved yourself

An array of evidence suggests that children with VI develop better spatial thinking skills when they learn with 3D materials.

4. Introduce exploration games that challenge children to "match the route"

Research hints that a particular form of structured 3D game, may be especially valuable. This is when children with VI are shown the "blueprints" for a map navigation and given a set of objects and directions to explore it. "Match-the-route" exploration games may be helpful, in part, because they stimulate spatial talk and navigation.

5. Encourage children to use and create spatial maps

Children with VI can handle more complex spatial maps, and they benefit from structured mapping activities, especially ones that require them to explain their choices.

6. Encourage kids to use gestures when solving spatial problems

Experiments demonstrate that adults and children solve planning problems more readily when they are allowed to gesture.

B) Visit

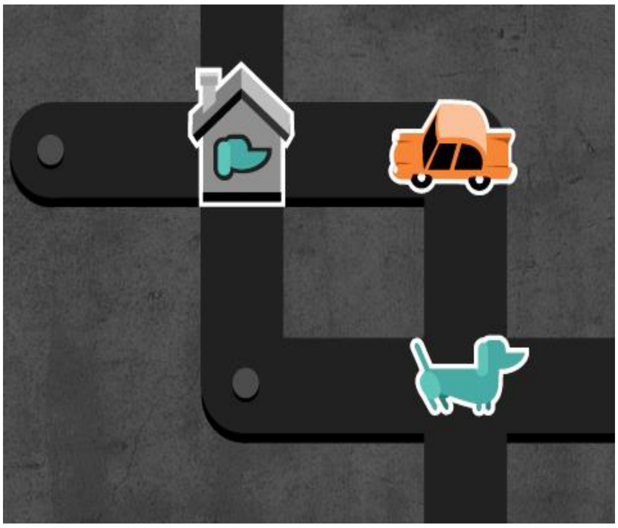
(Teaching Phase 2: Active Investigation)

"Active Investigation" takes places throughout the process and it continues in the follow-up process.

Teaching Phase 3: Creation

- **Gather evidence from observation:**
  Pet Detective deals with finding the shortest route to pick up lost pets and return them to their homes. The OT/Ergotherapist marks a beginning position on the game and gives a set of directions. The child has to find the the shortest route to pick up lost pets and return them to their homes before running out of fuel following the directions of the VISTE toolkit. Each dot on the route corresponds to one litre of fuel. Each game level corresponds to a specific fuel amount. The car may pick up to four pets.

LEVEL 1



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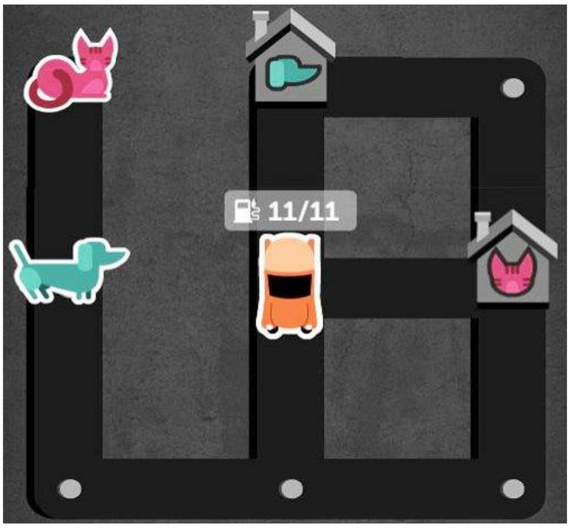

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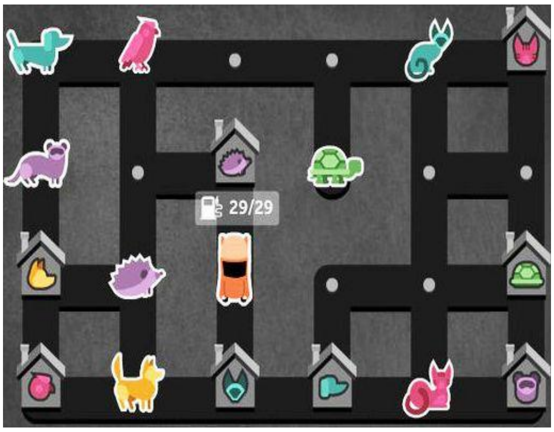

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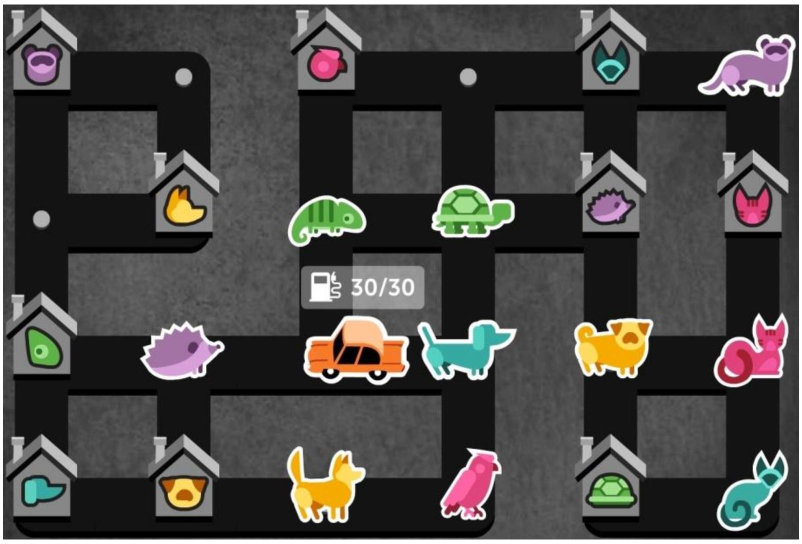

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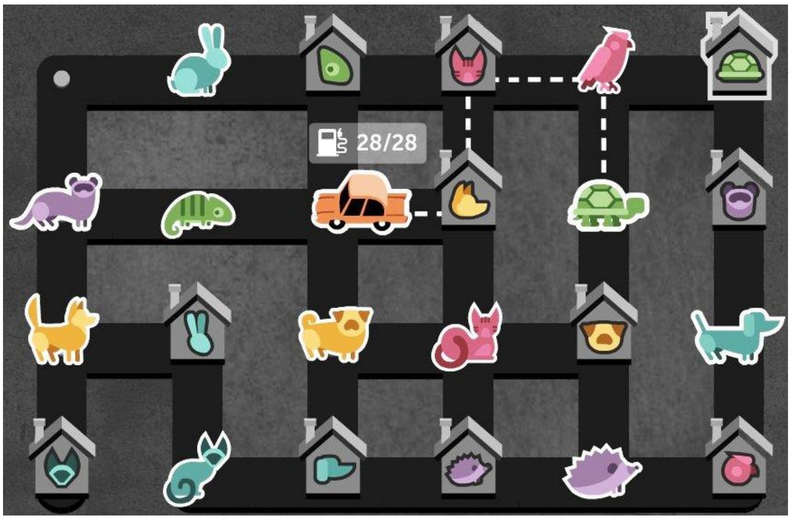


Teaching Phase 4: Discussion

Discussion took place either during or after the 'visit', or both, depending on whether the OT/Ergotherapist considers that the use of alternative orders is necessary (or feasible) at this stage. Ideally, Discussion, and particularly the step of Explanation based on evidence, reinforced the link between the physical experience of using the resource and the mental processing of the observed information by the child with VI.

- **Explanation based on evidence:**
  Pet Detective feels thematically relevant to planning in real life. It is a game around errands, and the most efficient order in which to do them, since that sort of planning is something people do every day. The child can recover after a series of mistakes. After a bad run in a game, it's easy to get rattled. Children can learn to stop, reset, and continue on. Also, they make use of the stuff they aren't aware they know. Children supply split-second solutions that turn out to be the right ones. The games teach children to trust themselves, trust their instincts.
- **Consider other explanations:**

Pet Detective is based on factorial functions, where each pet is a factor. The highest level asks the child to return 11 pets to their homes. This means there are 11 possible routes the child can take in this level and its job is to find the shortest. With that many possible routes the child can never find the shortest one without planning spatially.

C) Post-visit

(Teaching Phase 4: Discussion)

Perceptual abilities and underlying brain mechanisms are modified by experience in utilizing different modalities. Following sensory deprivation, children with VI learn to utilize more effectively other available sources of sensory information, for example, auditory and tactile by the VI. This results from heavy reliance on these sensory modalities, thorough practice in using them and changes in neuronal networks normally devoted to the lost senses. The tactile sense of the child with VI partially compensates for near vision and the auditory sense for distance vision.

Teaching Phase 5: Reflection

- **Communicate explanation:**
  Young children with VI have difficulties in developing cognitive maps and in tasks that require comparisons between modalities because they lack a general framework for fitting in sensory information. Children are the main actors in this game, and the game's narrative is evident from the art, with each pet corresponding to a house and the fuel monitor evincing the need for efficiency. Pet Detective develops cognitive spatial thinking maps based on tactile, kinaesthetic, and auditory information. This capacity for cognitive mapping develops more slowly than in the sighted person, but the product is not necessarily inferior to or less efficient than that based primarily on visual input. It is important to prompt children who are blind to organize spatial information by different coding strategies which differ from visual experiences. The lack of vision and the resulting difference in the quality of experience of space lead these children to approach a task by using strategies different from those of sighted children. The lack of vision is not a hindrance for images, but visual experiences make it possible to manipulate images. According to these specific spatial tasks, children with VI have the potential of achieving the same level of efficiency as sighted subjects. It is important to try to find and train a variety of strategies.

Follow-up activities and materials *For further practice, it would be important to determine how children with VI who could improve their perception of space in a multisensory way and how they could develop useful cognitive resources to structure an unfamiliar environment. Pet Detective was designed for children, but there are many adults who also want to learn to read tactile maps. They need their own, age appropriate learning programme. Besides children with VI, there are other groups, who can benefit this program. A recent study about the vision problems among the children with physical disabilities revealed problems in their functional vision and showed several difficulties when they try to and to orientate in the unfamiliar environment. It is worth of an experiment whether the children with different disabilities can learn better to control unfamiliar environment by learning map reading through a systematic programme.*

Sustainable contact

This activity was presented in:

- *"Project VI" training course that took place from 17-23 August 2015, in Swindon, United Kingdom. The course aimed to give confidence to those developing international activities under the Erasmus + programme the confidence and skills to engage VI and Blind young people into their future projects. Also the aim of the training course was to increase the opportunities available for blind and VI young people in the realm of international non-formal education projects.*

For further details please contact Ms Mary Stylidi, OT/Ergotherapist in the following e-mail address: marystilidi@yahoo.gr

5.6.4. Title: "Prefectures of Greece"

The Educational Pathway Pattern for a Pre-Structured Visit by the School

A) Introductory section and preparatory phase

This educational scenario aims at giving students with severe visual impairment an effective way to understand the division of a country into administrative regions.

Title: *"Prefectures of Greece"*

Short description:

Sighted children's learning is constantly reinforced by what they see around them (colors, shapes, objects in use at home, facial expressions, illustrations, digital images, animals, landscapes, skylines, architecture, transport and so on). Children with a vision impairment may have greatly reduced opportunities for incidental learning and the reinforcement of concepts and knowledge of the world around them. Some children with impaired vision may have gaps in their general knowledge and in their development of spatial, numerical and scientific concepts.

In particular, understanding the division of a country into administrative regions is considered difficult for visually impaired students and therefore teaching is a challenge.

Keywords: *Spatial thinking, prefectures, regions, visual impairments, Greece*

Target audience: *Teacher and students*

Age range: *9-12*

Context: *The educational scenario is implemented in the school classroom.*

Time required: *The approximate time which is needed to realize the educational scenario is estimated to 1-2 sessions of school-based work.*

Technical requirements: *For the implementation of the educational scenario are required: pc, cnc, tactile maps, piaf*.

Author's background: *School teacher*

Connection with the curriculum:

The presented educational scenario focuses on the ability to understand the division of a country into administrative regions*. The educational program implements scientific elements from geography, history and maths.*

Learning objectives:

Through this educational program, students become able to recall the prefectures of Greece, to locate them on the map and to recall their capitals.

Guidance for preparation:

For the indoor activities school teacher uses cnc machine to create a magnetic map of Greece and piaf machine to create swell-paper tactile maps

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  Teacher asks students to watch a forecast on YouTube about weather in different prefectures of Greece.

- **Define questions from current knowledge:**
  Students are encouraged to make assumptions about their remarks. In order to help them teacher poses questions. For example:

  - *What are the prefectures?*

  - *Why is Greece divided into prefectures?*

  - *What other prefectures have you heard?*

Teaching Phase 2: Active Investigation

- **Propose preliminary explanations or hypotheses:**
  The list of the prefectures of Greece as well as the geographical districts is given to students. Students are asked to match them.
  Additionally, they attempt to fit on a magnetic map (manufactured with a cnc machine) three-dimensional magnetic pieces and labels (braille and magnified) with prefecture names.
- **Plan and conduct simple investigation:**
  Students in their groups are searching on the Internet for information about the prefectures. Particular viewers collect photos of prefectures and print them on swell paper. Then adjust them (pencil strokes) in order to create the appropriate relief using the piaf machine.

B) Visit

(Teaching Phase 2: Active Investigation)

Teaching Phase 3: Creation

- **Gather evidence from observation:**

Students compare and match the magnetic pieces with the images that they have already collected and adapted. Then they look up on the map to find the right spot on which each magnetic piece will be placed. They place all the pieces.

Teaching Phase 4: Discussion

- **Explanation based on evidence:**
  Students orientate themselves on the map and using the toolkit they can hear the name of each prefecture. Then they read the label that they have already placed during a previous activity and either confirm or update their choice.

- **Consider other explanations:**
  Teacher and students talk about largest cities and students realize that there is one in every prefecture. This is the capital city. Then they match the cities with the prefectures.

C) Post-visit

(Teaching Phase 4: Discussion)

Teacher and students are looking for historical data about the division of Greece into administrative regions*. They discover the causes that led to this division.*

- **Follow-up activities and materials**

Students browse the web for information on administrative divisions in other European countries.

Sustainable contact

The educational program is presented to other teachers and is uploaded to the school webpage, where educational material is presented.

5.6.5. Title: “ The solar system”

The Educational Pathway Pattern for a Pre-Structured Visit by the School

A) Εισαγωγική Φάση

Educational Scenario

The educational activities in the presented educational scenario aim to introduce students to the following spatial concepts: earth, satellite, scale, rotation, sphere orbit, system, distance, size, space, interaction

Title: “The solar system”

Short description: Through the implementation of the presented educational scenario students will discover the solar system structure and the planets and satellites it consists of. Students will have the opportunity to compare the planets according to their characteristics (size, distance from the sun, color).

Key words: earth, sun, planets, satellite, scale, rotation, orbit, system, distance, size, space, system, interaction

Target audience: teacher with students

Age range: 12-15 years old

Time required: The approximate time needed to implement the educational scenario is estimated to 2 sessions of school-based work.

Context: *The educational scenario is implemented in the school classroom*

Author’s background: *The educational scenario was prepared by school teachers.*

Technical requirements: The implementation of the educational scenario requires:

- A 3d model of the solar system
- A tactile map of the solar system in scale
- A braille typewriter
- A ruler
- A source of heat

Connection with the curriculum:
The presented educational scenario is related scientifically to the subjects of geography, maths, literature, history, arts, and music.

Learning objectives:
Through this educational program the students actively learn, encode and discover:

- The structure of the solar system
- The planets and satellites it consists of
- Where earth is located in our solar system
- The planets’ orbital motion

- The planets’ distance from sun
- The satellite of earth
- The difference between the planets

Guidance for preparation:

The school teacher prepares a 3d model and a tactile map of our solar system.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  Prompted by the discussion about the sun and the earth and their interconnected motion and orbits, the teacher is assessing the students’ current knowledge about our solar system. The teacher asks the students to identify the earth in the presented 3d model of the solar system.
- **Define questions from current knowledge:**
  The students are asked to name all the solar planets they already know from the solar system and in parallel the teacher identifies the students’ current knowledge related to the motion of sun and earth and its relation to night and day.

Teaching Phase 2: Active Investigation

- **Propose preliminary explanations or hypotheses:**
  The solar system tactile map is presented to the students and they are encouraged to describe the solar system, make their hypothesis about the planets’ place, their distance from earth and sun and their motion.

- **Plan and conduct simple investigation:**
  The students, under the guidance of their teacher, construct a 3d model of our solar system and comment on the classification of the planets compared to their size and their distance from sun and earth.

B) Visit

(Teaching Phase 2: Active Investigation)

(Teaching Phase 2: Active Investigation)

Teaching Phase 3: Creation

- **Gather evidence from observation:**
  The students represent through role playing the solar system. Sun is represent by the source of heat and the students move around it emulating the planets orbits.
  Teaching Phase 4: Discussion
- **Explanation based on evidence:**
  A tactile map in scale of the solar system is created and students are asked to measure the planets distance on the model, and then calculate their real distance given the model’s scale. Then they try to understand the motion of the planets around the sun.

Consider other explanations:

In parallel with the spatial concept of distance, are also introduced the concept of time and light using the concept of eclipses

C) Post-visit

Teaching Phase 5: Reflection

- **Communicate explanation:**

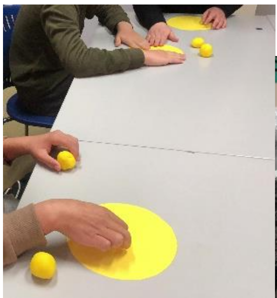
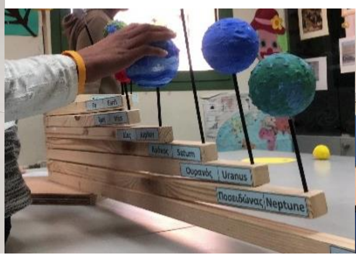
  Through the implementation of the presented educational scenario, students are encouraged to actively discover the planets of the solar system and classify them according to their special characteristics.

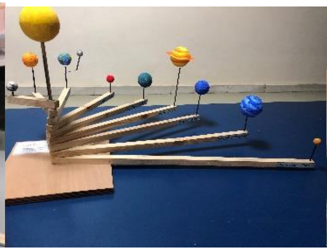
- **Follow-up activities and materials**

Activities referred to the satellites of the different planets and to space missions.

Document completed by: Maria Zeza

Implementation photos




5.6.6. Title: “The title of Earth's imaginary axis and the change of the seasons”

The Educational Pathway Pattern for a Pre-Structured Visit by the School

A) Introductory section and preparatory phase

The educational scenario with the title: **“The tilt of Earth's imaginary axis and the change of the seasons”** aims at giving chances to s**tudents with visual impairments to be able to** develop and elaborate their spatial thinking, working on 3D models, regarding **the Earth's rotation on its axis and the revolution of the earth around the Sun in a counterclockwise position. The above scenario will enable students to** get the appropriate knowledge, attitudes and skills to understand the cause for the changing of the seasons.

Title:

Short description:
The educational scenario gives some ideas and explanations in order visually impaired students to develop and elaborate their spatial thinking. We will focus on:

- How the Earth rotates (counterclockwise) on its axis every day.
- The tilt of the Earth΄s imaginary axis which is the primary cause for the changing of the seasons.
- Furthermore, students during guided practice will understand what are the solstices and the equinoxes.

Keywords:
- Earth
- Sun,
- tilt,
- equinoxes,
- solstices,
- rotation and **revolution of the Earth**
- season

Target audience:
Teachers

Age range:
Up to 12-15

Context:
The educational scenario is implemented in the school classroom. Also it includes a physical visit to Eugenides Fountation –Planitarium.

Time required:
The approximate time needed to implement the educational scenario is estimated to 3 sessions of school-based work and science lab-based work.

Technical requirements:

For the implementation of the educational scenario we need: three-dimensional resource materials showing:

- the Earth as part of Solar System
- the axis of the Earth
- rotation of the Earth and revolution of the Earth
- tactile images and digital resources

Author's background

The educational scenario was prepared by George Christofillakis.

Connection with the curriculum

The above educational material includes many interdisciplinary connections in order to support many subject areas such as: Science, Geography, Literature, History, Mathematics, Music and Technology.

Learning objectives:

Teacher presents the concept of the Earth rotating on its axis and revolving around the Sun, using a 3D model, which has been created in the science lab.

So, after the implementation of the scenario, students with visual impairments will be able:

- to demonstrate the rotation and revolution of the Earth around the Sun
- to understand that the tilt of the Earth΄s imaginary axis is the primary cause for the changing of the seasons
- to relate the four seasons of the year with the equinoxes and the solstices.

Guidance for preparation

Teacher works as facilitator in order to motivate visually impaired students to familiarize themselves with spatial concepts e.g. Earth, Sun, tilt etc. With his guidance and assistance students touch and observe the 3D model which presents the Earth's imaginary tilt and its revolution around the Sun.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

Provoke curiosity:

Resent research has shown that students of this age believe incorrectly that the seasons change because of variations in the distance between Earth and the Sun.

Teacher having in mind this misconception asks students to brainstorm what do they know about **how and why does the Earth move. Also, how is the Sun related to the movements of the Earth. In this way teacher reinforces students to share their prior knowledge as a whole class regarding the above questions.**

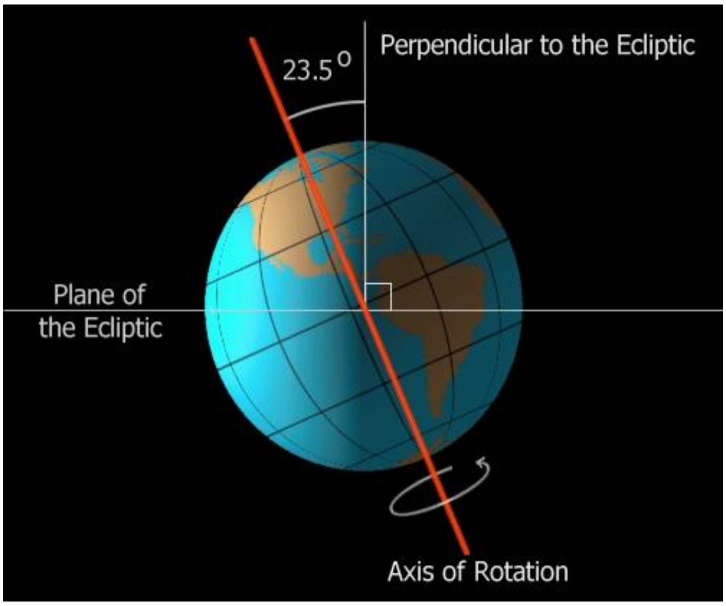
- **Define questions from current knowledge**

In order teacher to find out students΄ prior knowledge, he asks them to take few minutes to write their responses to the following questions:

- " Which is your favourite season of the year and why"?

- “ What season do people who are living in the south hemisphere have at the same time with us”?
- “ What would happen if the earth didn't rotate?
- “How long does each season of the year last” ?
- “ Describe the changes which occur in the nature during the seasons”.
- “ What is the primary cause for the changing of the seasons” ?

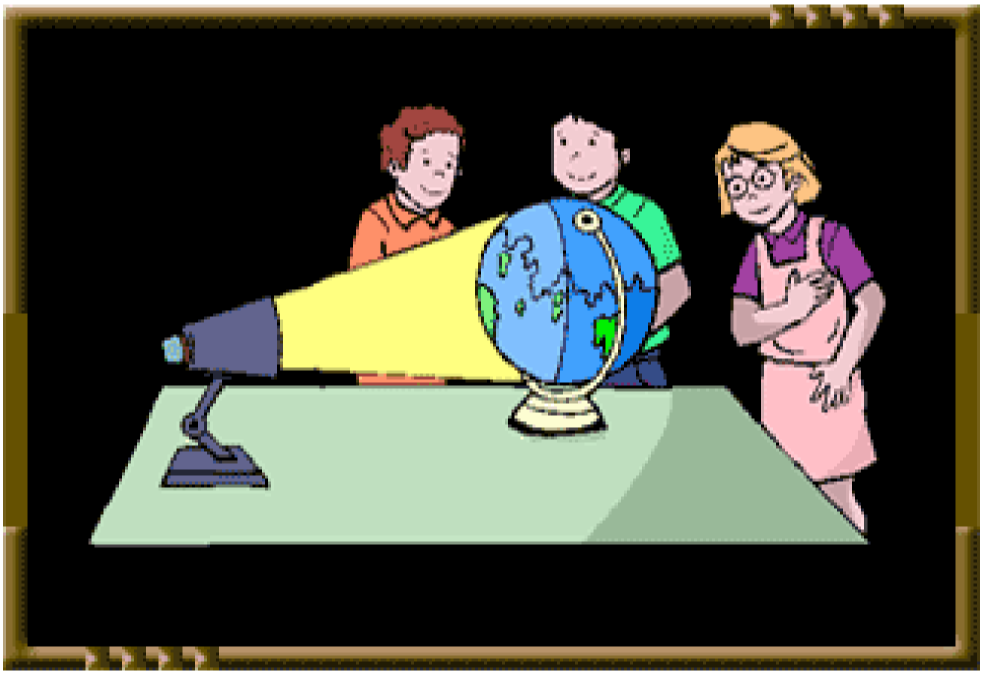
Teacher encourages vi students to elaborate their spatial concepts by let them touch and examine the three-dimensional model showing the Earth and its revolution around the Sun.
Students realize that **the Earth does not rotate with its axis vertically. The Earth's axis is actually tilted approximately 23 degrees and for that reason we have the changing of the seasons.**



Teaching Phase 2: Active Investigation

- **Propose preliminary explanations or hypotheses:**

Students are directed by the teacher to participate in an active investigation. In a central location of the classroom they place a light on a table. This lamp represents the Sun. A student in a distance about one meter away from the light is holding the globe tilted at approximately 23.5 degrees and rotates it around its axis and at the same time revolves it around the Sun, as he walks in a counterclockwise direction. The student has as a guide a rope which is stuck on the floor of the class. It is essential to mention that the student will not change the orientation of the axis while orbiting the model Sun. Teacher encourages students to observe carefully and point out changes in how the globe is illuminated by the lamp at different locations in its orbit. Furthermore, he asks students to identify the positions in the orbit which represent each of the four seasons of the northern hemisphere and to mark the classroom floor with the dates of the spring and fall equinoxes and the summer and winter solstices.



Plan and conduct simple investigation:

Teacher facilitates vi students by giving them a three-dimensional model (resource already available in the school classroom/lab) showing Earth's revolution around the Sun, which lasts 365 days and six hours. He asks students to observe the vertical incidence of the Sun΄s rays on the surface of the hemisphere, which is on the side of the Sun. This hemisphere has summertime and receives more amount of light and heat than the other hemisphere, which receives less amount of light and heat. That happens because the Sun΄s rays fall sideways on this hemisphere.

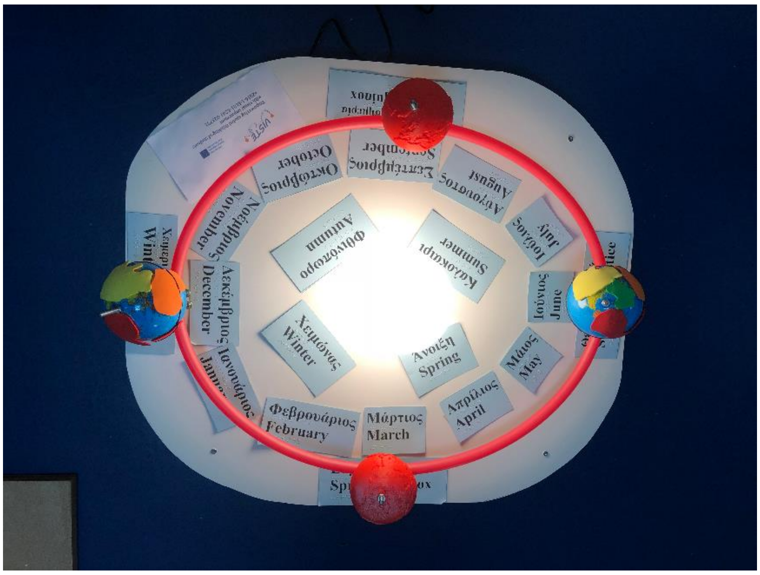
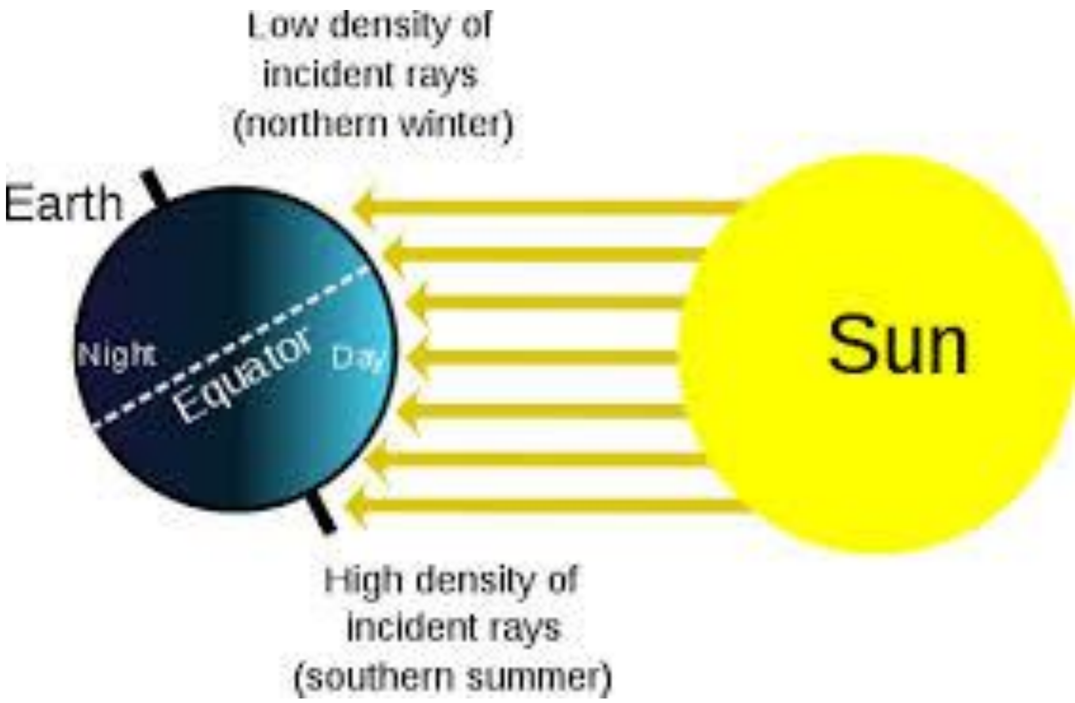


Image 3D model



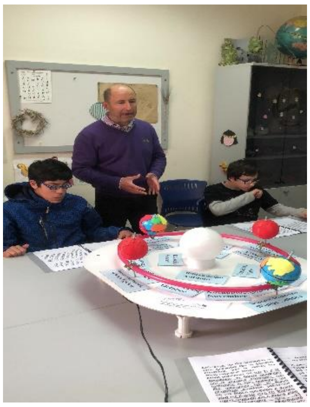
C) Visit

Teaching Phase 2: Active Investigation

Students will be directed to access the following internet websites:

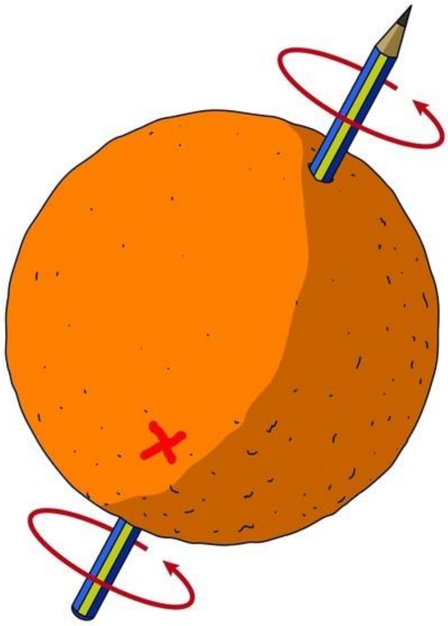
https://www.youtube.com/watch?v=vDgUmTq4a2Q
https://www.youtube.com/watch?v=cDed5eXmngE
https://www.youtube.com/watch?v=Pgq0LThW7QA

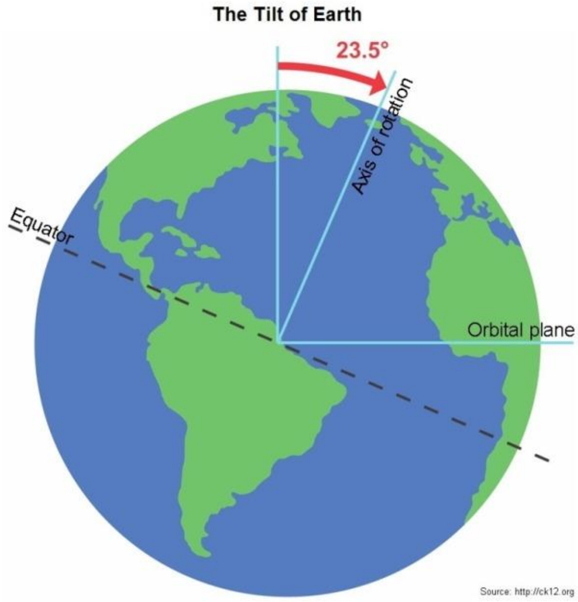
in order to listen from an expert the process of two movements of the Earth. They will understand that the tilt of the Earth´s imaginary axis is the primary cause for the changing of the seasons. From the narration they will be informed about the spring and fall equinoxes and the summer and winter solstices.



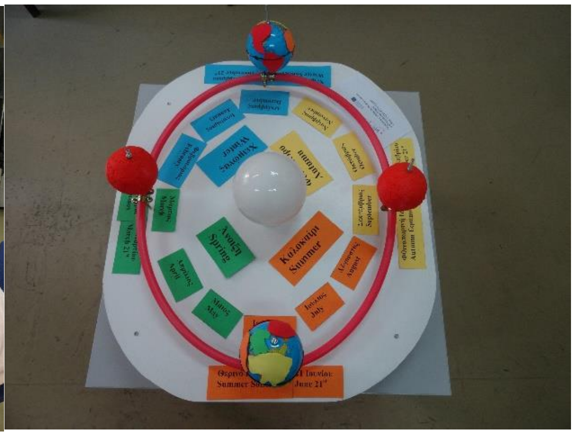
Teaching Phase 3: Creation

Teacher tries to built to his vi students a greater understanding of the **earth's axis which is actually tilted approximately 23 degrees. For that reason he directs students to puncture an orange with a pencil as it is shown in the model beneath:**



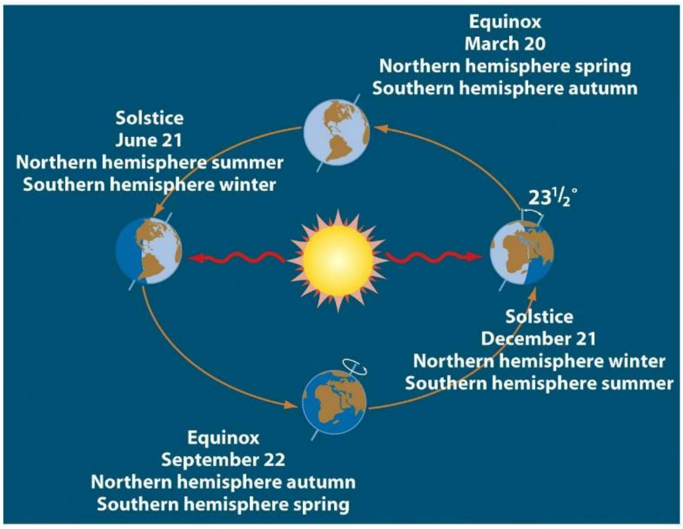


Furthermore, students observe and play with the 3D model which has been created in the science-lab and represents the Earth revolving around the Sun. With this activity student will improve their concepts and skills developed in the scenario regarding the changing of the seasons.



Gather evidence from observation

At this phase teacher provides vi students with an opportunity to collect evidence under his guidance to address the effects of the Sun's rays upon different areas of the Earth. Students work on the following three-dimensional model in order to elaborate their knowledge by their observation regarding the spring and fall equinoxes and the summer and winter solstices.



Part III Opener
Earth's Climate: Past and Future, Second Edition
© 2008 W.H. Freeman and Company

Teaching Phase 4: Discussion

- **Explanation based on evidence**
  At this teaching phase VI students could discuss how the Earth rotates (counterclockwise) on its imaginary axis every day and this action actually creates night and day for us. Also its rotation is on a tilt of 23.5 degrees. This tilt creates the four seasons.
- **Consider other explanations**

Students will be directed to access the following internet website:

https://www.youtube.com/watch?v=rnxdvWF8Mp4

in order to listen to myths related with the changing of the seasons. Particularly, they will get information regarding the myth of Persephone, the myth of Alcyone and some other myths from Greek mythology.

D) Post Visit
Teaching Phase 5: Reflection
Communicate explanation

Students will be directed to access the following internet website:

https://e-geografia.eduportal.gr/geo-st/gstd05_epoxes_why/index.html
https://www.youtube.com/watch?v=WLRA87TKXLM

in order to focus to the following points:
the spring and fall equinoxes and the summer and winter solstices.
Afterwards, students will work on the 3D model and with the teacher΄s guidance will be able to explain and describe what is happening on that equinoxes and solstices.

Follow–up activities and materials

- A visit is organized by the school to visit the Planitarium of Athens – Eugenidou Foundation.
- Students are asked to complete the following gaps by adding jobs of people who are living in Greece during the time of Summer, Spring, Autumn and Winter.
    1. Autumn: harvester, ……………….. ………………
    2. Winter: skiing, ………………… …………………….
    3. Spring: plowing, ………………… ………………….
    4. Summer: swimming, ……………… ……………..
- Students will be directed to access the following internet website:

https://www.youtube.com/watch?v=GRxofEmo3HA

in order to listen the music piece: "four seasons" of Vivaldi, one of the most famous composer of classic music. Then they will be asked to describe their feelings while listening the music.

- Also, students can relate the music pieces with the relevant season of the year. After that they will realize that the melody of the musical instruments could reflect sounds of nature which are related with every single season of the year.
- After the implementation of the above educational scenario, a questionnaire can be a powerful tool in order to assess students learning regarding spatial perspectives of this lesson. In this way teacher could be able to identify specific areas of interventions, to detect problems in order to achieve the desirable goals.

e.g. Some questions could be the following:

Q u e s t i o n n a i r e

1. What is the primary cause for the changing of the seasons?

A. the revolution of the Earth around the Sun and her distance from the Sun

B. the rotation of the Earth on its imaginary axis and the vertical incidence of the Sun΄s rays

C. the revolution of the Earth around the Sun and the lateral incidence of the Sun΄s rays

D. the revolution of the Earth around the Sun and the tilt of its imaginary axis.

2. When the northern hemisphere is turned to the Sun, what season does this hemisphere has?

A. winter

B. spring

C. summer

D. autumn

3. On the northern hemisphere the spring equinox occurs on 21st of March. At the same time on the southern hemisphere starts the season of:

A. summer

B. spring

C. winter

D. autumn

4. During the winter solstice (21st December) the Sun΄s rays fall laterally on the:

A. northern hemisphere

B. southern hemishere

C. eastern hemisphere

D. western hemisphere

Sustainable contact:

The educational program is presented to other teachers and it is uploaded to the school webpage where educational material is presented. Also it is available in the GEOTHNK repository.

5.6.7. Title: “Train of Spatial Thought – Divided Attention for 3rd- 6th grade”

The Educational Pathway Pattern for a Pre-Structured Lesson Plan by SESBA Using the VISTE Toolkit

A) Introductory section and preparatory phase

This educational pattern aims at Divided Attention through logical reasoning process for children with VI (blindness or low vision). Divided Attention refers to the ability to simultaneously respond to multiple tasks or task demands using spatial thinking cues and elements that enhance the ability to combine multiple cognitive processes to recognize patterns, draw conclusions and make decisions.

Title:

Train of Spatial Thought – Divided Attention for 3rd- 6th grade

Short description:

When interacting physically with the outside world, the child with VI must acquire motor and tactile exploration skills. This educational material gives the opportunity for conscious repetition of motor activities; listening and performing a kinaesthetic / tactile activity; and planning factorial functions efficiently.

Keywords:

VI, spatial thinking, divided attention, planning

Target audience:

The Occupational Therapist / Ergotherapist and students

Age range: *9-15*

Context: *A classroom, an OT center or independently.*

Time required: *45 min with gradually reduced time*

Technical requirements: *map rout, train models, train station models, VISTE toolkit*

Author’s background: *Occupational Therapist/Ergotherapist*

Connection with the curriculum:

Train of Spatial Thought combines multiple cognitive processes to recognize direction patterns, draw spatial conclusions and make planning decisions. Children with VI are delayed in developing a Euclidean understanding of space, or they are delayed in developing a unitary, integrated model of the environment, and thus spatial organization develops slowly. However, spatial information can be derived from hearing, touch and movement and also a child with VI therefore has the potential to acquire concepts and representations of the spatial domain equivalent to those of sighted children.

As prerequisite knowledge it is important for the child with VI to have adequate proprioceptive sensation arising in sensory receptors in the muscles and joints. In passive touch the child is the recipient and in active touch the child is the source of the movement. The development of the tactile sense is critical when children with VI are learning to read Braille or tactile graphics using spatial thinking notions.

Learning objectives:

VI together with training of tactile acuity and skills indeed leads to improved tactile skills on a broader scale.' Improvement of spatial thinking perceptual skills needs systematic training; it improves sensitivity and accompanying changes in cortical representations. Fine motor skills like directed reaching, wrist rotation, grasping, and pushing an object are essential for learning Braille, tactile graphics and map reading, as well as for keyboard technology and O&M skills.

Guidance for preparation:

The OT/Ergotherapist designs the spatial thinking map routes of trains and train stations that the child with VI has to follow in order to create a mental map by listening to specific directions from the VISTE toolkit. The OT/Ergotherapist also prepares tasks for the child giving starting and end points for spatial thinking notions.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  In order to get the students interested in learning how to follow spatial thinking directions the OT/Ergotherapist offers a preliminary revise of the main spatial thinking notions.

  Define questions from current knowledge:

  <u>*The following questions can be answered both verbally or non verbally.*</u>

  Which train station is the furthest / nearest one?

  Which train is previous / comes next?

  Which train or train station is on the right / left/ upwards/ downwards?

  Which train completes the first pair in the same way as the first train?

(Questions are adapted from the text book "11+ Non-verbal Reasoning and Spatial Awareness exam | Bond 11+")

Teaching Phase 2: Active Investigation

- **Propose preliminary explanations or hypotheses:**
  During the provoke of curiosity the OT has already given the preliminary explanations or hypotheses. The next step is the assessment procedure of the maximum spatial reasoning ability with the child's overall participation and fully contribution. It is a typically pre-defined level of

ability that the child with VI will need to demonstrate in order to continue with the implementation process.

- **Plan and conduct simple investigation:**

1. Encourage active, physical exploration of the real world

Children with VI need raw data. They need to feel tactile routes first, and explore objects and routes hands-on. Children with superior mental rotation abilities are the ones who spend more time handling and investigating objects.

2. Seize everyday opportunities for spatial thinking and spatial talk

Words that will help children with VI reason about spatial properties, like over, under, right, left, straight, straight ahead, turn, up, turn down, upwards, downwards, bent and curvy. Common sense suggests that kids who learn such terms are more likely to use them when they talk, and that will help them tap into the power of verbal explanation. Studies show that children learn concepts better when they are asked to explain what they discover to other people.

3. Provide kids with tools for building structures, and boost enthusiasm by getting involved yourself

An array of evidence suggests that children with VI develop better spatial skills when they learn with 3D materials.

4. Introduce construction games that challenge kids to "match the design"

Research hints that a particular form of structured 3D play, may be especially valuable. This is when children with VI are shown the "blueprints" for a map navigation and given a set of objects and directions to explore it. "Match-the-route" exploration games may be helpful, in part, because they stimulate spatial talk and navigation.

5. Encourage children to use and create maps

Children with VI can handle more complex maps, and they benefit from structured mapping activities, especially ones that require them to explain their choices.

6. Encourage kids to use gestures when solving spatial problems

Experiments demonstrate that adults and children solve planning problems more readily when they are allowed to gesture.

B) Visit

(Teaching Phase 2: Active Investigation)

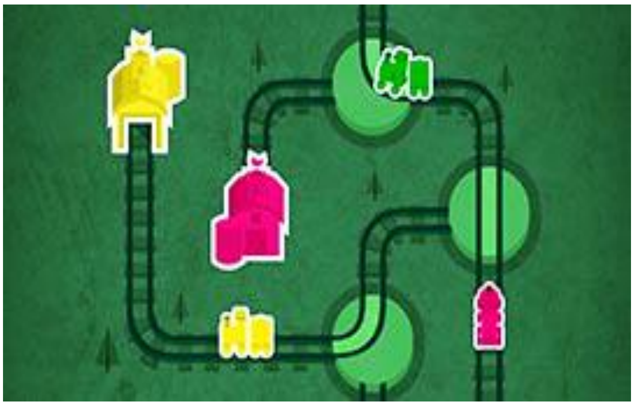
"Active Investigation" takes places throughout the process and it continues in the follow-up process.

Teaching Phase 3: Creation

- **Gather evidence from observation:**
  In Trains of Spatial Thought the child has to manage train tracks so that all trains can reach corresponding color train stations following the directions of the VISTE toolkit. For example the child has to manage the train track so that green colour train goes in green color train station. The game is organized into 14 levels. At the beginning of each level, the train leaves the mountain tunnel and emerges onto the truck. From there, the child must flip a switch at each fork in the track in order to guide the train into the color-matched train station. The OT/Ergotherapist marks a beginning position on the task and gives a set of directions.

LEVEL 1

LEVEL 2



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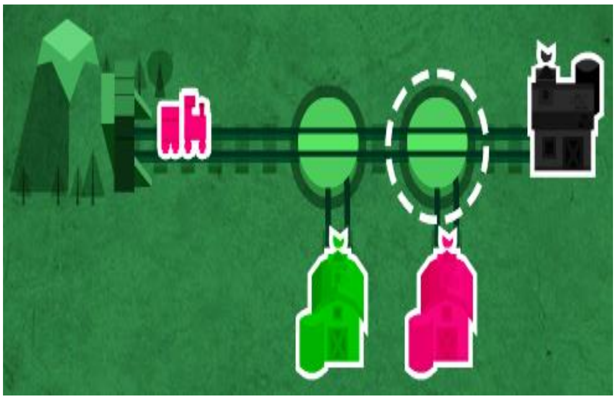

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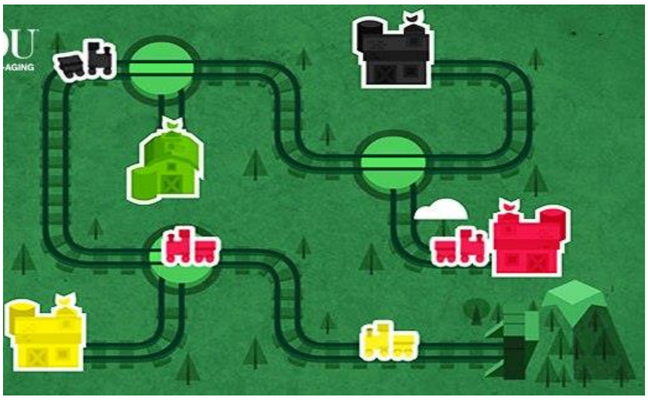

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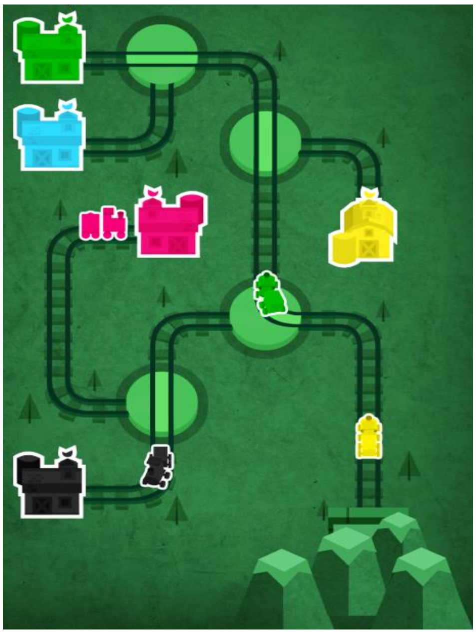

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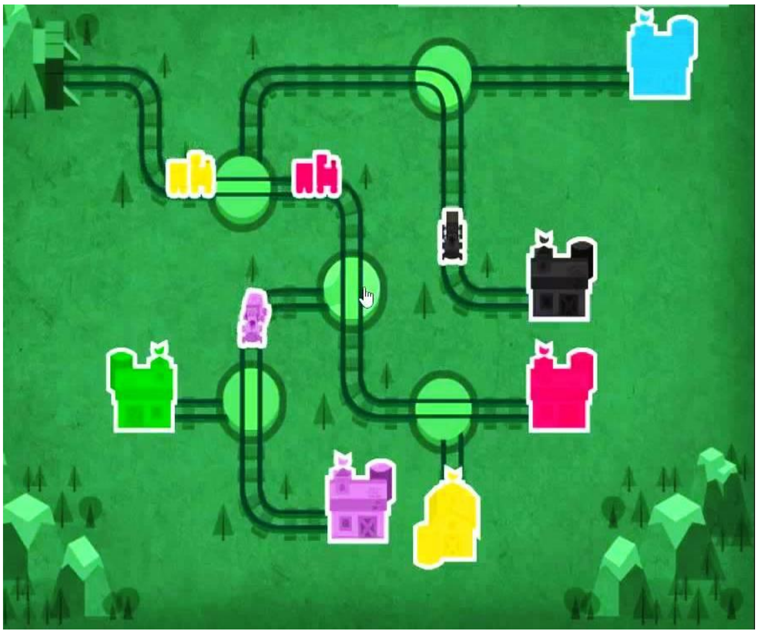

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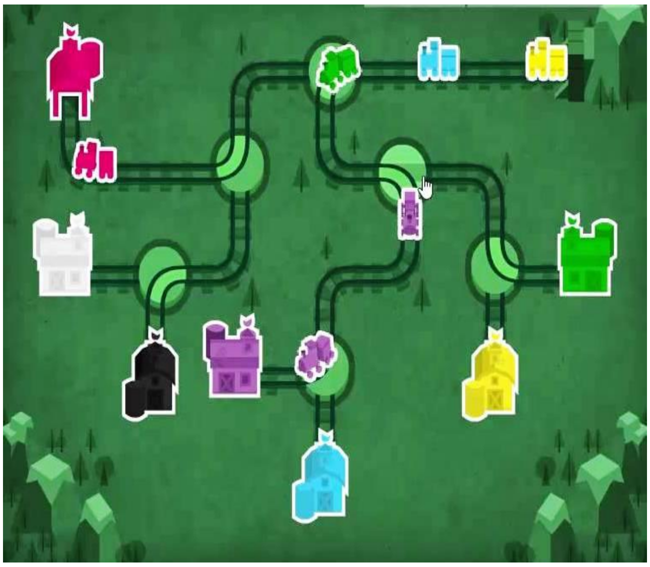

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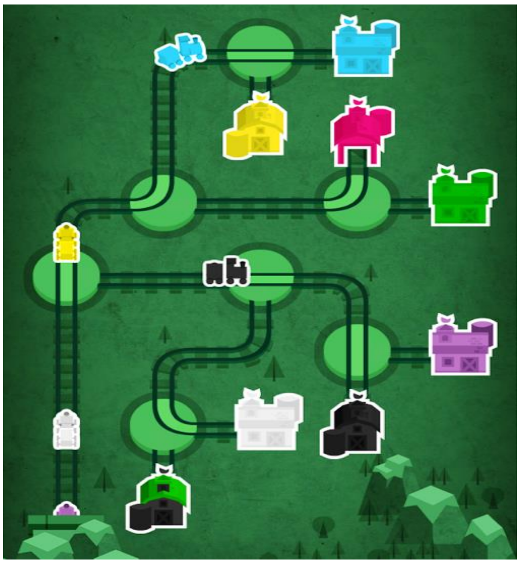

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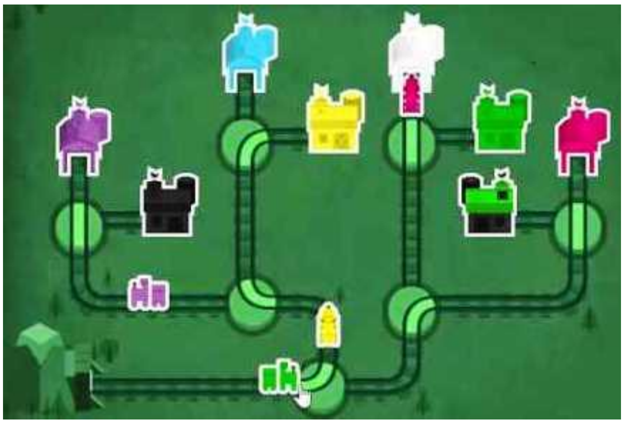

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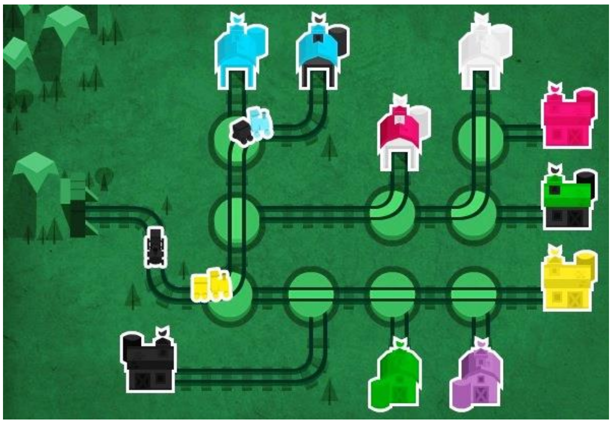

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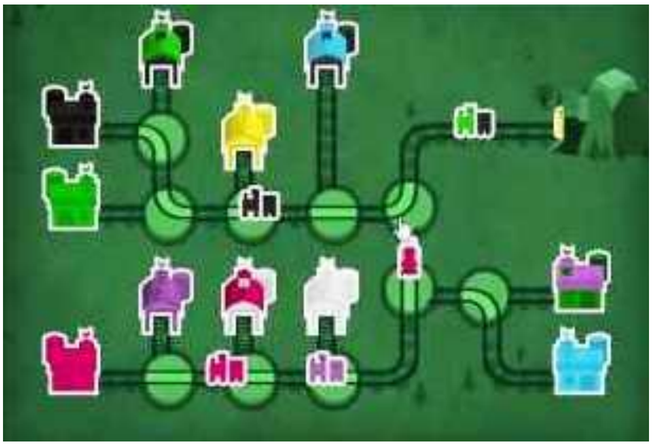

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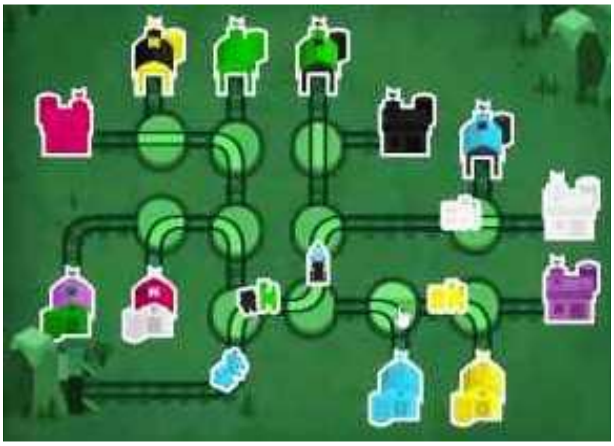

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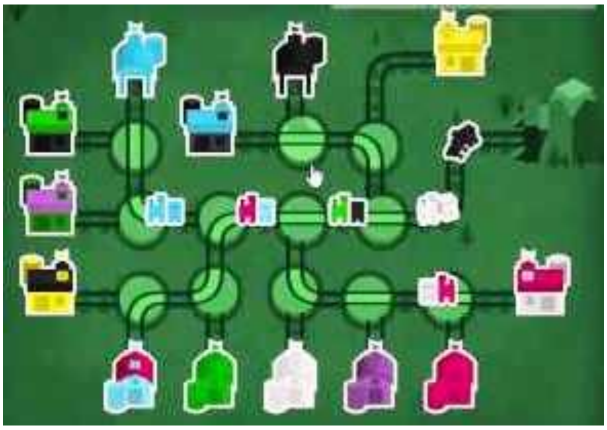


LEVEL 14

Teaching Phase 4: Discussion

Discussion took place either during or after the 'visit', or both, depending on whether the OT/Ergotherapist considers that the use of alternative orders is necessary (or feasible) at this stage. Ideally, Discussion, and particularly the step of Explanation based on evidence, reinforced the link between the physical experience of using the resource and the mental processing of the observed information by the child with VI.

- **Explanation based on evidence:**
  As a prerequisite of spatial thinking learning, the child with VI needs to experience spaces of accuracy and with different acoustics in order to develop spatial concepts, spatial understanding and orientation in space using the auditory and tactile cues available. Children with VI should be encouraged to explore the environment through locomotion. Early locomotion is critical in the development of spatial thinking and in finding the relationships between objects in the environment. Train of Spatial Thought is designed to help the player learn to avoid distraction and concentrate better in multitasking.

- **Consider other explanations:**
  The significance of hearing and auditory information increases in the perception of space when children with VI begin to move about. Besides vision, hearing is a sense that gives information from far. By hearing children can sense phenomena that are located behind their

body or around the corner. Auditory perception is generally a significant information source for a child with VI.

For children with low vision, Train of Spatial Thought enhances visual perception and peripheral vision.

C) Post-visit

(Teaching Phase 4: Discussion)

Perceptual abilities and underlying brain mechanisms are modified by experience in utilizing different modalities. Following sensory deprivation, children with VI learn to utilize more effectively other available sources of sensory information, for example, auditory and tactile by the VI. This results from heavy reliance on these sensory modalities, thorough practice in using them and changes in neuronal networks normally devoted to the lost senses. The tactile sense of the child with VI partially compensates for near vision and the auditory sense for distance vision.

Teaching Phase 5: Reflection

- **Communicate explanation:**
  Young children with VI have difficulties in developing cognitive maps and in tasks that require comparisons between modalities because they lack a general framework for fitting in sensory information. By young adulthood the tactile frame of reference has developed and these problems have disappeared. The presented educational lesson develops cognitive spatial thinking maps based on tactile, kinaesthetic, and auditory information. This capacity for cognitive mapping develops more slowly than in the sighted person, but the product is not necessarily inferior to or less efficient than that based primarily on visual input. It is important to prompt children who are blind to organize spatial information by different coding strategies which differ from visual experiences. The lack of vision and the resulting difference in the quality of experience of space lead these children to approach a task by using strategies different from those of sighted children. The lack of vision is not a hindrance for images, but visual experiences make it possible to manipulate images. According to these specific spatial tasks, children with VI have the potential of achieving the same level of efficiency as sighted subjects. It is important to try to find and train a variety of strategies.

Follow-up activities and materials

For further practice, it would be important to determine how children with VI who could improve their perception of space in a multisensory way and how they could develop useful cognitive resources to structure an unfamiliar environment. This spatial thinking programme was designed for children, but there are many adults who also want to learn to read tactile maps. They need their own, age appropriate learning programme. Besides children with visual impairments, there are other groups, who can benefit this program. A recent study about the vision problems among the children with physical disabilities revealed problems in their functional vision and showed several difficulties when they try to and to orientate in the unfamiliar environment. It is worth of an experiment whether the children with different disabilities can learn better to control unfamiliar environment by learning map reading through a systematic programme.

Sustainable contact

This activity was presented in:

- *"Project VI" training course that took place from 17-23 August 2015, in Swindon, England , United Kingdom. The course aimed to give confidence to those developing international activities under the Erasmus + programme the confidence and skills to engage VI and Blind young people into their future projects. Also the aim of the training course was to increase the opportunities available for blind and VI (visually impaired) young people in the realm of international non-formal education projects.*

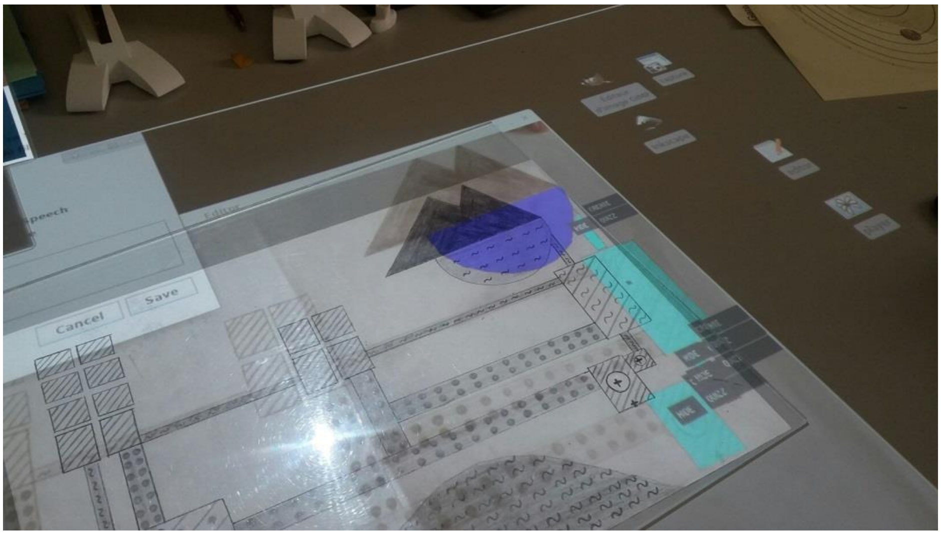
For further details please contact Ms Mary Stylidi, OT/Ergotherapist in the following e-mail address: marystilidi@yahoo.gr

5.6.8. Title: "Water in everyday life"

Water in everyday life

Educational scenario for enhancing spatial thinking in students with vision problems
Scriptwriter: Angeliki Kosma, Specialized Teacher at the Special School of Blind Kallithea (SESBA).
Link to the Curriculum: This educational scenario is an interdisciplinary scenario. It is connected with the subjects of the Environmental Study, Language, Physics, Visual Arts and Music. Gives some ideas and explanations to develop and process the spatial thinking of students with visual impairments about water in everyday life and how from the source, the lake or the river the water is gathered in the aqueduct where it is cleansed and then large water pipes are shared in the homes and other buildings of a settlement. The used water goes with sewer pipes in the sewers and the biological cleaning building where it is cleaned before it returns to nature. The educational scenario is applied to the classroom.

Age range: 7-9
Target audience: Teachers and students
Time Required: The approximate time required is 2 teaching hours.
Technical requirements: To apply the educational scenario are required: three-dimensional haptic model of the water cycle, made by a CNC machine tool, another model of the water supply system of a settlement and its recycling through biological purification. A model of a traditional watermill, and a second model showing a hydroelectric plant in a natural environment with all the relief elements (lake, river, barrier, hydroelectric plant, etc.) helps visually impaired students to understand that the water is for the planet our "green energy" in addition to a basic component of life. Embossed Globe, Embossed globe of smaller size made through 3D printer. Tactile toy-water modeling model , water map of settlement using microcapsule paper materials for visual constructions such as paints, (markers, pastels, etc.) *clay*, plasticine. Braille machine, computer, toolkit.



A toolkit-map of water supply

Keywords: Energy (dynamic - kinetic), alternative energy sources, hill, small lake, residence, water mill, water volume, settlement, ecosystem, observation, environment, river, hydroelectric plant, aqueduct, water supply.

Learning objectives

Cognitive

Visually impaired students understand the interaction between man and water.

Meet what is the hydroelectric plant, the watermill, the aqueduct and the biological purification plant.

Learn to analyze, synthesize and evaluate the information they collect.

Learn about the variety of uses of water.

Learn about the dangers posed by drinking water.

Understand the role of water to preserve life on a global scale.

Recognize the symbolism in a memo.

Learn to use modern technologies.

Emotional

To raise awareness among children about water and the environment.

Develop a sense of responsibility for sustainable management - the consumption of water with which they have daily contact.

Understand the consequences of water pollution

Psychomotor

Watch using all their senses, listening to water sounds, tasting it (sweet, salty, cold, hot) by touching and smelling it.

Pre-visit

Teaching phase

1.1 Question Eliciting Activities Provoke curiosity:

Students hear different sounds of water (rain, storm, waterfall, etc.) and then water songs.

Define questions from current knowledge

In order to encourage students to share their previous knowledge of the amount of water on the planet, we ask the students to express their opinion on this subject. We discuss and explain to our students how important water is to our lives. Water is an essential element of our planet's life. Three-quarters of the surface of the Earth is covered with water. We give our students an embossed globe (Fig.1 and Fig.2). Students observe the embossed parts and the blue color of our planet and conclude that most of the surface of the earth is covered with water. Although only 1% of freshwater can be used by people for their different needs (agriculture, industry, domestic use). In addition, clean drinking water is only a small percentage of this. The largest part of child mortality (and not only) in the Third World is due to the inability of people to access clean drinking water. That is why it is worth highlighting the need for proper management and recycling.

The Embossed globe

Children touch the Embossed globe

Embossed globe from a 3D printer2nd

Teaching phase 2

2.1 Active Investigation
Propose preliminary explanations

We encourage students to make assumptions about the origin of drinking water and its recycling. We do a discussion and help students to express their views and write their ideas and suggestions on the origin of the water (what they know about the water cycle, the hydroelectric plant, the water mill, the water supply network, the aqueduct and the biological water purification)

Children learn the “PERPERITSA” a story of the water cycle, made by the teacher of SESBA , Maria Z. and Basilis P .

2.2 Active Investigation - Planning and conducting simple research

In order to enhance the spatial thinking of visually impaired students, we give pupils the chance to study the water circle with haptic activities. Children observe an embossed model of the water cycle and discover the journey of water to nature. (fig. 3) They learn that the water of the sea, the lakes and the rivers, when heated by the sun, evaporate, that is, it becomes water vapor. Water vapor rises up in the sky and forms the clouds. There they are cooled; they are dropped again and fall to the earth like rain, hail or snow. So they return to the sea, the rivers or lakes, that's where they started. This water journey continues again and again and is called a circle of water.

Water cycle model

Children discover the Water cycle model

Children discover the Water cycle model

We collect data from the observation: Visually impaired students observe a haptic three-dimensional model representing a watermill (fig. 4). Students are aware of the use of energy that water can provide (hydraulic power), with the operation of the watermill, which is a hydro-powered mechanism with a small or large hydro rocket, the impeller, mounted horizontally (Greek) or vertically Roman). They are monuments of the technical civilization of the pre-industrial period.

Traditional watermill model

Children discover the traditional watermill model

Students then observe the model of a hydroelectric plant (Fig.5 and Fig.6), which is a development of the traditional watermill.

Children learn the traditional watermill model

Children learn the traditional watermill model

Hydroelectric plant

Hydroelectric plant model

Children learn the hydroelectric plant model

Children discover the hydroelectric plant model

Children discover the hydroelectric plant model

Hydroelectric plants produce "green energy", which does not pollute the environment; on the contrary, it protects lakeside life. Students observe the barrier that holds the water in an artificial lake (the reservoir) and the water barriers that regulate the flow of water. The turbine is a device with special fins, thanks to which the kinetic energy of the flowing water turns into a rotary and the generator, which converts kinetic energy into electricity. Finally, from the power generation plant, electricity transmission lines to the places of consumption begin.

Visit

Teaching phase 3

3. Creation

3.1 Gather evidence from observation

We encourage visually impaired students to process these spatial concepts and observe a tactile model related to the water supply of a settlement with the aqueduct, the dwellings and the biological purification unit (Figure 7) Students, in the first instance, monitor the journey of water from the source to the tap, that is, the water supply with an intersection to the aqueduct, where natural water becomes drinkable and suitable for every household use. In the second stage the students are engaged in the journey of the used water to the sea, i.e. the drainage, with the intermediate purification plant, where the water with special purification treatment returns to a nature-safe state.

Water supply and biological cleaning model

Children learn the Water supply and biological cleaning model

Children discover the Water supply and biological cleaning model

Children discover the Water supply and biological cleaning model

Teaching phase 4

4. Discussion

4.1 Explanation based on evidence

We give pupils a three-dimensional haptic toy model that shows the water supply of a small settlement (Figure 7). The toy includes pieces of related items such as aqueduct, settlement, water pipes, drainage pipes, biological cleaning center. We discuss and explain to our students their place and their existence. Students need to identify and then place the pieces in the model game in the right place. Then we give a haphazard map of the water supply network of a settlement that gives audience information to students with visual impairments on the map data (Fig.8). Students process the map and discover the data given to it.

Water supply and biological cleaning model- toy

Children “play” with Water supply and biological cleaning model- toy

Children “play” with Water supply and biological cleaning model- toy

Children “play” with Water supply and biological cleaning model- toy

4.2.Top of other explanations

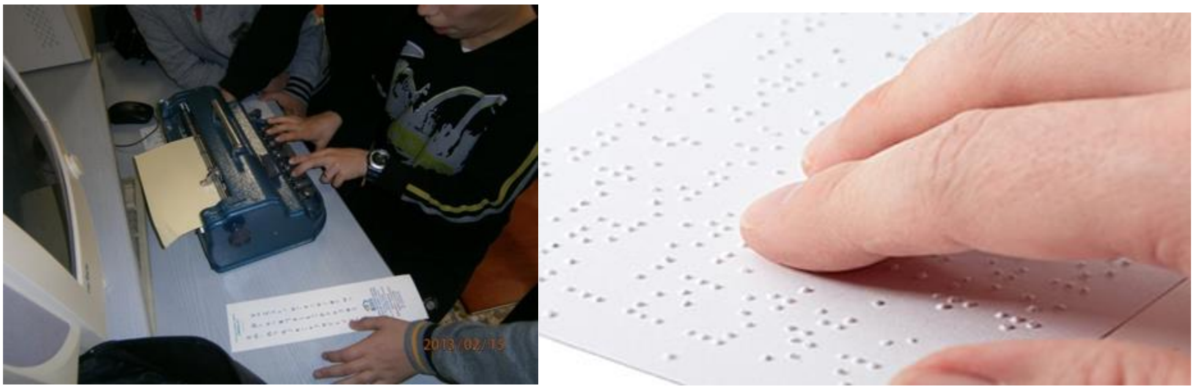
We discuss with students the possible misconceptions they may have about the subject that was analyzed and investigated. Possible misunderstandings of students about the tactile reading of the map.

Post- visit

Teaching phase 5

5.1 Reflection

The teacher encourages creative writing. Students, with the help of the teacher, prepare a small report - a report describing their investigation and conclusions, expressing their opinion from the experience they have acquired (fig.9 and fig.10)



Completion of worksheets

5.2 Post-monitoring activities and materials

Students can still express themselves through visual arts, painting, (Fig. 11) Sculpture, collage, music or play by transferring the newly acquired knowledge of spatial concepts that have been analyzed.

Paintings

On World Water Day (22 March) we visited the water company of Athens (EYDAP)

On World Water Day (22 March) we visited the water company of Athens (EYDAP)

On World Water Day (22 March) we visited the water company of Athens (EYDAP)

In a school celebration we sang and dramatized the cycle of water

5.3 Sustainable contact

The educational scenario is presented to other teachers and uploaded to the school's website, where other educational material is presented.

5.6.9. Title: " Imaginary Tour of Europe by Plane"

A) Introduction and Preparation

Short Description:

The activity aims at integrating mathematics and calculus skills in daily life situations that involve air travel. Thus, students have the chance to develop various interdisciplinary skills, such as: map reading (geography), air transport means (technological education), measure units, ratios and proportions (mathematics). The teacher and the students will visit the airport together, in order to collect the necessary information related to air travel and, then, will use this information in the calculation of the distance and duration of a European tour by plane which will include 5 cities. The representation of the tour and the information related to the reading of the maps could also be made accessible by means of the ICT tool developed during the VISTE project.

Key Words:

Spatial thinking, map, scale, measure unit, airport, plane, tour

Target group: 11 visually impaired students

Age range: 12-15 years old

Context:

Classroom – Special High School for the Visually Impaired in Cluj-Napoca

Avram Iancu International Airport in Cluj-Napoca

Timing: 3 hours

Technical requirements:

- Tactile map of Europe
- Tactile ruler
- 3D models of representative buildings in the 4 capitals included in the tour
- worksheets
- Calculator
- Computer, video projector, speakers
- VISTE Toolkit

Author:
Adriana Ondreiov – Math teacher (Liceul pentru deficienti de Vedere, Cluj-Napoca)
Curriculum expert: Dina Pripon (Casa Corpului Didactic Cluj)

Connection with the curriculum:

The activity integrates specific notions of geography, technological education and mathematics. The concepts of geography refer to the representation on the map, the exploration of a map and the way to use the scale to find out the real distances between two points on a map. Another issue is the transmission of specific information on some representative cities in Europe, focusing on national and local particularities. The concepts of technological education relate to the means of air transport and the specifics of their use. Mathematical concepts refer to specific exercises of transformation of units of measurement and to reports and proportions.

Objectives:

- To develop spatial thinking skills for visually impaired students through practical applications such as: Identifying capitals on the map of Europe, using a tool kit to determine a route, measuring distances on the map, calculating actual distances by knowing the scale of the map, converting units measure in the appropriate ones to solve the problems, calculating the flight times between two European localities, calculating the local time.

- To improve the skills of visually impaired students to adapt to a new environment – visiting Avram Iancu International Airport in Cluj-Napoca, respecting the rules of travel and security specific to an airport, exploring the interior of an airplane, finding technical details about flights.

- To use technology in order to present and watch a collage of images from the proposed capitals, as well as to listen to the national anthems of those countries.

- To develop the skills to recognize and apply concepts from multiple school disciplines such as mathematics, geography, physics, arts, music in everyday life.

Scenario Preparation Guide:

The scenario consists of 3 main stages: the preparatory stage, the applicative practical stage and the integrative theoretical stage. The initial stage is required for the preparation and implementation of a visit to the airport, a visit where visually impaired students are in contact with the specifics of air transport. In the integrative theoretical stage, the participants will use the notions discovered in the previous stages and, by using already acquired mathematical operations, will calculate the real distances between two cities for some European air routes.

B) Pre-visit

Phase 1:

Activities to generate questions
• Provoking curiosity:
The introduction of abstract concepts such as the flight route or the route of an international flight will be made only after teaching the students the specifics of air transport. In order to present the specific aspects of the air transport, the participating students will visit Cluj-Napoca International Airport.
• Formulating questions based on students' knowledge:

- How do we identify certain cities in Europe on the map?
- What rules do we have to respect at the airport?
- What is the specificity of each city presented?
- How do I calculate the distance to a specific city?

Calculating the distance using the map

Phase 2: Main Investigation

The investigation stage consists of a visit to Cluj-Napoca International Airport

• Suggestion of preliminary explanations or assumptions:

The investigation starts from the hypothesis that the most effective way to travel a long distance between two European cities is air travel. Students will then be able to explore different routes on the map between several cities. As a precursor to integrating information, students understand the specificity of air transport by visiting the airport.

• Planning and coordinating the simple investigation:

The teacher talks to the children about a few aspects that are useful to know before visiting the airport – the objectives of the trip and the main purpose of the trip, the way of travel, rules of behavior during the journey, security rules as well as specific elements such as the way of passing through air control, rules to be respected when boarding an airplane, etc. All stages of the visit and the objectives pursued in each of these stages are presented in detail.

B) Visit

Phase 2: Main Investigation

The visit to the airport is based on the following structure:
-Travel to the airport;
- Passing security control;
- an airport tour;
- Watching a landing or take-off of an airplane;
- Visiting the interior of an airplane;
- Acquiring flight details through staff discussions: at what height the plane is raised, the average speed, the airplane dimensions, the fuel, the number of seats.
- Arrival through the arrival terminal;
- Travel to school;
- Discussing the acquired information.

Visitnig the airport

Phase 3: Creation

• Gathering evidence based on observation:
The gathering of relevant information during the visit to the airport is done through discussions with airport staff and through direct observation. Relevant information refers to the flight time between two cities, the number of passengers, the average height of the plane, the fuel consumption, and the price of a ticket.

Phase 4: Discussion

In the process of integrating and processing information, the pupils discuss the information obtained by tracking aspects such as the speed of a particular route, the distance between the two cities, the average speed of the airplane on the route. At this stage, the participants will have different roles, depending on each person's abilities, as follows:

- A student will assume the role of topographer. It will track the relevant information on the map and calculate the actual distance according to the map scale;
- 4 teams of two pupils will record the departure and arrival points for each route on the map and calculate the distance between the two cities and the journey time;
- A team of two students will make a presentation for each city within the circuit.
- In the final stage, the four routes will be summed up to obtain a total distance and a total time of the flights, that will be calculated by the topographer.

• Evidence based explanations:

Tracking a route on the map will be done through the interactive Toolkit. Students will receive relevant information for the cities explored when they reach them with their fingers on the map: (name, country, population, tourist attractions.

The distance between two cities will be calculated by multiplying the actual distance measured between two points on the map (can also be reported via the toolkit) to the map scale, thus achieving the actual distance. Thus students will convert the scale of the map to be appropriate to the unit of measurement that is being measured (eg, kilometers in centimeters)

The journey time will be calculated by reporting the current distance to the average flight time on that route. Average flight time is available, at this stage, as a result of the information obtained during the airport visit by reporting the average distance speed.

For the suggested cities on the map, we will use 3D printed models of representative buildings / monuments.

• Other possible explanations:

The flight time thus obtained can be compared to the actual duration recorded based on the information obtained from the airport. Thus, the IT team can consult the airport site to check the time of departure and arrival time for a particular route and calculate the actual flight duration.

C) Post-visit

Phase 4: Discussion

Participants discuss the usefulness and specificity of air travel, based on the information received during the airport visit. Members of each team will present how they calculated the actual distance between the two cities in relation to the map scale. At this stage, students can bring arguments on the usefulness of maps in finding a direct distance between cities. In addition to calculating distance and travel time, the members of each team will express their views on the main tourist attractions of each city which were presented by the IT team.

Phase 5: Reflection

- **Communicating the explanations:**
  Explanations offered by students focus on using the plane as an effective way to navigate long distances in a very short time. The teacher makes it easy to explain how to use the scale of the map to calculate the distance between cities. Assisted by the toolkit, students also show each route on the map, the actual distance between the two points and the actual duration of the route.

Follow-up activities and materials

Complementary activities can be organized, in order to calculate the distance between the respective cities and the journey times by other means of transport (rail or road). These activities will allow the tours to be imagined in a number of ways, depending on the means of transport, as well as comparisons between these circuits (total distance and travel time).

Contacts to ensure sustainability

The project will be available for other specialists on the VISTE project platform.
The activity will be presented to other specialists in special education in the framework of some methodical activities carried out in the Special School for the visually impaired in Cluj-Napoca.

5.6.10. *Title: "* Integration /consolidation of spatial concepts in independent mobility"

A. Introduction and Preparation

Short description:

Each fully formed concept provides students with a foundation for future understanding and expanded possibilities for learning. The focus of many O&M lessons is to develop skills that can be used to travel independently in a variety of environments. The development of reading skills of maps is an essential objective in orientation and mobility training of visually impaired students.

The reading of maps promotes the integration of concepts in the development of skills, increases understanding of spatial relations and allows students to travel independently in any type of environment. Mental representations or ideas about how people, places and things are positioned and located in the environment are commonly referred to as spatial concepts. Spatial concepts, that may include the relationship between your own person and the surrounding object, the relationship between objects, are often represented in positional terms, such as: near / in front / back, right / left or north / east/west /south. Spatial concepts are used during travel to:
• describe the relative location of people, places and things within the environment (e.g. the dog is behind the fence that is on your right)
• arrange the segments of a route (e.g. the route to the dining room is before the office)
• provide an egocentric reference framework for spatial updating (I just passed by the drinking fountain and the office should be on my right)

• understand the plan of a map,
• learn mobility techniques that require specific spatial positions.

Spatial understanding is closely linked to body awareness and supports the development of advanced environmental concepts. Cartographic forms of reference involved system of spatial arrangements, including these grid patterns (parallel and perpendicular streets). The teaching process will be applied individually to each student. The students will be able to move on a predefined route, which has been presented to them in advance.

Key-words: travel, route, 3D map, tactile map, distance, movement, landmark and clues, directional and positional concepts: up/down, top/bottom, forward/backward, center/corner/side, left/right, parallel/perpendicular, 90°/180°/360° turn, cardinal directions

Target group: visually impaired students

Age group: 12-15 years old

Lesson context:

- The orientation and mobility classroom
- An orientation and mobility route from our high school to Unirii Square in the centre of town and back to school on 21 Decembrie 1989 Boulevard.

Time required: up to 6 hours

Technology: computer, three-dimensional printer, Thermoform, GPS apps, smart phone, white cane, Augmented Reality Prototype Toolkit.

Author:

Cristina Eunicia Hosu – special education teacher and orientation and mobility instructor within the Special High School for the visually Impaired in Cluj-Napoca

Curriculum expert: Dana-Zoe Mateescu

Connection with the curriculum

The area of orientation and mobility aims to develop independent movement from a restricted and close environment to a growing and unforeseeable space. This general goal is subordinate, at each age stage, to partial objectives. Teaching orientation and developing mobility is done individually, differentiated according to the abilities of each student. The training is gradual and is first performed in the familiar environments, like home, school. It includes the cultivation of motricity and inter-systemic compensation, the formation of spatial representations and notions, and the continuous updating of environmental information.

Students learn to read and create travel maps and are taught to appreciate and measure distances by going through guided tour of increasingly complicated trails with a cane and other helpful means. Through many orientation exercises they become able to find and maintain their way and to acquire and maintain, as far as possible, the sense of direction.

Lesson goals:

- To move on a predefined route using tactile maps;
- To develop and improve spatial representations of the surrounding environment by means of direct experience with the tactile map;
- To improve students' ability to use tactile maps/3D maps;
- To actively use the information gathered during the walk on the predefined route;
- To develop social skills in interaction with new people;

Objectives:

- To go on a walk in town, on a predefined route, using cardinal points correctly;
- To identify parallel and perpendicular streets;
- To create a mental representation of the tactile map and the actual route in relation to cardinal points;
- To anticipate and recognize clues which confirm the route based on indications previously received;
- To develop behavior abilities useful on the way, such as:
  - How to address people when they need some information;
  - How to refuse the help they consider inadequate;
  - How to express sociability;
- To increase students' self confidence and their courage to test and explore new routes.

Scenario Preparation Guide

Tactile maps can be used to integrate and use spatial concepts previously taught: understanding direction/cardinal points, planning to explore a specific route. It is absolutely necessary not only to encourage students to express themselves verbally and show their understanding of the spatial concepts, but also to apply those concepts by actually moving on a given route.

B) Pre-visit

Phase 1: Activities to generate questions:

Curiosity challenge

The teacher shows the students a tactile map of a new route. This map can also be 'augmented' by means of the VISTE toolkit, which will give students both tactile and audio information.

Thus students participate in a teaching scenario which will help them travel independently on a new route in town, by means of tactile/visual and audio input, using the toolkit and 3d models created by means of the 3D printer.

Proposed route: High School (LSDV) - located on Calea Dorobantilor Street) > Calea Dorobantilor Street > Unirii Square (St. Michael Church) > 21 Decembrie 1989 Boulevard > Petofi Sandor Street > Calea Dorobantilor Street > LSDV.

Students must fill in the map with as many ‘details’ as possible which they will have found during their walk.

Asking questions based on students’ knowledge:

To help students identify the specific route on the map, the teacher will ask them questions based on their previous knowledge. The aim of these questions is to refresh students knowledge and to practice using spatial concepts like: up/down, direction, left/right, in front/behind, parallel, perpendicular, 90 degrees turn. Students will practice the concepts they have already learned within the school premises.

They will also discuss about possible ways to ask for help on the street, when necessary. To practice such pieces of conversation and get used to various ways of addressing people, students will engage in a few role-play scenarios.

Phase 2: Proper Investigation

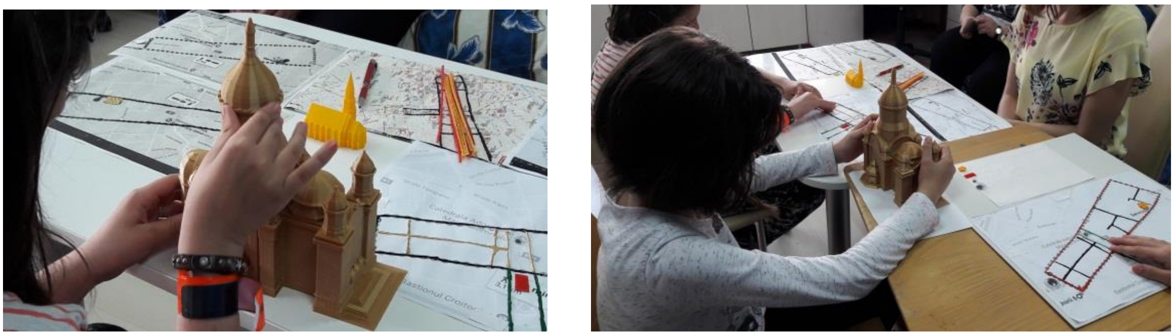
Suggestion of preliminary explanations or hypotheses

The tactile map contains, at a smaller scale, the essential elements of the proposed route: LSDV – the starting point, the way to the square, the catholic church in the square etc. Each student will have to answer three essential questions in order to be able to explore the map and then the actual route:

- Where am I now?
- Where do I want to go?
- How do I get there safely?

Management and coordination of the simple investigation

Each student will explore the route by means of the tactile map; he/she will identify the starting point and then will travel with their fingers towards Unirii Square, noticing the crossroads on the way there and important buildings, such as the Orthodox Cathedral, the National Theatre, the statue of Matei Corvin etc, which will become essential landmarks for our route. Meanwhile, sighted students will be shown pictures of the particular landmarks and blind students will be able to touch the respective 3D models. They will also discuss the spatial orientation of these landmarks in relation to the blind student walking on the proposed route. Students will also identify 21 Decembrie 1989 Boulevard, parallel to Calea Dorobantilor Street, and the streets perpendicular to Calea Dorobantilor.



Using 3D models on the tactile map

B) Visit

After the tactile exploration of the map and the identification of specific landmarks, each student will go individually on the proposed route, accompanied by the teacher. According to their preference, they will either use a white cane, or be guided by the teacher.

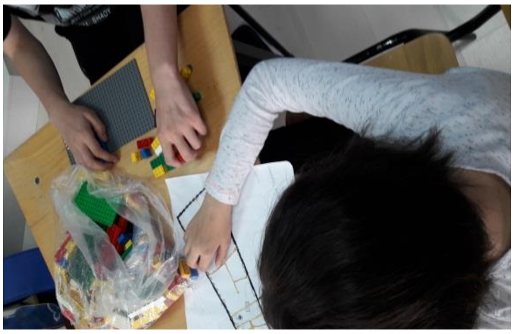
Having acquired the previous tactile information, students will now discover and use other clues, based on various sounds, smells, visual and kinesthetic elements. They are encouraged to ask questions about the names of streets they go on or cross, the types of crossroads they pass through, the direction of traffic, about spatial landmarks, unusual clues or characteristics. The teacher will also encourage them to record on their phone/recorder the information they gather on the way. During the walk, students will identify and memorize the essential landmarks. Thus, at the first crossroads in Avram Iancu Square they will notice that the Orthodox Cathedral will be on their right and the National Theatre on the left; they will also identify the direction of traffic, the traffic lights with sound, the pedestrian crossings etc. The walk should not be done in a hurry, in order to allow each student to process and memorize as much information as possible.

After getting back to the school, each student will be encouraged to talk about what they have learned, about how they have felt during the walk, about how they consider to have managed to travel in town; they will also refer to people’s attitude towards them, to their own feelings, to their fears and desires related to the future practice of the same route.

Phase 3: Creation

Gathering proof based on observation

The information that each student has gathered on their way will then be used in the creation of a 3D tactile map; for its production, the students will use different types of materials – various textures, Lego pieces etc. Thus, students will transpose the gathered information and will create their own 3D representation. They will decide on specific symbols for each category represented on the map and will stick to them. In this way, buildings will have their distinct symbol, pavements will be represented in a certain way, streets will be marked differently, crossroads will be highlighted by means of a different texture and so on. The choice of materials for the production of the maps will be done according to each student's preference and abilities.



The tactile map created by the students

C) Post-visit

Phase 4: Discussion

Explanations based on proof:

Each student will describe the map he or she has produced and will bring arguments to support the way in which the buildings were placed on the map, the dimensions of the buildings, the way in which the streets, the pavements and the crossroads were represented. They will also present other spatial landmarks that they have represented on their map and will explain the way in which they have placed them on the given itinerary. They will describe the dangers they have encountered on the way and how they were avoided. They will remember the route they have been on and will try to notice whether during the walk they have made any deviations from the planned route. If so, they will try to find answers to the following questions: how did the deviations occur? How were they corrected?

Other possible explanations:

Phase 5: Reflection

- **Conveying explanations:**

The teacher will give feedback to the students, individually, will describe how they managed during the walk, will highlight the positive aspects and will explain the aspects they have ignored. Each student will design a few cards on which they will write (in Braille or regular print) different pieces of information about the landmarks on their route – position of the buildings, addresses (number and street) – thus learning how to describe the surrounding environment and understanding the route even better.

All the cards and maps produced by each student will be shared among all the students who have participated in the lesson, in a group activity. The teacher helps the students and encourages them to talk and give each other constructive feedback related to the route. This way they will learn from each other, will enrich their knowledge and will thus acquire an accurate mental map of the itinerary.

- **Follow-up activities and materials:**

The toolkit could be used to create other tactile maps for students containing important routes in town. Thus the maps could be explored both by touch and by sound, providing useful information such as: names of streets, crossroads, landmarks, important sights.

- **Contacts to ensure sustainability**

The scenario could be implemented for all students with visual impairment who would like to learn this route. It can be used either in special schools for the visually impaired or in mainstream schools, during orientation and mobility classes.

5.6.11. Title: "Color and perception of paintings"

A) Introductory section and preparation stage

Short description:
The lesson was designed to stimulate creativity, to develop a particular language related to artistic communication, along with the acquisition of various artistic techniques, to develop the perception and understanding of the artistic space in a given painting and adapt to a new and exciting system of tactile representation.

Keywords:

Art, perception, color, plastic composition, plastic space, kinesthetic touch exploration, tactile translations, molding, textures, volumes, proportions.

Target group: Gymnasium students

Age category: 12-15 years

Context:
The art class of the Special School for Visually Impaired Cluj-Napoca, Romania
National Art Museum Cluj-Napoca, Romania

Time Required:
4 hours

Technical requirements:
Necessary to the didactic activity are embossed drawings made on the oil painting proposed to be adapted to a tactile representation, auditory descriptions of the compositional structure of the work, collages made with unconventional materials and textures, some models transposed through the 3D printer, and access to an art studio.

Author's expertise:
Professor Plastic Arts, Elena-Daniela Bodea
Curriculum expert: Pompilia Herman

Curriculum link:
The study of a static nature in the drawing and painting technique is found in the curriculum at the gymnasium level for the plastic education discipline. Thus the following concepts are: the elements of plastic language, composition, relation and proportions, distances, textures, close plan, distant plan, types and genres of arts, plastic techniques. The challenge of this approach is to make the perception and understanding of a painting accessible to the blind by means of tactile transpositions.

Brief description of scenario objectives
- Knowledge of plastic language elements: point, line, shape
- Knowledge of the plastic compositional principles specific to the pictorial space of the static nature type: equilibrium, hole-full, proportions.
- Knowledge of two-dimensional compositional structures and three-dimensional transposition
- Identifying the tactile perceptual level of artistic emotion by exploring contours, shapes, textures

Scenario Preparation Guide:
-Identification of art object/ painting for transposition, searching for working materials: clay or non-conventional materials, making assisting models, making a descriptive text on the art work that it’s proposed to be tactile transposition. Machetes and relief drawings must respect some rules regarding the most efficient perception of the composition of the art work. Thus, where some elements overlap and even visually can be proper be percept tactile only a fragment of the object cannot be proper percept so must be rendered entirely as not to affect very much the composite structure of the original artwork.
The development of the relief drawing, which reproduces the compositional structure of the work, is done with the help of the Toolkit .

B) Pre-visit

Phase 1: Questions for generating questions

- **Challenge of curiosity:**

Offering for study:
- Color reproduction / photo of the work done at the right scale as the original.
- a schematic drawing, where the composition of the painting is transposed at the level of the drawing in relief or by incision, creating contours. The composition is simplified by creating clear, sometimes geometrized surfaces, but trying to preserve the compositional structure, compositional character and subject
-the audio description of the artwork that aims to present some descriptive information about the artist and painting chosen for research:

Romanian painter Alexandru Ciucurencu was born on 27 September 1903 in Ciucurova, Tulcea County, and died on 27 December 1977 in Bucharest. He studied painting at the School of Fine Arts in Bucharest (1921 - 1928), where he had as professors George Demetrescu Mirea and Camil Ressu. After working for a while with the group of artists who formed the Baia Mare School, he studied at the Julian Academy in Paris and in the workshop of André Lhote during 1930-1932. *Static nature with carnations* by Alexandru Ciucurencu is painted in oil on canvas technique and the frame format is a rectangle.

The composition is geometric with a clear construction with a concise drawing using black border contour lines, accentuating the constituent elements of the central composition: caraway with carafe, apple plate. Objects are placed on a table whose decorative motif is geometric by suggesting alternations of gray and red strips, outlined in black. Objects abstracted to geometric, flat, two-dimensional funds. The chrome of the objects is adjacent to a slight confusion with the background dominating the warm color of the rocks, along with cold gray rocks and fine pink and white spots, which suggests the carnations.

This short audio description can also be adapted to the toolkit.




A schematic drawing, where the composition of the painting is transposed at the level of the drawing in relief or by incision, creating contours

• **Formulating questions based on the students' knowledge:**
What is the frame of the composition?
What does static nature mean?
What are the elements that make up compositional balance?
How is tridimensional suggested in painting?

Phase 2: Investigation itself

- **Suggestion of preliminary explanations or assumptions:**
  -Offer to study some frame supports that can be painted in various sizes and textures: canvas, cardboard cloth, textured cardboard.
  - Tactical exploration of real elements found in painting to identify particularities of size, shape, texture, temperature, faces, edges, cavities, concavities.
  -Exploring of unusual textiles or surfaces by choosing with affective perception: pleasant or disgraceful, soft or harsh, fluffy or glossy, hot or cold.
- **Planning and coordination of the simple investigation:**

Students are challenged, using real objects, to create as a response to the proposed painting, their own composition and spatial organization, on various close / distant planes, with correlations between elements: distances, overlapping, juxtaposition. Students will be provided with audio information on the job description as well as 3D casts.

B) Visit

(Phase 2: Investigation itself)
Student will receive a drawn in volume contour so that the compositional structure and subject are reproduced. At this stage will be explored:
- the compositional geometric structure of the art work.
- the possibilities of understanding and perception of the colour in the painting presented.
- the possibilities of tactile transposition using unconventional materials to glue on the frame support received with the contours of the ready-made constituents.
- relation big-small and multi-layered compositional: near-distant.

"Planning and Coordination of Simple Investigation"

Phase 3: Creation

• **Collection of evidence based on observation:**
The color will be transposed tactile in the form of textures, but perceived emotionally behind the perception of the descriptive audio information on the painting. Thus, color is replaced by tactile materials placed according to the known compositional laws, but in a most expressive form, according to their own perceptions to intention to make a tactile paint.
The tactile transpositions take the painting from two-dimensionality into three-dimensionality, and the materials used are always the most unusual: twine, textile materials of various textures, seeds, plastic, paste, gypsum, glue, newspapers and various textures, wood, clay, etc.
Activity it's planned to work in groups so at the class level will result in more tactile representation, varied of the same painting.

The paintigs: from two-dimensionality to three-dimensionality

Phase 4: Discussions

• Evidence based explanations:

These creative activities do not have the role of creating a unique canon of tactile representation of a painting, but important are the approaches to visually impaired and blind learners. With all of these work options, and the possibility of work being passed through many genres of artistic expression, embossing, transposing to a 3D printer, touching textures, make each move a single existence or a succession, in series, of that painting. Serial as a form of work offers the opportunity for another "viewer" (pupil or adult with visual deficiencies) to explore to understand an artistic intent easier. Of course, the artistic message transmitted can be no more than the intention of the creator.

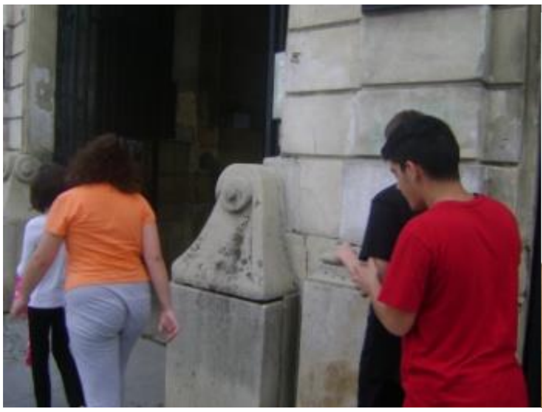
At this stage, students will study each of their colleagues.

C) Post-visit

(Phase 4: Discussions)

The activity takes place at the National Art Museum in Cluj-Napoca where the students will be guided following:

- the concept of museum and initiation in the perception of architecture, museum history, art works
- acquiring elementary knowledge necessary for students' perception of plastic art,
- presentation of the works of the museum's heritage, exhibited in the National Art Gallery of Cluj-Napoca




A visit at The National Art Museum in Cluj-Napoca

Phase 5: Reflection
• Communicate the explanations:
The museum visit will generate discussions on:
 - the skills acquired by students to identify and recognize the presented works and to identify in the historical context the studied work.
-the possibility that their work in the school's workshop could find their place in the museum.

Follow-up activities and materials
Each student has the opportunity to conceive an audio description that is a guideline for perceiving and understanding the tactical transposition that has been reached.

Contacts to ensure sustainability
Publishing the script in a volume with examples of good practice developed within the Viste program and on the platform with open educational resources.

5.6.12. Title: “Accessible Journeys”

A) Introduction and Preparation

Short Description:

This teaching scenario was designed for students with various degrees of visual impairment, working together, either as a small team, or in a larger group setting, including sighted students. The lesson will cover a favorite theme of our students, namely that of accessible travel, and will challenge them to work together and plan tourist routes through London. The lesson will focus on aspects related to British culture and civilization, on the geography of the United Kingdom and its countries, in general, and of London, in particular, but also on practical solutions at hand to help visually impaired travelers make the most out of their journeys. The scenario will target spatial thinking concepts / key words such as: cardinal points, spatial orientation, position, direction, distance, vertical, horizontal, diagonal, crossroads, roundabout, landmark, bi-dimensional, tridimensional.

The accessible materials and resources used during the lesson will include: tactile and large print maps, 3D models of tourist attractions, GPS apps, audio/video materials related to London tourism, and, when possible, the ICT tool developed during the VISTE project.

Key words:

cardinal points, spatial orientation, position, direction, distance, vertical, horizontal, diagonal, crossroads, roundabout, landmark, route, bi-dimensional, tridimensional.

Target group: a class of 8 visually impaired students

Age range: 12-15

Context: classroom/computer lab

Timing: 100 minutes

Materials and resources: :

- Braille and large print worksheets
- Tactile and large print maps
- 3D models of tourist attractions
- Phones/computers using screen readers and/or magnification software
- GPS apps (Google Maps, Navigon etc)
- Audio/video materials related to London tourism
- The ICT tool developed during the VISTE project.

Authors’ Expertise :

Elisabeta Pintilie – English language teacher within the LSDV high school in Cluj-Napoca
Curriculum expert Edmund Ienei – Casa Corpului Didactic Cluj

Connection with the Curriculum:

English language classes include, as one of their main objectives, the development of students' knowledge related to British culture and civilization. Thus, students are provided with a large variety of content through which they come to discover and understand British life, geography and cultural heritage.

When talking about London, the focus is usually on the knowledge of the representative landmarks in the city and their significance, but also on the stimulation and development of students' ability to understand, use and even create maps of the main areas covered in the lesson.

This particular teaching scenario will be based on the previous knowledge of our students related to London and its main sights, and on their map reading and orientation skills. We will embark together on an exciting process of discovery through which students will not only come to know what each particular landmark looks like, but also have the chance to find it on the map and truly explore the city spatially, not only in a theoretical way. Having done this, they will then have the possibility to navigate through the city, to discuss aspects related to the most appropriate and the most accessible means of travel, and to create real and personalized sightseeing routes, adapted to the needs of visually impaired tourists.

Objectives:

- To increase students' knowledge related to British geography, culture and civilization;
- To develop students' orientation skills and their map reading and route creation skills;
- To encourage the use of both access technology tools, designed especially for the visually impaired, and mainstream, accessible GPS technology apps and tools.

Preparation Guide:

The following will be prepared / produced before the implementation of the lesson:

Braille/large print worksheets, accessible maps, 3D models, audio/video resources, GPS apps and the ICT tool.

B) Pre-visit

Phase 1: Introduction

a) **Questions to elicit students' prior knowledge about the lesson content**
In order to start the whole teaching scenario based on students' prior knowledge, the teacher will ask them questions about the specific geographical areas covered in the lesson. Thus, students will be challenged to answer questions such as:
   - What do you think about when you hear the phrase 'Great Britain'?
   - Where is Great Britain located?
   - Which countries constitute Great Britain / The United Kingdom?
   - Where in particular would you like to go in GB? What would you like to see?
   - What representative landmarks do you know in GB / in London?

As students answer the questions, they will be encouraged to identify the different countries, cities and landmarks on the maps.

b) **Stimulation of students' curiosity**
The teacher will show the students two short audio-video Youtube materials made by some tourists in England/London. The aim of using these clips is to increase students' interest in these particular areas and their desire to visit places like Summerset, Stonehenge, London.

Students will watch the clips and, afterwards, will have a few minutes to share their thoughts.

C) Visit

Phase 2: Investigation

a) Students will receive a small 3D model collection of representative landmarks in London. They will be encouraged to guess which is which and, with teacher's help, will locate them on the tactile/large print map.

b) Then they will work in two teams and will play a short game, trying to match as many landmarks as possible with their description. They will be given cards with the names of 10 London landmarks and 10 cards with essential details about each one of them. In this way, they will not only use all the information they have already got and make useful correlations, but will also acquire new knowledge.

c) The next step will consist of finding the particular landmarks students would like to visit by means of their GPS apps, using the 'Points of Interest' section of the app. Then they will simulate a GPS route towards the specific landmark.

d) Starting from the activity above, the teacher will encourage students to participate in a short class discussion related to the means that visually impaired tourists have at their disposal in order to travel independently in a way which is both accessible and safe. Students will be challenged to ask questions and find possible answers, to actively participate in conversation and express their opinions and experiences, to find arguments to support their ideas.

The discussion will focus on aspects like:

- What makes a place accessible / inaccessible?
- Finding/using spatial clues on a particular route;
- Orientation and mobility solutions when finding ourselves in a new environment;
- Advantages / challenges of using GPS apps;
- Electronic GPS routes versus tactile maps;
- What possibilities do visually impaired travellers have at hand to help them achieve mental representations of the routes they are going through and, moreover, to help them plan personalized routes, including the landmarks they want to visit and arranging them in the appropriate, geographical order?
- Making the most of the use of complementary aids: tactile maps + GPS apps + 3D models.

Phase 3: Creation

A) Students will split again into two teams – this time one team will work on a tactile map and the other one on a large print map – and will create a route of their choice which will include at least 5 places to visit. Students will take into account not only their own interests, curiosities and special needs, but also the location of the included elements and their position on the map, in relation to each other, the preferred way of transport and its degree of accessibility, the time required for each leg of the route and for the actual visit of each landmark. They will use the GPS apps to determine the distance and the time required to get from one place to another and, eventually, will calculate the duration of the whole route. While designing the route, students will be encouraged to use the Internet for any necessary details and they will also have the possibility to find information in the leaflets provided and directly from the teacher.

On the tactile map, the route will be shown using wax sticks, while, on the visual map, it will be drawn with a marker. Subsequently, each route will also be represented by means of the ICT toolkit developed during the VISTE project.

B) In the end, each team will present their route and will describe the landmarks they have included, the way in which the tourists have travelled and the time it took them to do this particular route. They will explain why they used certain means of transport in particular areas and will focus mainly on the aspect of accessibility.

C) Post-visit

Phase 4: Reflection

Students will share their thoughts and experiences related to the making of each route, will describe the difficulties they had during its creation and will notice the differences, in terms of mental representation possibilities, between such routes and GPS routes only.

Follow-up Activities:

- Creation of tourist routes, according to the phases presented above, followed by real, not only imaginary visits.
- Contact with partners – to ensure sustainability
- Possible publication of the lesson in a volume including samples of good practice teaching scenarios developed within the VISTE project

5.6.13. Title: "Proportion in the Solar System"

A) Introductory section and preparation stage

Understanding spatial proportions is essential for the development of spatial thinking skills in visually impaired students. Immediate experience is essential to perceiving space, especially as regards the estimation of spatial proportions.

For spatial mathematical computations, spatial objects are commonly used in educational practice. The use of models contributes to the understanding of the shapes and parts of an object but contributes very little to the understanding of the proportions, especially when it comes to comparing the proportions of several objects.

The concepts of astronomy are more efficiently internalized by using models, but the interiorized mental models must contain relevant information about the proportions of the celestial bodies. Reporting to everyday objects is often irrelevant in this case because spatial proportions use scales of different sizes.

The project aims to develop the acquisition of concepts specific to astronomy (proportions and distances in the solar system) based on mathematical calculations specific to gymnasium geometry.

Scenario title:

Proportions in the Solar System

Short description:

Understanding spatial proportions in the Solar System through mathematical calculations

Keywords:

Solar System, planets, sphere, geometry in space, distance, surface

Target group:

Visually impaired students

Age category:

12-15 years,

context:

Classroom, Special High School for Visual Deficiencies Cluj-Napoca

Time Required:

1 hour

Technical requirements:

Projection apparatus for designing a documentary film about the Solar System;

Graphical representation of the distances between the planets of the Solar System (thermoform);

The 3D representation of the proportions between the bodies of the solar system.

Work sheets.

Author's expertise:

Ioan Marin Cîmpean, educator teacher, Special School for Visual Deficiency Cluj-Napoca

Curriculum link:

Mathematics: Reports and proportions, segments, sphere surface

Astrology: Solar System, Solar System Plans, Cosmic Body Surface

Objectives:

- *To identify the specific elements of each Solar System planet by consulting various documentary materials (documentary film, 3D model of the solar system, accessory astronomy atlas);*
- *Calculate reports between the distances of the planets of the solar system using the information received in the documentation stage;*
- *Calculate the surface of each planet of the solar system using the information from the documentation stage;*
- *To calculate the ratios between the surface of the earth and the surfaces of two other planets in the solar system;*

Scenario Preparation Guide:

Depending on the specificity of the students' visual deficiency, the teacher prepares a series of materials to ensure that, before the actual investigation begins, all students have access to the relevant relevant information;

Students with light deficiency watch sequences from the movie "Everything about the solar system" https://www.youtube.com/watch?v=EmSic07S0X0

The blind learners can perceive the relevant information in the film by means of an astronomical atlas printed at the thermoforms (planetary distances) and a 3D layout of the planets (the proportions of the planets);

All students will perform calculations based on a worksheet that contains for each planet the radius, diameter and distance from the Sun or the previous planet;

B) Pre-visit

Phase 1: Questions for generating questions

- **Challenge of curiosity:**
  After a preliminary discussion of the students' current knowledge of the Solar System, all students follow the documentary film. While watching the movie, blind students have at their disposal the astronomy atlas and the plane-sized layout.

- **Formulating questions based on the students' knowledge:**
  Starting from the information presented in the film, students are asked the main questions to answer:

  What are the closest planets in the Solar System and which are the farthest planets. What are the distances between planets?

  What is the proportion between Earth and the sun? What are the proportions of planets?

Phase 2: Investigation itself

Starting from the informative materials, the students will identify the largest planets in the Solar System and estimate the distances between them. The teacher centralizes students' estimates on the blackboard.

Students are explained that they need accurate data to calculate the surfaces and distances in the Solar System. Consequently, each student receives a work sheet containing information about the planets (distances, diameter and radius)

- **Suggestion of preliminary explanations or hypotheses:**
  U sing a model allows more accurate understanding of the distances between the planets of the solar system. Knowing the distance of each planet from the sun, we can find the distance between two planets by simple mathematical formulas. By using mathematical abilities related to reports and proportions, ratios can be determined between the distances of different planets from the sun.

  Also, once known the diameter of each planet, by using geometric geometry formulas in space, the surface for each planet can be determined.

- **Planning and Coordination of Simple Investigation:**
  Divided into groups of 2, students calculate for a planet the smallest distance from neighboring planets using the plug with each planet's distance from the sun. Thus, the distances are by decreasing the distance of the nearest planet from the distance of the planet. Each interplanetary distance will be calculated by two separate groups, the second group verifying virtually the result obtained by the first group for a particular pair of planets.

  The distances are centralized on the students' work sheets and on the blackboard.

B) Visit

(Phase 2: Investigation itself)

Using distance learning, students will calculate for each planet the ratio of distance to the nearest planet and distance from the sun. The results will also be centralized on the worksheets.

Kids who finish their calculations faster will help colleagues so that at the end of the work sequence for each planet there is a relationship between the distance from the sun and the distance from the nearest planet.

Phase 3: Creation

- **Collection of evidence based on observation:**
  To find out how large the surface of each planet is, students will calculate the surface of the sphere using their diameter values in the work sheets. Each student will calculate the surface for a particular planet and the results will be centralized on the board.

  To estimate the difference between surfaces, each student will calculate the ratio between the planet's surface and the Earth's surface. The student who calculated the surface of the planet Earth will calculate the ratio between the earth's and the sun's surface. All results are centralized by the teacher on the blackboard.

Phase 4: Discussions

To apply the information learned, students will try to answer some practical questions:

- **Evidence based explanations:**
  To get a more practical estimation of distance, students will try to answer the question "How long does it take to get from planet X to the sun traveling at the speed of light." Initially, students will estimate the response by which they will get an appropriate response in the group by dividing the distance to the speed of light.

  To get a more practical estimate of the surface, students will answer the question, "How long do I need to surround the planet in a supersonic plane that travels four times the speed of sound? (5000 km / h). Students with mathematical inclinations can do this calculation for Earth and two of the largest planets of the solar system.

- **Other possible explanations:**
  The teacher will illustrate the distance between Earth and Mars by providing information on the time spent by NASA specialists to transport the Curiosity rover that is now exploring the surface of the red

planet. Thus, the speed of light can be compared with the speeds that can be reached at this time in the solar system.

C) Post-visit

(Phase 4: Discussions)

By using the information obtained, students can answer questions about the distances between planets. Thus, we can find out which are the most distant planets between them and which are the closest planets. Distances will be explored on the interactive toolkit to get an overview of the proportions.

Using surface information, students can provide answers to questions about the surface of the planets. Thus, they can easily identify the largest planets and the smallest and can estimate the relationship between them and the earth's surface. In order to form an overview of the proportions, the sequences of the documentary film and the 3D model of the planets will be used.

Phase 5: Reflection

- **Explanation of explanations:**

  From the data obtained, it is evident that there are very large differences between the distances between certain planets. The nearest ones are hundreds of millions of kilometers away.

  For a distance estimation a useful resource is the scale available at http://www.northern-stars.com/solar_system_distance_scal.htm .

  There are also very large differences between the surfaces of planets such as giant giants (Jupiter, Saturn) For illustration, the video can be used at: https://www.youtube.com/watch?v=GoW8Tf7hTGA

Follow-up activities and materials

For students interested in space and exploring it, the learned skills can be developed by calculating interstellar distances (Distance to the nearest star, for example)

A series of science fiction films can be used to learn information about the solar system in an informal manner. (The Martian, Interstellar, etc.)

Contacts to ensure sustainability

The project will be made available to interested teachers via the VISTE educational portal.

5.6.14. Title: "Space and Time in Frame Stories"

A) Introductory section and preparation stage

Short description:

The scenario, designed especially for students with visual disabilities, aims at developing the perception of fictional space starting from the real one,. The scenario follows an interdisciplinary approach, connecting other subjects like geometry and geography. The main concepts Taken into account are space-time relation, frame, folder, perspective, zoom in and zoom out.

The scenario's main goal is to facilitate the understanding of inclusion (content) using the means given by frame stories, where a character becomes narrator in the included story. Thus the correlation between fictional and real space will be undertaken using various means such as 3-D models and a short movie with audio description.

Keywords: Space, time, frame folder, inclusion relationship, perspective, micro and macro, zoom in and zoom out

Target group: Students
Age range: 12-15 years old
Context: Classroom
Required time: 100 minutes

Technical requirements: student desks adapted to pupils with visual deficiencies, cubes in different sizes, Matrioska puppet set, explained video, toolkit with the map of the main stories in the frame stories, 3D objects (frame narrative) 3D picture, etc.

Author: Lucian Şchiopu – Teacher of Romanian Language and Literature
Curriculum expert: Liliana-Dana Lung

Connection with the Curriculum

In the context of the study of the Frame story, it is necessary to clarify the relations between the time and space types of the narrative: the time and space of writing, narration and action, as well as the relationship of inclusion established between a frame story and the story it contains.
Students already master the concepts of author, narrator, character, storytelling, action, time and space.

Objectives:
- To develop the spatial concept of inclusion, starting from the peculiarities of the Frame story

- To make correlations between fictional space and real-world space by means of 3D representations
- To develop tactile skills – perceiving the space in the narrative in correlation with spatial elements in real life – by means of the tactile map and the toolkit

Scenario Preparation Guide

Preparation of the text sheets, the necessary technological means, the 3D representations, the toolkit etc.

B) Pre-visit

Phase 1: Activities aimed at generating questions

- Provoking curiosity:

  Analyzing a 3D and a 2D picture. What are the component parts? What is their role?
  The presentation of an Explained video, in order to Understand Zoom Out and Zoom In (Focus) (https://www.youtube.com/watch?v=rlTZvz0oiao)

- Questions based on students' knowledge:

  How do the two perspectives seem to you? How does it change the outlook on things around us?

Exercise: We imagine we look at a Braille text page. By extending the perspective, we will see that it has a role, that it belongs to a much wider context and is just a small part of a text, a book and a fragment from a library. We now focus on a word, a letter, a braille dot ... can there be something beyond it?

c) Visit
Phase 2: Investigation

- Suggestion of preliminary explanations or assumptions:

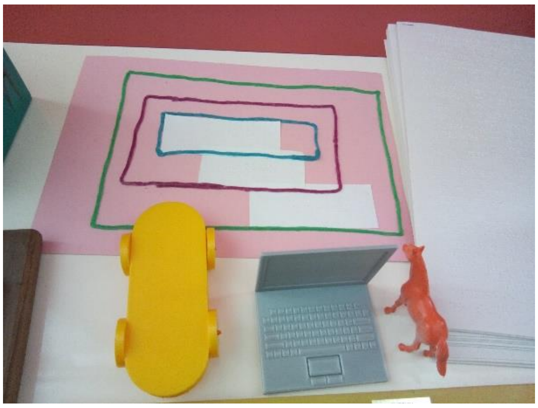
Read the story of the Frame story Florin writes a novel by Mircea Cărtărescu.

- Planning and coordination of the simple investigation:

What's the story? How many are they actually? What are the characters, the narrators, the time and space of each story?

The teacher leads the discussion about the specifics of the Frame story. Its definition and characteristics will then be received on worksheets.

Exercise - example with different sized cubes which clearly show the relationship of inclusion: Students will receive three cubes of different sizes that can be placed one in the other and three objects (made on the 3D printer), each representing symbolically one of the three stories : a horse, a skateboard and a computer. Students will decipher the symbols, place them in the right box, and thus identify the narrator and the story to which each 3D symbol refers, and the relations of inclusion between them.


A diagram will be drawn on the blackboard/flip chart, showing the successive relations of inclusion of the three explicit stories and the fourth implicit one (the reality of the last storyteller in the chain – Cartarescu, the author).

Phase 3: Creation

• Collection of evidence based on observation:
Presentation of the diagram on the blackboard accompanied by tactile diagram for the blind, using the toolkit. (The toolkit map will be done in a simplified way on thermoform or other relief technique).

Making a Short Role Play, using the Matrioska puppets. Puppets will be given around and the pupils will experience the successive opening, thus understending the zoom in concept

For the totally blind students, the exercises involving the matrioshka puppets and the different sized cubes, will actually represent a tactile representation of the movie in the beginning of the lesson to which reference will be made here, and it will be concluded that the studied story is organized on the zoom out model, but students will become aware that there are also stories organized on the zoom in model (like the Matrioshka).

Post-visit

Phase 4: Discussion

Ordination of the information thus obtained, zoom out, integration relationship, entry-exit, house-city-country-continent-planet-solar system-galaxy... etc.

Phase 5: Reflection

• Communicating explanations:

Follow-up activities:

Making connections with the real world, representing space from small to big and the other way around.
In orientation and mobility, understanding the details in a wider context etc.

Contacts to ensure sustainability
The materials can be presented at other special high schools for the visually impaired or in mainstream schools that have inclusive educational programs for pupils with visual impairment.

5.6.15. Title: “The Fascination of the Road”

A) Introduction and Preparation

Short description

The scenario aims to bring in the necessary concepts in order to configurate the real space by using the means offered by the literary universe. Thus, any fictional world is based on a depiction of spatial concepts such as in, out, ascend, descend, distance, the progress of the hero being marked by the well-known oppositions: known _ unknown, secure _ insecure, move _ rest and so on. The scenario uses fantasy to improve orientation and the need to explore the real world.

Keywords: direction, road, ascent, descent, horizontal, vertical, close, distant

Context: secondary education

Age range:12 - 15

Educational Setting

Special Education (Students with Visual Impairment)
Inclusive Education

Objectives

- To identify the characteristics of fairy tales
- To make correlations between fictional space and real space
- To develop compensatory skills for the perception of space in the narrative

Preparation guide:

Preparation of the literary text, of the necessary worksheets, of the dramatized audio version and of the additional equipment

Prerequisites

The connection with the curriculum is given mainly by the need to properly understand literary concepts such as fictional world, the journey of the hero and the spatial coordinates implied in fairytales.

Level of difficulty: medium

Time required: up to 2 hours

Technical requirements: audio-video materials, 3D model, Map of the journey.

Author: Teofil Pintilie– Teacher
Curriculum expert: Liliana-Dana Lung

B) Pre-visit

Phase 1: Activities aiming at generating questions

- **Stimulating curiosity in students:**

The pupils will watch /listen to a short play of the setting out of the hero, in a traditional fairytale. The brave younger son and the golden apples.

- **Defining questions from current knowledge**

Description:

What could define the space of home?

What is specific to the road?

Which could be the feelings of the young hero setting out?

- **Propose preliminary explanations or hypotheses**

Description:

The pupils will read the previously played sequences, taking into account the similarities and differences between the two versions. The information thus obtained will be organised in the table, on the blackboard. / flipchart.

Each column will contain specified content, Familiar, and nonfamiliar. A special interest will be given to sound representation in the audio version of the story.

C) Visit

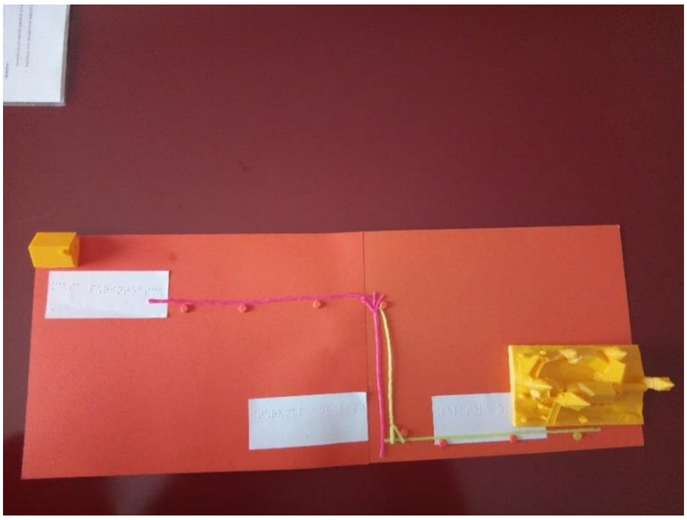
Phase 2: Investigation

Plan and conduct simple investigation

Description:

The teacher will help aim the discussion towards the understanding of the specifics of space representation in fairytales.

The map will show all space related elements, such as setting out, the main points of the journey, descent, ascent.



Phase 3: Creation

Gather evidence from observation

Description:

The students will fill in the table with the spatial coordinates in the story

The first task will imply writing setting out moment starting from a familiar place such as school or home. The focus of the task will fallow the feelings of the hero, while leaving a space that is familiar.

Explanation based on evidence

Task: Describe the fantastic world, (the other realm) by using real world refferents, such as land forms, climate, etc.

Description: The students will read the texts they've created, thus, ensuring the appropriate understanding of the recently learned concepts.

D) Post-visit

Phase 4: Discussion

The discussion will focus upon the similarities and differences between the fictional world and the real one, understood as reference world. The point is to overcome the anxiety implied in any of them act to explore unknown spaces. The students will also bring into discussion other circumstances that imply exploring unknown spaces.

Phase 5: Reflection

Communicate explanation

Task: Describe the fantastic world, (the other realm) by using real world refferents, such as land forms, climate, etc.

Follow-up activities and materials

Description: The students will use the acquisitions thus obtained, in various daily living contexts that imply leaving safe well-known space, in order to explore new places**.**

Sustainable contact

Description:

All materials obtained while working on this scenario, such as map, 3-D models, Audio/play, can be successfully used in various educational contexts, in schools for visually impaired, or in inclusive education settings.

6.VISTE – Augmented Reality Toolkit

6.1. Function

The system augments existing tactile O&M tools such as raised-line maps and magnet boards, by adding audio feedback about map elements. It also adds visual feedback in the form of projection for the benefit of low vision users. Two modes have been implemented for the prototype: Exploration Mode and Construction Mode.

In exploration mode, our prototype enables visually impaired students to explore existing maps by combining raised-line maps with audio output and projection (see **Error! Reference source not found.**). Users explore the tactile map with both hands as they are accustomed to. Complementary visual information is projected on the raised-line map, for the benefit of low vision students. Students can obtain an audio description by simply pointing to a tactile element with one finger and pressing a key on the keyboard.

Exploration Mode: a raised-line map is augmented with projection and audio feedback

In construction mode, our prototype enables visually impaired users to construct maps or itineraries them-selves by combining magnet boards with audio output and projection. O&M instructors developed a step-by-step learning scenario, and our augmented reality prototype follows this scenario to provide instruction to the students. Starting from elements placed by the teacher, the system prompts the student to place a point of interest or a road on the map in relation to these starting elements. The student then places elements on the map: magnets with foam paper for POIs, and Wikki Stix for road elements. For POIs, the user may verify whether an element is placed correctly using the same interaction as in exploration mode that is by pointing to an element and pressing a key to hear an audio description. If the element is not in the right place according to the scenario, then the system provides corrective directions (left/right/top/down). For line elements, the "verification mode" was more challenging to design, and to our knowledge no prior study has investigated this. We designed an interaction technique, in which the student points of the start position of the line with one finger. He or she then follows the line by sliding the finger along the WikkiStix. As long as the line is correctly placed, a beep sound is played. When the finger touches a portion of the line which is incorrectly placed, the system verbally provides directions to help the student correct his construction (as for POIs).We designed this interaction technique, as it allows users to identify which parts of the line are correctly placed and to modify only the incorrect parts.

Construction Mode: augmenting a magnet board with projection and audio feedback. Wikki Stix a used to represent line elements, and magnets with foam paper to represent points of interest

6.2. Implementation

The augmented reality toolkit is based on an existing spatial augmented reality framework (PapARt), previously developed by the partner team at INRIA Bordeaux and commercialized by the company RealityTech[40].

Two hardware versions exist of the prototype, shown in **Error! Reference source not found.**.

The first one iss equipped with an ASUS B1MR short throw 720p projector, a Kinect camera for Xbox 360, and a Playstation Eye camera. The computer is an Intel NUC with a core i5 and 8Gb of RAM.

The second version uses an ASUS P3B short throw 720p projector, and an Intel Realsense SR300 (combining depth and color camera), as well as a custom built computer with an Intel core i3CPU and 8Gb of RAM. The second version is easier to transport, as it was more light weight than the first one and it could be disassembled into several pieces.

[40] http://rea.lity.tech/

Two versions of the PapARt hardware: 1 - left, 2 – right

7. Scenarios using the VISTE Toolkit

7.1. *Title: “Let’s start from Kallithea to visit three important ports of Attica’s Prefecture: Piraeus, Rafina, Lavrio”*

The Educational Pathway Pattern for a Pre-Structured Visit by the School

Title: “Let’s start from Kallithea to visit three important ports of Attica’s prefecture: Piraeus, Rafina and Lavrio”

A) Introductory section and preparatory phase

The educational scenario with the title: “Routes from Kallithea to the important ports of Attica’s prefecture”, aims at giving chances to students with visual impairments to be able to develop and elaborate their spatial thinking, working on the augmented reality toolkit in order to understand the routes which they have to follow starting from their school (at Kallithea) visiting the ports of Attica: Piraeus, Rafina and Lavrio.
Through the use of 3D models and tactile maps students will be able to get the appropriate knowledge, attitudes and skills regarding the places which they are going to visit and to collect valuable information.

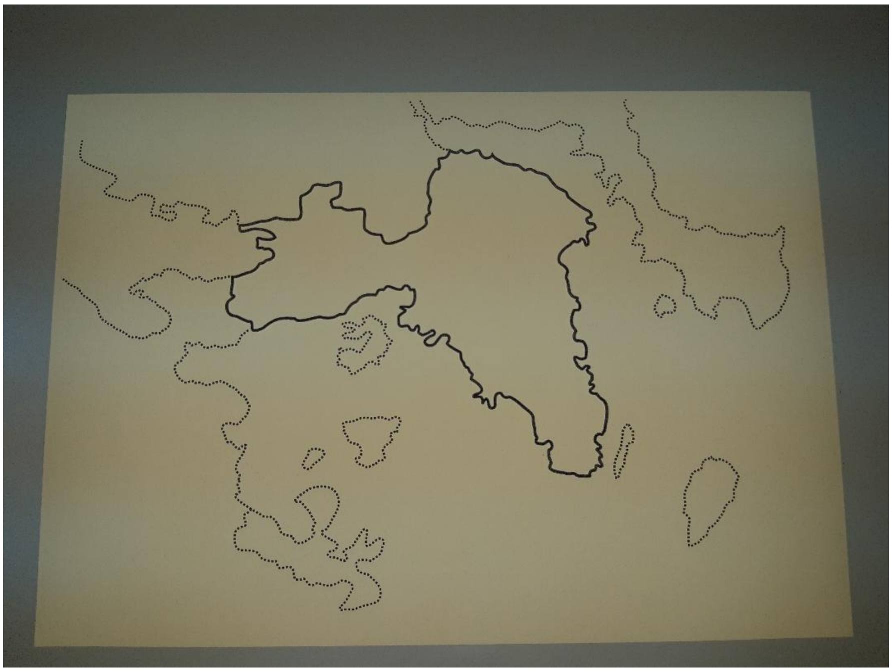
Title:

“Let’s start from Kallithea to visit three important ports of Attica’s prefecture: Piraeus, Rafina and Lavrio”.

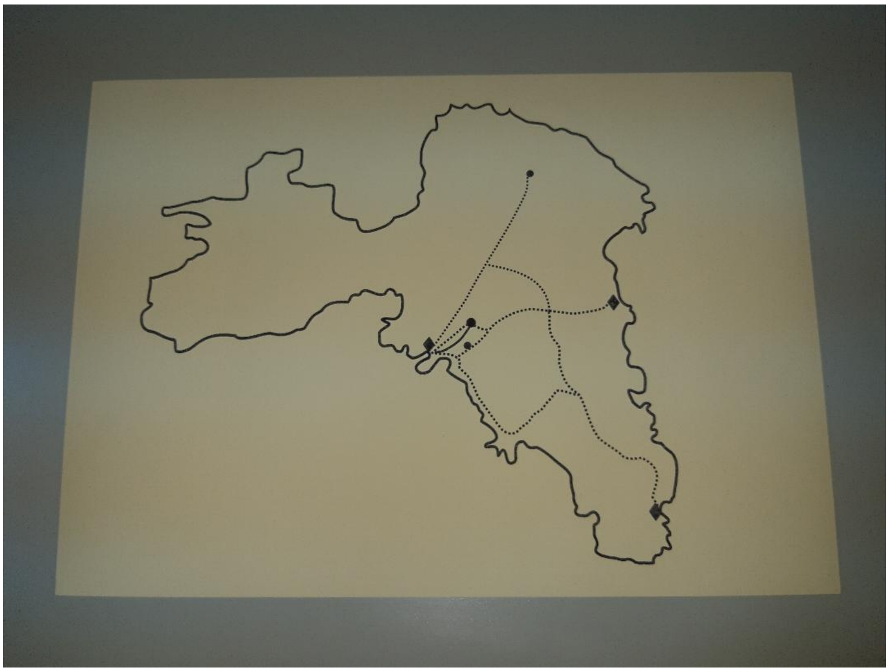
Short description

The educational scenario will give the chance to visually impaired students to elaborate their spatial thinking by using the augmented reality toolkit in order to follow the routes starting from their school at Kallithea to:

A) Pireaus, the chief port of Greece and one of the largest passenger ports in Europe.
B) Rafina, the second largest port of Attica which in the recent years has developed significantly
C) Lavrio.



Prefecture of Attica



Routes from Kallithea to the important ports of Attica's prefecture: Pireaus, Rafina and Lavrio

Keywords:

- Road
- Road network
- Railway
- Railnetwork
- Means of Public Transport
- Port

Target audience:
Teachers and MDVI students

Age range:
Up to 12-15

Context:
The educational scenario is implemented in the school classroom.

Time required:
The approximate time needed to implement the educational scenario is estimated to 3-4 sessions of school-based work and science lab-based work.

Technical requirements:
For the implementation of the educational scenario we needed:

- three-dimensional resource materials showing:
    - The port of Pireaus
    - The port of Rafina
    - The port of Lavrio

Also, we used:

- Tactile maps of :
    - Greece,
    - the geographical area of Sterea Hellas and
    - the prefecture of Attica
        - digital resources
        - wooden puzzle

Author'sbackground
The educational scenario was prepared by the teachers:
Vasiliki Pasparaki, Maria Plastira, Anna Karagioule and George Christofillakis.

Connection with the curriculum
The above educational material includes many interdisciplinary connections in order to support many subject areas such as: Geography, History, Literature, Environmental Studies, Music and Technology.

Learning objectives:
Students with visual impairments through guided practice exploiting the tactile map of Attica, the augmented reality toolkit and the 3D models of Pireaus, Rafina and Lavrio will be able to:

- describe the routes which they had follow while visiting the above ports
- to recall information (historical data) from the places they visited
- to express their impressions of the places they visited.

Guidance for preparation

Teacher works as facilitator in order to motivate visually impaired students to familiarize themselves with spatial concepts e.g. Road network, Railway, Rail network, Public Transport, Port etc.
With his guidance and assistance students touch and observe tactile maps of: Greece, the geographical area of Sterea Hellas and the prefecture of Attica.
Also students work on the 3D models which present the ports of: Pireaus, Rafina and Lavrio.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities
Provoke curiosity:

Tactile map of Greece (created by the use of CNC machine

Students observe the tactile map of Greece in order to get the whole picture of their country. We are going to separate the continental country from the island part of Greece. Students will focus on the geographical area of Sterea Hellas which has been made by a tactile image maker. Students with teacher΄s guidance will focus on the prefecture of Attica made by a tactile image maker, in order to understand the boundaries of the prefecture.

The geographical area of Sterea Hellas (created by the use of PIAF and swell paper)

Seven prefectures of Sterea Hellas (Wooden puzzle created by the use of CNC machine)

- **Define questions from current knowledge**

In order for the teacher to find out students΄ prior knowledge, he asks them to take a few minutes to write their responses to the following questions:

- "What massive means of transport do you use on your journeys?"
- "Have you visited the port of Piraeus? What do you know about the history of Piraeus?"
-"Where is Rafina? Which major road has improved access to the city center of Rafina?"
-"Except for the port for what other reason is Lavrio known?"

2. Active Investigation

- **2.1 Propose preliminary explanations or hypotheses:**

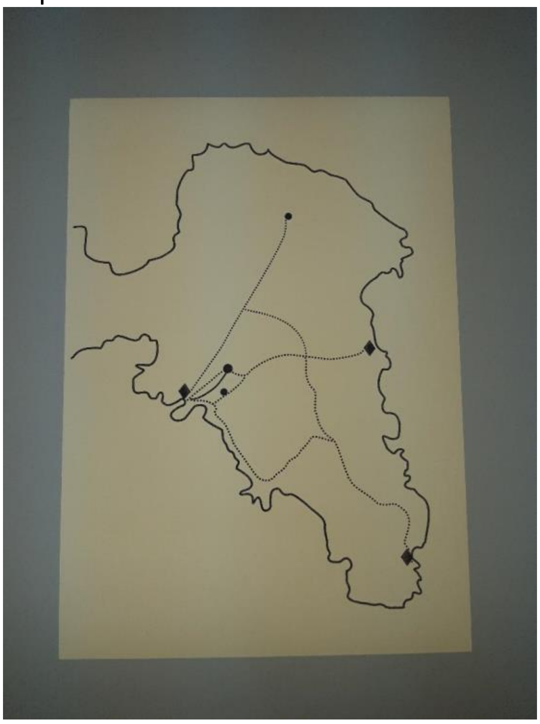
Teacher takes advantage of the prior knowledge of the students regarding the ports of: Pireaus, Rafina and Lavrio, which they are going to visit. Gathering their answers he finds out what they know.

2.2 Plan and conduct simple investigation:

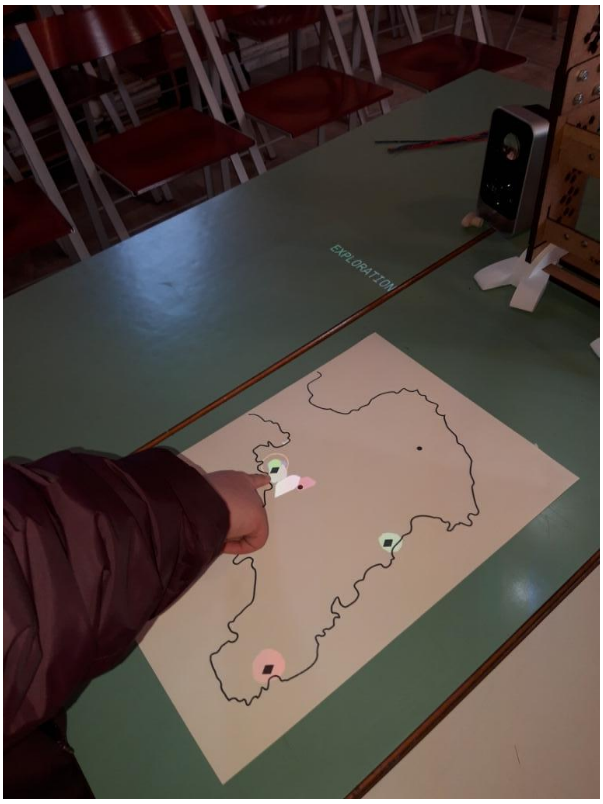
Description:

The instructor provides to the students the tactile map of the prefecture of Attica and together they follow step by step with the support of the augmented reality toolkit the routes:

A) from Kallithea to the port of Pireaus
B) from Kallithea to the port of Rafina
C) from Kallithea to the port of Lavrio.



Tactile map of the prefecture of Attica for the augmented reality toolkit



The student follows the instructions on the tactile map of the prefecture of Attica with the use of the augmented reality toolkit

Snapshot from the inclusive educational program with the use of the augmented reality toolkit

Snapshot from the inclusive educational program with the use of the augmented reality toolkit

Snapshot from the inclusive educational program with the use of the augmented reality toolkit

C) Visit

Teaching Phase 3: Creation

- **Gather evidence from observation:**

Description:

In order to elaborate students' spatial thinking the instructor gives them the opportunity to observe the tactile map of the prefecture of Attica. It is important for students to realize that the starting main point of the scenario is Kallithea (where the school is located) and to put a mark on the tactile map of Attica and on the 3D model of the prefecture of Attica. From this stage it will be easy for the students to locate the three points of interest in the county, the three ports of: Pireaus, Rafina and Lavrio.

Student explores the tactile map with the assistance of his instructor

Students explore the 3D model with the assistance of their teacher

Student is marking Kallithea (where the school is located) and the 3 ports of Attica with pins on the 3D model with the simultaneous use of the tactile map and the assistance of the teacher

Student creates routes with the use of yarn with wax between Kallithea and the 3 ports of Attica with the teacher's assistance

4. Discussion

- **Explanation based on evidence:**

Description:

Visually impaired students through guided practice study the tactile map of the prefecture of Attica and point out the location of Pireaus, Rafina and Lavrio. The map could be explored both by touch and by sound, providing useful information for each port.

At this stage a *barcode-scanner-meets-digital-recorder* device (named Penfriend) could be used so as to incorporate auditory information and to give the opportunity to the students to elaborate their historical knowledge with an amusing way.

Handmade 3D model of the prefecture of Attica with routes made by yarn with wax and auditory information given by a *barcode-scanner-meets-digital-recorder* device and a wooden puzzle of Sterea Hellas


Student using a *barcode-scanner-meets-digital-recorder* device on a 3D model of the prefecture of Attica in order to get auditory information

The auditory information could be:

A) The port of Piraeus is the most important industrial center of the country and the largest commercial center of the Greek economy.

Students will also be informed of the Long Walls connecting Piraeus with Athens in the 5th century B.C., of the Piraeus archaeological museum, of the port of Piraeus, of the Nautical Club of Greece, of the football team of "*Olympiakos*" and of various districts such as *Mikrolimano*, *Kastela*, *Drapetsona* and others.

B) For the port of Rafina students will hear that it is located in the center of Eastern Attica and it is the second largest port of Attica. They will also be informed that in 1922 refugees from Asia Minor came to Rafina.

C) For the port of Lavrio students will hear that it is located in the southeastern part of Attica, and it is known for its harbor and its mines, from which mining was carried out (silver, lead, etc.) since antiquity.

Geopolitical map of Attica (created by the use of thermoform)

- **Consider other explanations:**

Description:
At this teaching phase the instructor discuss with the students about the directions they have to follow in order to reach the three ports, which have been mentioned above.
Students scribble on the map made by a tactile image maker the starting point of the route, which is Kallithea towards the three ports.
Furthermore, the instructor can give basic information to students to think about alternative routes to reach the same points of interest.

D) Post Visit

Teaching Phase 5: Reflection
Communicate explanation

Students under the guidance of the teacher are looking for more information about the routes of the places they visited. They record and present them to the classroom.

Follow–up activities and materials
In order for the instructor to have a follow-up, he can invite students to express themselves through visual arts, painting, music, collage, and play by making use of all the information they have gained from these visits.
By completing the teaching of the educational scenario, students with the support of the teacher on the 3D model can use yarn with wax material to enhance their imagination and their creativity.

Students with the help of the teacher create their own handmade 3D model of the prefecture of Attica and the 3 ports

Students with the help of the teacher create their own handmade 3D model of the prefecture of Attica and the 3 ports

As regards the connection of the script with the subject of Music, students are encouraged to listen to the following songs:

“Children of Piraeus”

https://www.youtube.com/watch?v=DyPs49e1V3c

"I do not know what to play for children"

https://www.youtube.com/watch?v=hdo08pUPnMw

“Rafina”

https://www.youtube.com/watch?v=soxU4R2nKBc

5.3. Sustainable contact:

The educational scenario is presented to other teachers and it is uploaded to the school webpage where educational material is presented.

It is, also, available in the VISTE Platform

https://portal.opendiscoveryspace.eu/en/edu-object/xekinisoyme-apo-tin-kallithea-gia-na-episkefthoyme-ta-tria-simantika-limania-toy-nomoy

7.2 Title: “The Hercules’ labours in Peloponnese”

The Educational Pathway Pattern for a Pre-Structured Visit by the School

Title: “The Hercules’ labours in Peloponnese”

Special School for the Blind in Athens, Greece (SESBA)

Aggeliki Kosma, Special Teacher in SESBA

Nikolaos Vaitsis, Special Teacher in SESBA

Maria Zeza, Special Teacher in SESBA

A) Introduction

Educational Scenario

The educational activities in the presented educational scenario aim to introduce students to the following spatial concepts: direction, orientation, distance, map, scale, and route.

Title: “The Hercules’ labours in Peloponnese”

Short description: Through the implementation of the presented educational scenario, students will actively learn and discover about Hercules’ labors by focusing on those which are located/took place in the Peloponnese region. Additionally, they will locate the areas on the map and will navigate the map of the Peloponnese "following" Hercules. This educational material gives some insights into how students will be introduced to the following spatial meanings through educational technology (toolkit): map, distance, scale, path, symbolic representation, direction, mountain, lake, plain, orientation.

Key words: map, scale, distance, route

Target audience: teacher with students

Age range: 08-10 years old

Time required: The approximate time needed to implement the educational scenario is estimated to 2 sessions of school-based work.

Context: The educational scenario is implemented in the school classroom.

Author's background: The educational scenario was prepared by school teachers.

Technical requirements: For the implementation of the educational scenario are required:

1. Printed map of Greece

2. Tactile map of Greece in Braille (Photo4)

3. Tactile map of Greece and Peloponnese in thermoform (Photos 6,7)

4. Tactile wooden geophysical map of Greece made with CNC machine (Photo 5)

5. Map of the Peloponnese on maquets' paper with geographical areas. (Photo 13)

6. Map of the Peloponnese on microcapsule paper (Piaf). (Photos 1, 2, 9)

7. Tactile map of Peloponnese made by clay (Photo11)

8. 3D models made using a 3D printer (Photo12)

9. An educational tactile game that includes a Map of the Peloponnese and three-dimensional figures with the symbols of the myths of Hercules

10. Braille machine

11. Embossed globe (Photo 3)

12. Computer

13. Implement toolkit

14. Materials for visual and tactile constructions such as paints, (markers, pastels, etc.) clay, plasticine

Connection with the curriculum:

This educational scenario is an interdisciplinary educational scenario because it is linked to various subjects such as History, Geography, Mathematics, Language, Art, and Music. It is included in the second section "Hercules", in the book of History of the 3rd Grade of Primary School and is completed in seven modules.

Learning objectives:

Through this educational program the students actively learn, encode and discover:

- To locate in the map of the Peloponnesus the regions where the feats were made.
- Calculate distances.
- Read the haptic map
- Make a route on the map
- To recognize the symbols in a memo
- To learn to use modern technologies, toolkit.

Guidance for preparation:

The school teacher prepares tactile maps of maquets' (tissue) paper and the map on microcapsule paper. Additionally, he prepares the three-dimensional figures in the 3D printer and the map for the educational game.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  We encourage pupils to observe the toolkit and a tactile map of the Peloponnese, made of microcapsule paper (Piaf), which gives auditory information to visually impaired students about the areas of Hercules' labours. (Photos 1, 2)


- **Define questions from current knowledge:**

In order to share their previous knowledge of Hercules' achievements, we ask students to watch a video (https://www.youtube.com/watch?v=zZRcMiIwFpY),

They then express their opinion on this subject, summarizing the information they already know about the lessons they were taught.

Finally, the pupils select the labours which took place in Peloponnese and identify the areas of action on the haptic map of Piaf.

Teaching Phase 2: Active Investigation

- **Propose preliminary explanations:**
  Prompted by a discussion and students are motivated to express their views and write their ideas and suggestions on the difficulty of visually impaired students to locate in a map the areas that Hercules' labours have taken place in the Peloponnese.

  Propose original hypotheses:
  We present our students with the embossed globe (Photo 3) and we ask them to locate Greece and then we give them the haptic map of Greece (Photos 4-8) to locate Peloponnese and encourage them to associate the specific Hercules' labors with the regions where these took place and to locate them on the map.

- **Plan and conduct simple investigation:**
  Through discussion, the question arises as to the possibility of a two-dimensional haptic map that provides voice information and is accessible to visually impaired people. The students, through discussion, are thinking about how to map the route of Hercules to the Peloponnese on the haptic map. They also select the information that can be integrated into the toolkit application

  Through the discussion, the need and importance of using a toolkit that focuses on the potential to:

  - make a map accessible for visually impaired students through the provision of voice information

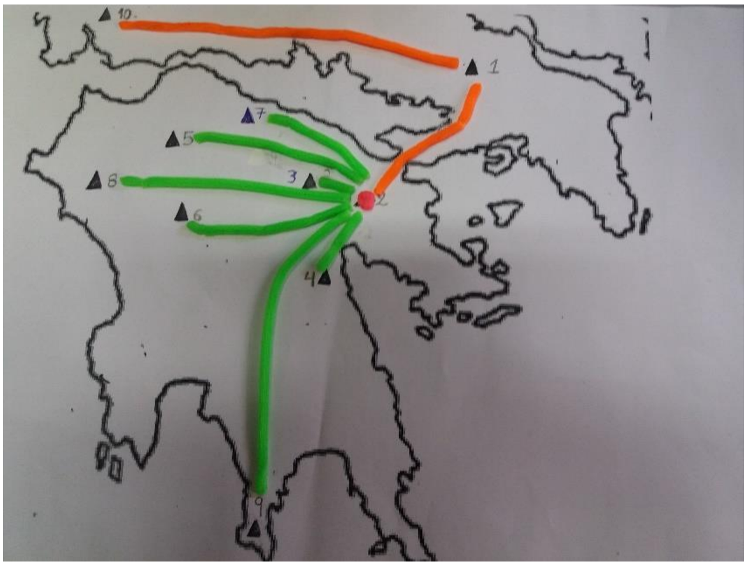
  - provide at the same time tactical and vocal information.

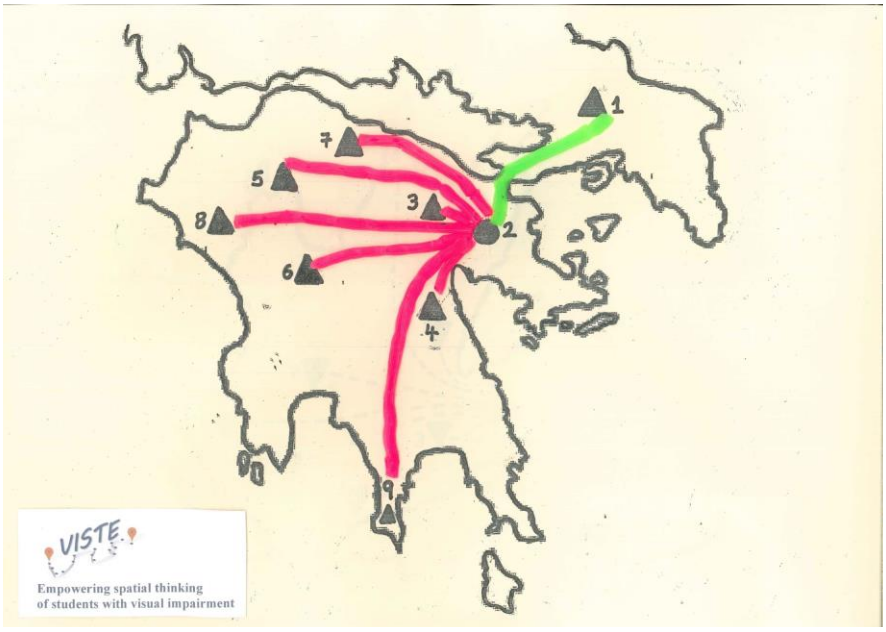
  The goal of implementing the toolkit is for the visually impaired pupil to be able to navigate the map of the Peloponnese by following the routes from one city or region that each Hercules feat to the other (Photo 9, 9a, 9b, 9c, 9d).

For example, Thiva (1) from where Hercules started, was placed as a starting point and then went to Mycenae (2). The first labour was played in Nemea (3). On the map, tactile indications for all cities / regions are incorporated:

1. Thiva 2. Mycenae 3. Nemea 4. Lerne 5. Achaia 6. Arcadia 7. Stymphalia 8. Ilia 9. Lakonia - Cape Tainaro 10. Aetolia

The toolkit application additionally provides the student with auditory information about the area and the labour took place there. For example, when the student tapes the point 3 he will hear from the toolkit: "Nemea, 1st labor: Nemea's lion". (Photos 10a-i)

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VISTE
Empowering spatial thinking
of students with visual impairment


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VISTE
Empowering spatial thinking
of students with visual impairment


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B) Visit

(Teaching Phase 2: Active Investigation)

Teaching Phase 3: Creation

- **Gather evidence from observation:**
  We present our students with the haptic map of microcapsule paper (Piaf) (Photos 2, 9). Students note that this is a simple map with tactile information, without a memo. We encourage our students to navigate the haptic map through the implementation of the toolkit and to take on the information it gives about the labours of Hercules and the areas that have taken place.

Teaching Phase 4: Discussion

- **Explanation based on evidence:**
  We give students a three-dimensional tactile model-play. Students, through the narration of the labours, represent the route of Hercules in the Peloponnese in the haptic model-play (map). At the same time the students emphasize the geomorphological features of the regions, as they are depicted on the haptic map. (Photos 11, 13, 13a).

  Teacher present to the students the three-dimensional figures which represent each labour. (Photos 12a-i) The students locate the areas on the map (Photo 13), they get from a three-dimensional figure and are called after they recognize it and associate it with the labor to place it on the haptic map in the city of Peloponnesus, where the labor took place.








- **Consider other explanations:**
  We discuss with students the possible misconceptions they may have about the subject that was analyzed and investigated.
  Possible misunderstandings of students about tactile reading of the map

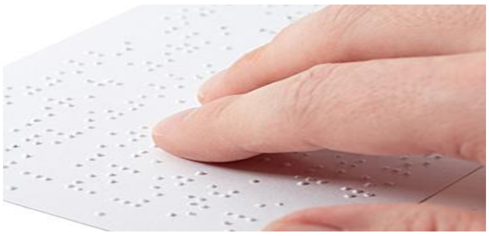
C) Post-visit

(Teaching Phase 4: Discussion)

Teaching Phase 5: Reflection

- **Communicate explanation:**

  The teacher encourages creative writing. The students, with the help of the teacher, prepare a small report - a report describing their investigation and their conclusions, expressing their opinion creatively from the experience they gained after their navigation with the toolkit application on the haptic map with a microcapsule (Piaf). (Photos 14, 15)



- **Follow-up activities and materials**

  Additional educational activities

  Through these educational games teacher attempts to assess students' knowledge and misconceptions referred to the already taught module and the perception of spatial concepts.

  1. Board game with three-dimensional figures and the haptic map with the micro toolkit (Piaf) of the toolkit application.

  2. Identify cards with the names of the cities of the Peloponnese and the three-dimensional models of the Hercules' labors.

- **Keeping contact**

  The educational scenario was presented to other teachers and uploaded to the VISTE platform, where other educational material is presented.

7.3 Title: "Facial Expresion"

TEACHING SCENARIO IMPLEMENTED WITHIN THE MAINSTREAM ARTS HIGH-SCHOOL IN CLUJ-NAPOCA

A) Introduction and Preparation

Title: Facial Expressions

Short description

This teaching activity proposes to identify new ways to approach understanding and teaching representations of facial expressions to students with and without visual disabilities, using clay and making masks, stimulating creativity and imagination, developing kinesthetic tactile refinement.

Keywords:
Art, perception, plastic composition, plastic space, kinesthetic exploration by touch, tactile transpositions, molding, textures, volumes, proportions.

Target group:

A class in a mainstream arts school.

Age range : 12-13

Context:
The Arts classroom/workshop

Time Required: 3 hours

Technical requirements:
Embossed drawings mask made using the 3D printer, audio descriptions of facial expressions used with the VISTE toolkit, collages made with unconventional materials and textures, and access to an appropriately equipped workshop.

Author's expertise:
Elena-Daniela Bodea – Arts teacher – Liceul Special pentru Deficienţi de Vedere, Cluj-Napoca
Pompilia Herman – Curriculm expert, Casa Corpului Didactic Cluj

Links to the curriculum
The study of the human figure and the plastic rendering of a portrait in various plastic techniques: drawing, clay, painting, collages are found in the school curriculum starting with the fifth grade. The concepts covered are the following: proportions, relations, plastic language elements, distances, stylization, the specificity of facial expression that represent emotions. The challenge of this approach is to make accessible for the blind students the perception and understanding the facial expressiveness and tactile transposition using clay.

Objectives:

- To acquire knowledge of plastic language elements: point, line, shape
- To learn more about plastic compositional principles in rendering a portrait in various plastic techniques: drawing, clay, collages
- to learn the ratios and proportions of the constituent elements of a portrait: balance, positioning, proportions, reports between the nose the eyes the mouth
- To identify facial grimaces, using the tactile perception of facial physiognomy
- to learn how to make a mask representing some specific emotions, using clay.

Scenario Preparation Guide:
Making layouts, collage designs, clay works whit facial expressions: fear, sadness, anger, joy, wonder, disgust. Making descriptive texts accessible in Braille or using the toolkit to

synthesize how angles, corners, lines of the eyes, of the nose, contour of the mouths, cheeks, and eyebrows look and how they change when the face expresses different emotions.

B) Pre-visit

Phase 1: Questions for generating questions

• Challenge of curiosity:

Offering for study:

- reproductions / color photographs of facial expressions that have a proper scale accessible to explore
- schematic drawing, where portraits are transposed at the drawing or embossed drawing level, making contours. The composition is simplified by creating clear, sometimes geometric surfaces, but trying to preserve the physiognomy of a human figure.
-the audio description of the types of physiognomies offered for exploration by means of the toolkit.

Test 01: Fear

- Line contour of the head
- Line of eyebrows raised and pulled together to express fear
- Tensed eyelids, to express fear
- Contur of the mouth almost open but with lips slightly stretched horizontally back to ears

Test 02 Disgust

- Line contour of the head
- Line to suggest nose wrinkling – to suggest disgust
- Line to suggest eyes wrinkling
- Upper lips line

Test 03 Surprise

- Line contour of the head
- Line to suggest forehead wrinkling
- Round line to suggest eyes wrinkling, eyebrows raised and because the eyes are widened in the middle, it is the perfect cercle of the iris – thus eyes are suggesting surprise
- Mouth open like a cercle

Test 04 Sadness

- Line contour of the head
- Dropping upper eyelids and losing focus of the eyes - losing the round form suggests sadness
- Slight pulling down of lips corners

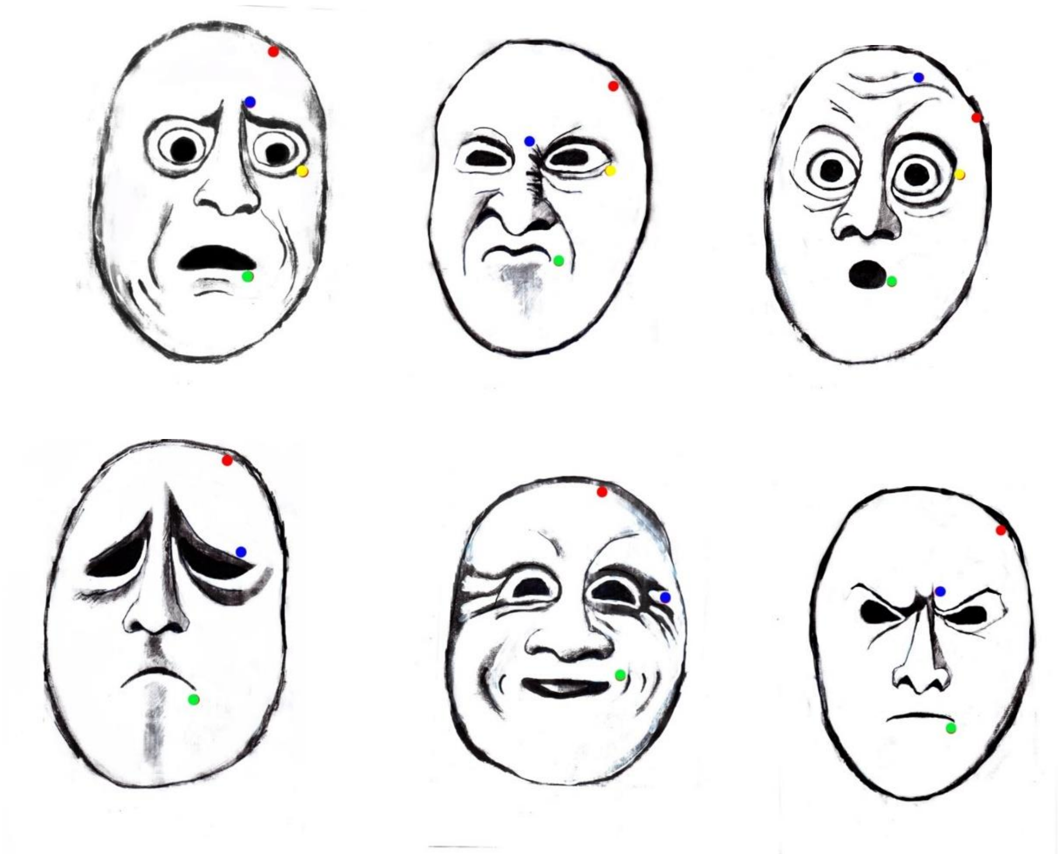
Test 05 Happiness

- Line contour of the head

- Wrinkles which suggest happiness
- Line to suggest pushed up cheeks and the line lips corners are also up

Test 06 Anger

- Line contour of the head
- Eyebrows line down and connected to express anger
- Narrowing of the lips to look like one straight line



• Asking questions based on the students' knowledge:

What is a portrait?

What are facial expressions?

What are the plastic techniques in which a portrait can be rendered?

By what techniques can the three-dimensional portrait be created?

Phase 2: Investigation itself

• Suggestion of preliminary explanations or assumptions:

- exploring the kinesthetic touch of one's own physiognomy when expressing certain emotions: sadness, joy, etc.

-To study some portable translations in various painting, drawing, collage, clay techniques.

-the study of three-dimensional unconventional elements from the surrounding reality that resembles the nose, mouth or eyes when they read an emotion.

- making clay in volume, stylizing oversize exaggerating reality in the nose, mouth when expressing an emotion

• Planning and coordination of the simple investigation:

A challenge for the students is to make their own portrait whit the intention to understand the organisation of a portrait with correlations between the elements: distances, overlapping, joining and suggesting an emotion. Students will be provided with audio information on the description of facial expressions as well as 3D casts.

B) Visit

Phase 2: Investigation itself

Drawings will be given to the pupils so that the composition of a portrait with some facial expressions could be analysed. They will explore and discuss expressions such as: joy, sadness, fear, astonishment, disgust, anger.

At this stage the students will observe and learn about:

- the positioning the constitutive elements of a human physiognomy: nose, mouth, eyebrows, cheekbones etc

- similitudes and association by stylization with geometric figures of the nose, mouth, eyebrows

- the compositional composition of a portrait that renders certain facial expressions in two-dimensional compositions and in three-dimensional compositions

- the identification of large-small, top-down, vertical / horizontal / diagonal ratios, symmetries / asymmetries

- the possibilities of tactile transposition using unconventional munitions bounced on the frame support received with the contours of the ready-made constituents.

- possibilities of working with clay in the creation of facial epressives.

Phase 3: Creation

• Collection of evidence based on observation:

Students will receive clay tablets on which the outline of a portrait is already drawn in the relief, and the pupils' intervention is to use clay and to make a facial expression of choice, also suggesting whether the figure is that of a child, an adult, a boy or a girl thus adding specific details. The composition can be as original as possible and as close to or as far from the two-dimensional as possible, exaggerating certain features so that the portrait takes the look of a mask. This classroom activity stream will result in a number of new portraits.

C) Post-visit

Phase 4: Discussion

• Evidence based explanations:

These creative activities do not have the role of creating a unique canon of tactile portrait representation, but what is important in this endeavour is the number of steps taken by students with and without visual impairment towards new ways of understanding and representing facial expressions in a tactile manner.

Since we have at our disposal various options to represent a portrait with different facial expressions, in different genres of artistic expression, - embossed drawings, 3D printing, texture touching, clay composition, we can make creations in the form of a singular existence, or as a serial succession. The ability to explore multiple variants of plastic expressions of a portrait facilitates students' perception and understanding of facial expression when expressing certain emotions. At this stage, students will explore and discuss each of their colleagues' creations.

This stage will be followed by a short activity in which students will analyse facial expressions in theatrical performances, will link them to full body postures and will try to express them in small role-play tasks.

Phase 5: Reflection

The activity will generate discussions about:

- the skills acquired by students to identify and recognize emotions after exploring some plastic works in different artistic techniques and artistic forms

-the opportunities given to the students by means of the series of steps taken during this teaching scenario; students are thus offered the chance to explore their own facial and body expressiveness, the awareness of the role played by the facial and body expressiveness in day-to-day or interpersonal communication the one assumed by theatrical performances.

Follow-up activities and materials

The activity has many possibilities of approach and each student has the chance to choose his or her own form of translating a portrait: painting, drawing, collage, modeling in clay, performance.

Contacts to ensure sustainability

Publishing the scenario in a volume with examples of good practice developed within the VISTE program and uploading it also on the VISTE platform that contains open educational resources.

7.4 Title: "Torball Game"

The educational model for a structured scenario implemented in school

A) Introductory section and preparation stage

The activity aims at teaching and strengthening specific motor skills specific to the torball game

Children will become familiar with the rules, the structure of the game, the torball field, etc. The lesson scenario develops movement-motion schemes specific to torball, but also motor skills applicable to everyday life.

Title: The Torball Game

Short description:

The activity involves the acquisition of knowledge concerning the game of torball, its basic rules and play strategies, field orientation, as well as the development of motor skills, in general, and the torball movement schemes, in particular.

Keywords:

Bidimensional, tridimensional, spatial notions of: up, down, right, left

relative position of two objects, lateral.

Target group: 29 students wit hand without visual disabilities

Age category: 12-15 years old

Context:

School gymnasium with necessary accessible marks on the floor, functioning as a torball field

Time Required: 90 minutes

Technical requirements:

• Torball field
• torball balls
• specific equipment: black eyeglasses
• Computer - connected to the projector and speakers;
• VISTE Tool kit.

Author's expertise:

MANIU EMESE AGNES – sports teacher in the School for the Visually Impaired, Cluj-Napoca

Mihaly Bela – sports teacher - Liceul Teoretic „Batory Istvan"

Dina Pripon- Curriculum Expert, Casa Corpului Didactic Cluj

Links to the Curriculum:

The lesson develops skills covered in the main sports curriculum used by all public schools in Romania. The key terms are found in the learning contents of the torball curriculum areas.

Objectives:

- To develop spatial thinking skills, through practical applications, such as: orientation and mobility in tridimensional space, measuring the length and the width of the field, measuring distances between different floor landmarks on the torball field.

- To develop motor skills in general and movement schemes related to the torball game, in particular.

- To teach and practise technical and tactical techniques used in the game of torball: launching the ball, plunging, etc.

USED METHODS

Orientation and mobility

Familiarizing, knowing the workspace is very important for blind children. This includes changing rooms, showers, space in the gym, torball field, etc.

The starting points and final destinations will be established. Between these, intermediate points will be established for better orientation.

We have to choose a starting point like the entrance door. From here we can set the fixed landmarks we are heading towards and then count the steps between them.

It is very important to establish concrete concepts and approximate the distances between landmarks.

There can be signs, tactile landmarks on the floor that will help students orientate on the field.

Kinesthetic method

Propriooception (from Latin proprio and perception) is the sense of perception of body parts. It is the sense that informs us about the position of our body and limbs.

Kinestezia is another term often used as a substitute for proprioception, although kinesthesia puts more emphasis on movement.

Sherrington's original description states that proprioception is the ability to determine exactly where the different segments of the body are, while kinesthesia is described as the sensation that the body or its segments have moved.

When we teach a blind child to play torball it is very important to realize that the information he or she receives can not be visual. So we have to use the other senses of hearing, the sense of touch, kinesthetic, proprioceptive to make him or her learn and execute the essential movement schemes as accurately as possible.

Before we begin applying the method, we will allow the child to feel the movement that the coach or other colleague is doing to get an overview of what he or she is going to do. (complete motion scheme).

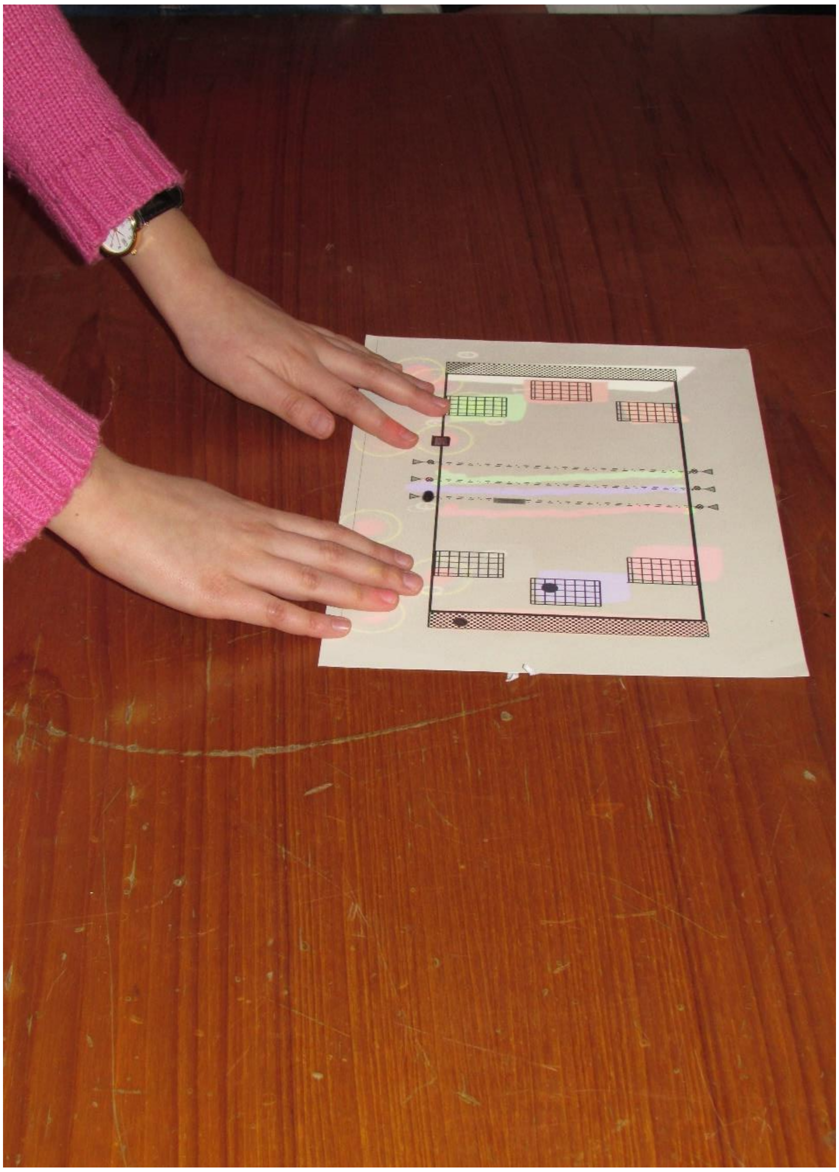
We will also explain in detail each movement performed to understand it correctly.

We will insist on the correctness of the execution of the movements from the beginning in order not to develop incorect skills

Scenario Preparation Guide:

The scenario consists of 3 main stages: the preparatory stage, the practice stage and the game itself

During the preparation stage, the structure of the field of torball is explained, the pupils will explore the tactile charts accompanied by the information provided by the toolkit.



The second stage consists of the proper trening and practice of players position and necessary actions.

The third stage consists of a torball game.

B) Pre-visit

Phase 1: Questions for generating questions

The teacher will ask questions to elicit students’ prior knowledge about adapted ball games for the visually impaired.

• **Challenge of curiosity:**

Explanation about the special ringing ball and about basic concepts and rules related to the game of torball.

The game is played between two teams of three players, with a maximum of three reserves for each team. The game takes place on the floor of a gym, inside a rectangular field, divided in two by a central line. The gates are placed at both ends. The game is played using a special ringing ball. The objective of the game for each team is to move the ball beyond the opponent's goal line while the other team tries to prevent it.

The rules for international torball competitions are those adopted by the International Sports Association for the Blind (IBSA).

The teachers will use the toolkit in order to help the students become familiar with the structure of the field and with its landmarks: the gate, the middle line, the positioning of the players, etc.

Students will also have the chance to explore and practise their orientation on the real torball field, based on the information previously received through the tactile map and the toolkit.

B) Visit

Phase 2: Training and practice

The teacher will then encourage the students to do a few minutes of body exercise, which will prepare the body for effort: walking forward and sideways, light running, fast running etc.

Then, the lesson will continue focusing on the locomotor apparatus (shoulders, trunk, lower limbs).

In the next phase students will acquire the specific technical elements: launching the ball with a flip-flop and sliding for gate defense. The teacher/trainer, positioned behind the student, will move along with him/her, leading them in such a way as to understand and acquire both the movement and its direction. Students will be taught to listen for where the ball comes from and for the distance between them and the other players. They will also learn to adjust the position of their body, in order to have an effective launch.

Phase 3: The game

There will be teams of 3 players and they will play according to the rules presented in stage 1.

Phase 4: Discussion

In the process of integrating and processing information, students will discuss the information obtained - aspects such as technical and tactical schemes of the game of torball. The teacher will encourage them to take into consideration both what they enjoyed and understood best, and the challenges they faced.

Contacts to ensure sustainability

The project will be available to other teachers, trainers and specialists on the VISTE project platform

The activity will be presented, at various teacher workshops/conferences, to other teachers and specialists who work with visually impaired students, in special schools and in mainstream educational settings.