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Faculty of Electrical Engineering and Computer Science

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# Smart Solutions for the Inclusion of Students with Disabilities in Higher Education (SSSD-HE)

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## IO2: Data Analyses and Publication about the Requirements of Disabled Students in Higher Education

## National Report from Slovenia

Authors: Dr. Ines Kožuh, Tina Časar, Anja Zakošek, Teja Voglar, Maja Pučko, Nina Katarina Bračko, Nuša Majcen, Ana Tomšič, Svetlana Roškar, Jan Strmšek, Dr. Matjaž Debevc

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# I. Introduction

## i. Aims/Objectives of the Report

The aim of the Report is to provide results on data collection of testing the Digital Assessment Tool for the Requirements of Disabled Students in Higher Education in Slovenia. Moreover, it provides the findings of desk research on the requirements of persons with vision and hearing loss. We also provide a review of the current research findings on the available assistive technologies supporting these students, and the good practices of the inclusion of these students into the Higher Education process.

## ii. Scope of the Research

The scope of the research will be students with all types of disabilities (Physical (e.g. muscular dystrophy, chronic asthma, epilepsy), developmental (e.g. dyslexia, processing disorder, autism), behavioural/emotional (e.g. ADHD, oppositional defiance disorder, panic attacks) and the sensory impaired (e.g. blind, visually impaired, limited hearing)). According to the expertise of the University of Maribor team and as derived from the application form of the project, the emphasis of this Report will be on students with sensory and hearing disabilities.

## iii. Method

The findings of the desk research are presented in the first part of the Report. The findings of the survey as a research method are presented in the second part . Descriptive statistics were employed in the analysis.

## iv. Contribution to Existing Literature

Our main contribution to the existing literature is providing results on testing the innovative Digital Assessment Tool for the Requirements of Disabled Students in Higher Education in Slovenia. Along with these results, key findings from desk review are provided, where the emphasis is on people with sight and hearing loss.

# II. Key Findings from the Desk Review for the Blind and Visually Impaired

## i. Requirements of the Blind and Visually Impaired

### a. Requirements of the Blind and Visually Impaired regarding Adaptation of the Environment and Infrastructure

According to the Slovenian Association of the Blind and Visually Impaired (n. d.), in the premises where a blind or partially sighted person is located, it is necessary to remove all dangerous and unnecessary obstacles, both on the ground and at height. We need to provide a safe place and allow blind people with a guide dog or wheelchair to move around. Basic room adaptations should include:

a. *Floor, tactile and visually contrasting markings*: It is always necessary to mark the beginning and end of stairs and stair edges, entrances to the building and rooms in the building, pedestrian crossings in front of the building, ground level changes, floor markings in front of static dangerous low or hanging obstacles.
b. *Handrails, railings*: Handrails are very important in improving the movement of visitors, but it is important that they are placed in the room sensibly.
c. *Glass surfaces*: All glass surfaces, especially glass doors, must be marked with coloured and sufficiently contrasting strips, and the entrance with appropriate floor markings.
d. *Markings, inscriptions*: Rooms and floors must be marked with type markings, while some inscriptions must also be written in Braille.
e. *Colour contrasts*: In addition to inscriptions, colour contrasts are used appropriately for warning signs, marking of the walking path or space of movement (contrast between the floor and the wall).
f. *Materials of the equipment:* The materials must not be reflective and glary, the floor surfaces must not be slippery or sticky, and carpets must be installed correctly, which can serve as a guide for the blind and partially sighted.
g. *Room lighting*: The light source must be placed in a way that it causes as few shadows or little glare as possible.
h. *Room acoustics*: Acoustics are important, as they can help the blind person to orientate in space more easily.
i. *Room map*: Must be tactile and colour contrasting.
j. *Elevators*: In the elevator, it is recommended to use sound and tactile numbers and inscriptions in Braille.

### b. Requirements of the Blind and Visually Impaired regarding Access to Information

Access to information is also considered a requirement of blind and partially sighted persons. The Association of the Blind and Visually Impaired of Slovenia (n. d.) states the basic principles of access to information for the blind and visually impaired. The following elements must be considered:

a. *Appropriate formats:* Content offered to blind and partially sighted people must be in an appropriate format. E-formats should be provided - Word, html, rtf or pdf formats (background text, unprotected), DAISY, ePUB (eg e-books).
a. *Choice of typography:* Italics, underlining, below or above written text should be avoided. Preferred are a left alignment and a line spacing of 1.5. The base on which the text is located must be non-reflective, and the font size from 12 to 18 dots in handy materials, and 24 dots or more on nameplates - depending on the distance of the inscription.
b. Colour contrast: There must be an appropriate colour contrast between the font and the background. Combinations should be avoided where the colour of the letters and the output have a similar brightness. We should also avoid similar colour tones, as it is best to combine the contrast of dark and light.
c. *Visual information*: We should replace all visual information as much as possible with descriptive or audio information, e.g., an audio description of information, pictures, exhibition objects, video materials, etc.
d. *Tactile material*: We try to use as many physically accessible tactile examples as possible, e.g., exhibition objects, models, tactile paintings… In museums e.g., tactile examples may be offered representing objects from the collection.

### c. Requirements of the Blind and Visually Impaired regarding Technical Devices

The requirements of the blind and visually impaired also include technical aids that they need to perform daily activities. As defined by Valentinčič Vidovič (2016), technical devices are distinguished according to their use at different stages of visual impairment and the mechanism of augmentation. The author presents four basic mechanisms of augmentation:

a. By enlarging the observed object;
b. With a shorter reading distance;
c. With telescopes, and
d. With electronic systems.

The devices can be classified according to their use in different degrees of visual impairment (Table 1). The visually impaired may use, in addition to devices to replace visual information, other devices that serve to reinforce this information. The blind, on the other hand, can only use aids to replace vision (Valentinčič Vidovič, 2016).

**Table 1.** Devices for people with different degrees of visual impairment (Valentičič Vidovič, 2016).

| **Moderate, severe, and very severe low vision, (almost blindness)** | | | **(Almost) blindness, blindness** | |
|---|---|---|---|---|
| **Enhancing visual perception** | | | **Replacing visual perception** | |
| **Optical** | | **Electronic** | **Sound** | **Type** |
| Magnifiers | Glasses | Electronic magnifying systems | Sound carriers | Braille typewritter |
| Ordinary | Bifocal | Computer reading and writing systems | Computer reading and writing systems | Computer reading and writing systems |
| Ocular | Hypercorrectional Telescopic | | | |

## ii. Inclusion of the Blind and Visually Impaired in Higher Education

### a. Obstacles for Students with Sight Loss in Higher Education

Blind and visually impaired persons involved in the higher education process most frequently face accessibility obstacles. The most basic are the physical accessibility of the Faculties, the accessibility of public transport and the adaptation of the study process. To ensure physical accessibility, we should provide appropriate markings on the floor or on the wall, which help them in their orientation at the Faculty. We should also acquaint these students with a description of the space and where other students are in the lecture hall (Kraljić, 2010).

There are still major problems in the field of Electronic Access to Study Materials and technical or communication aids that enable the blind and partially sighted to study independently (Rot, 2014). The accessibility of lectures, seminars and exercises is further enhanced using software such as screen readers or magnifying glasses, that enable the blind and partially sighted to read the material and follow the study process (Kraljić, 2010). Blind students need non-visual support when working with computer systems, where they follow the content on the screen with the help of computer-generated speech, or use the tactile mode with the help of a Braille screen. The content is displayed dynamically on a line of variable plugs over which the blind student slides his fingers. Blind students also frequently use audio input to enter text or commands, and use a system that translates text into sound (Debevc, 2010). For visually impaired students, it is necessary to enlarge the screen from 2 to 16 times, and the use of clear and larger fonts, such as Arial or Verdana, is also recommended (Debevc, 2010; Kraljić, 2010).

### b. Report from Practice: How Students with Sight Loss Overcome Obstacles in Higher Education

When we talk about higher education for the blind and visually impaired, we can say that they face primarily reading or writing problems, and they can benefit from combinations of different sources of Information Technology, such as screen magnifiers (i.e. systems that magnify characters on a computer) and speech synthesisers (for special adaptations with voice output that convert screen content into speech) (CCDF Alves et al., 2009).

An indispensable technology in higher education is a personal computer, where blind and partially sighted students can write and record material. They can also send materials to each other, making it easier to access the materials. The student can ask the Association of the Blind and Visually Impaired of Slovenia to record the study material in audio form, for example on a CD, but, in modern study, it often happens that access to the material is needed in a very short time. In such a case, the student does not receive the material on time and is, therefore, largely left to himself. Due to the digitisation of materials and books, however, this has been simplified, and study opportunities have almost become equal to other students (Vnuk, 2007).

The main aim of ICT assistive technologies for the blind and visually impaired is to work in a way that will improve or replace vision. For visually impaired people, this means increasing the screen display to facilitate the performance of visual tasks such as reading text, selecting media, responding to system calls, and the like. Typically, screen magnification software applications are used, and they allow users to enlarge text and graphics at a variety of levels (Söderström & Ytterhus, 2010).

For blind people, however, access to ICT is used through non-visual alternative tasks, traditionally understood as visual, using assistive technologies that translate the visual interface into tactile or auditory output, or a combination of both. The most common ICT support technology for the blind is the electronic Braille display, which provides a tactile line-by-line output on a special keyboard. This tactile output is based on text only, so it has the disadvantage that it is not useful when translating graphical interfaces. In this case, however, the blind person needs a 'screen reader' software application that interprets and translates text and graphics into auditory output. In this case, they can turn to mobile applications that provide translated access to texts and graphics (Söderström & Ytterhus, 2010).

Education through mobile learning technologies enables emerging forms of mobile interaction, including speech and audio forms of interaction, to help students participate as much as possible in inclusive education. Inclusive education means focusing on the needs and problems of teachers, while helping them to achieve their goals and potential (Arroba et al. 2011; Walker and Logan, 2009). One of the ways to use mobile technologies is through mobile applications that are aimed at pedagogical education of the blind and visually impaired. These applications pay special attention and offer support to the process of learning through the screen and interaction. It offers the student specific guidelines and principles, for which students with visual impairments must be trained in digital literacy and digital learning (Akcil, 2017).

### c. Report from Practice: Inclusion of Students with Sight Loss in Higher Education in Slovenia

Along with the Slovenian Placement of Children with Special Needs Act[1] pupils and students can be included in all forms of education and training. From the point of view of inclusion and education of the blind and visually impaired, Slovenia is classified in a group of countries with a well-developed system of special education for the blind and visually impaired. It is developing various forms to include the blind and visually impaired in the majority education system constantly (Cankar & Pinterič, 2014). Blind and partially sighted students in Slovenia can enrol in a higher education programme if they meet the general conditions for enrolment, regardless of the number of points achieved at the Matura at the end of the secondary level of education. Blažič (2012) found out that the attitude of professors towards blind and partially sighted students is adequate in most cases. Professors try to adapt to the needs of students as much as they can. The interviewees pointed out that in their work they had no problems with obtaining the study material in electronic form, and if the study material was not adapted, they turned to the Association of the Blind and Visually Impaired of Slovenia for help.

### d. Use of Assistive Technologies in the Inclusion of the Blind and Visually Impaired in Higher Education

#### 1st. Environment

In Slovenia, within the Equalisation of Opportunities for Persons with Disabilities Act[2], there is also a policy concerning assistive technologies and adaptation of vehicles. Moreover, there is also in use the Personal Assistance Policy, where persons with disabilities (deaf, hard of hearing, blind, people with vison loss or deafblind persons) can choose between personal assistance or communication allowances in the amount of 150 EUR. Based on the Act Regulating the Use of Slovene Sign Language[3], deaf persons can also get vouchers to obtain support in communicating live in public.

When it comes to assistive technologies, the blind and partly sighted pupils, and students at primary and secondary levels of education can turn to the State, which, by law, offers them certain aids, such as a braille bar and a braille display. Later, during their studies,

[1] http://pisrs.si/Pis.web/pregledPredpisa?id=ZAKO5896
[2] https://www.fimitic.org/content/slovenia-law-alignment-opportunities-persons-disabilities-dan%C4%8Di-maraz
[3] http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO1713

they are also entitled to subsidies and scholarships, and for support technologies they can turn to Lions Clubs, which contribute money for the purchase of support technologies for education (Blažič, 2012).

## 2nd. Assistive Technologies and Technical Aids

Assistive technologies refer to any product, piece of equipment or product system, whether commercially sourced, modified or adapted, used to increase, maintain or improve the functional capacity of persons with disabilities. Such technologies can be lower-tech or high-tech, so, we can say from walking sticks to a voice recognition system (Bryant & Seay, 1988). According to Wiazowski (2009), assistive technology can offer support to students who are blind or partially sighted in all academic fields. The choice of technology, however, depends on various factors. To begin the treatment process, it is necessary to determine the student's state of vision. The choice of appropriate support tools, in most cases, is determined by the category of blindness or visual impairment, according to which, technical aids for the education of the blind and visually impaired also differ.

Blind students need non-visual support when working with computer systems, where they follow the content on the screen with the help of computer-generated speech or use the tactile mode with the help of a Braille screen. The content is displayed dynamically on a line of variable plugs over which the blind student slides his fingers. Blind students also often use audio input to enter text or commands, and use a system that translates text into sound (Debevc, 2010). The following assistive technologies are used most in the education of the blind:

- *Braille bar*: A computer keyboard based on 6 Braille keys with additional function keys.
- *Braille display*: The use of a tactile mode using a Braille display, which displays the contents of the display dynamically on a line of variable plugs, through which they then slide their fingers.
- *Braille labels on the keyboard*: Tactically accessible labels with Brailled characters can be used to create labels on the keyboard.
- *Microphone*: Students use audio input to enter text or commands.
- *Headphones or speakers*: To use the text-to-sound system.

- *Audiobook player recorded in DAISY format*: An International Standard for digital audio recording that allows a combination of text, sound and image.
- *Aids for drawing graphics* (e.g., with the help of a pencil we draw on a positive foil, which bulges when touched, and the blind can feel what they have drawn. It is used mainly in Mathematics to draw graphs and curves.

Visually impaired students need special aids to work far or near, and adjustments depend on the degree of visual impairment. The most common technical aids are:

- *Computer*: It is necessary to enable additional computer-supported functionality of the materials: The possibility of enlarging the text, changing the background and foreground colours, the size and number of windows on the screen.
- *Magnifying glass*: To enlarge the text in the materials, it can be plain or spectacle.
- *Electronic magnifier*: Allows users to view pictures, read newspapers and books. A special colour camera transfers the text from the sheet and magnifies it to the screen.

An important tool in education is certainly the computer, through which the student records his notes, exchanges texts with classmates and obtains easier access to other materials. The personal computer also allows them to be up to date and independent to a greater extent. Namely, they can scan the text through it, and then provide the desired literature themselves (Vnuk, 2007). The computer also offers a braille bar, a braille printer (for printing text in Braille), a graphic touch screen (as an addition to Braille) and optical readers (for font detection and conversion to Braille) (Vouri, 2019).

The work has also been simplified by the digitisation of books and other material. The exams can be passed by regular deadlines and in regular times. Instead of writing on paper, they can submit a CD with their product, or answer exam questions. For the disabled, education via the Internet is also quite practical, which enables them to access materials, correspond with classmates and solve tasks and exams from home. The Association of the Blind and Visually Impaired of Slovenia also offers them a studio in which they can record material for study in sound form (Vnuk, 2007). As part of the

Library for the Blind and Visually Impaired project, in 2015, we received the first 150 books in Slovenia in the International Standard for digital audio recording DAISY. It is a set of hardware and software that enables the production and playback of digital audio books. The biggest advantage of books recorded in the DAISY format is that the listener can move accurately and quickly through chapters, pages, and paragraphs, which also makes it easier for students to read study material (ZDSSS, 2015).

In the case of Mathematics and Arithmetic, they have most of the classic tools available, such as a ruler, triangles, protractors, pads, drawing foils and compasses, which are adapted for the blind and partially sighted. With the development of technology, this area has also become easier for them - a personal computer with the help of special software enables them to work using arithmetic and mathematical operations (Association of the Blind and Visually Impaired of Slovenia, n. d.).

### 3rd. Access to Information

Devices or programmes that provide blind and partially sighted support when reading printed material or browsing the web:

- *Text readers (text-to-speech):* Some programsme, such as JAWS Screen Reader, can be installed on a computer and allow text to be read by converting text to speech or braille. There are also some open-source readers available, such as NVDA[4].
- *Braille screens:* They are a technology that enables blind and partially sighted people to recognise characters with the help of electronic lifting pins in a braille cell. The cells are changing constantly as the user moves his fingers around the screen.
- *Tap TapSee mobile app:* Allows users of iOS and Android mobile devices to recognise objects in photos. The screen is touched twice by the user so that it can be photographed, and then the application recognises the objects in the image and transmits the information by voice (Illinois University Library, 2020).
- *Hand magnifiers:* They can be considered as one of the most direct examples of assistive technologies. These portable low-tech tools help students access text, images and other visual information. It is a great example of low-tech and

[4] NV Access | Download

relatively initial support technology. There are also digital hand magnifiers with LCD screens and adjustable magnifiers (Dikusar, 2018).

#### 4th. Mobility

For easier mobility, the following are also available for blind and partially sighted people:

- *Assistant dogs*: They are trained dogs with the mission of helping owners with special disabilities. For example, dogs can be trained to pick up items, while the dog warns others nearby if their owner needs help. Assistant dogs can be present in a public space wherever their owners go. They are also allowed to enter buildings where other dogs are not allowed in principle, e.g., at airports or restaurants.
- *White canes*: They can be defined as a primitive support technology used by the blind and visually impaired to navigate and move around or outside. With the help of a stick, a visually impaired person can recognise the obstacles in front of them.
- *Electronic devices*: They are devices that use ultrasonic waves to reflect obstacles in front of an individual and tell them what is in front of them. Such technologies are usually used in conjunction with a cane or dog. Such devices are, for example, a device that works by means of sound signals and can help a person to detect objects at a distance of up to 280 cm. The so-called UltraCane device is a combination of just such technology and a long stick, and allows the detection of objects over long distances (Illinois University Library, 2020). Another solution is Bluetooth low energy beacons – hardware transmitters which allow smartphones and tablets to perform actions when near a beacon. They help users in indoor location tracking.

### e. Good Practices: Support to the Blind and Visually Impaired in Higher Education

We reviewed what tools are available to blind and partially sighted people at different universities, and how the universities take care of adapting the study process for blind and partially sighted students. We first checked how it is around the world, and then we focused on Slovenia.

### 1st. College Stats

On the College Stats website[5], where they help students choose the right Faculty and school, users can find a variety of tools and applications to help students with special needs in one place. For different types of disability, they first provide a general explanation of disability, mobile applications, computer applications and online resources to help these people. To help blind and partially sighted people, they suggest three applications for mobile phones:

- Voice Brief[6] helps in reading news, emails, tweets, text messages, weather and the like
- Ariadne GPS[7] helps with navigation and mobility; the user explores the environment by typing on the phone, which tells him with voice commands what is in front of him.
- NantMobile Money Reader[8] helps with purchases, and checks that they return enough money in the store and elsewhere, and prevents exploitation due to blindness.

They suggest a few more PC applications in advance:

- VoiceOver supports more than thirty languages in the text, and supports various devices for rendering Braille.
- Like the VoiceOver programme, NVDA Screen Reader has the option to print Braille, but, at the same time, it can, additionall,y pronounce text.
- ZoomText[9] is a programme that allows the text to be printed larger and, if necessary, we can also include the option of listening to the text. The programme reads the text aloud to us. Thus, students who have difficulty seeing do not need to strain their eyes. For blind people, the programme has a convenient option to turn on the pronunciation of the text aloud.

[5] https://collegestats.org/
[6] https://appadvice.com/app/voice-brief-text-to-speech/423322440
[7] https://www.ariadnegps.eu/en/more-on-the-app/
[8] https://www.iaccessibility.com/apps/deaf-blind/index.cgi/product?ID=43
[9] https://www.zoomtext.com/products/zoomtext-magnifierreader/

### 2nd. Perkins School for the Blind

Perkins[10] provides educational services for children and adolescents with blindness, deafblindness, and multiple disabilities. They also share their expertise and work with global manufacturers of change in education, business, medicine, and politics. Perkins' mission is to prepare children and adolescents who are blind, with the education, confidence and skills they need to realise their potential (Perkins School for the Blind, n. d.).

The Perkins School has formed partnerships with international organisations to provide learning for the visually impaired in 67 countries. This was made possible by advances in online learning technology. Perkins has also helped with the National Programme for the distribution of deafblind devices and is a member of the History Hub.

### 3rd. Accredited Schools Online

Accredited schools[11] produce content focused on school accreditation online. On their website, however, they also have defined nicely and explained all the details about the visually impaired and blind. With the help of three experts in this field, users can obtain information on what blindness and low vision are, the spectrum from low vision to complete blindness and the technologies that can come to students during their education at colleges or universities.

In the Table they have three levels of blindness, arranged by colour, from mild visual impairments to low vision and, finally, blindness. In each of the three levels we have two tools to help. It is intriguing that each tool is descriptive, we get information from the site about what this tool does or how it helps with low vision or blindness, what is special is that we also know information about where we can get such a tool and how much it costs, which is a very important factor in learning about tools and in helping the blind and partially sighted, as well as others who are not so familiar with blindness. So, we get from magnifying glasses and calculators that cost up to $ 6 to tools suitable for blindness such as a Braille printer, which also costs up to $ 2000. The higher the level of blindness, the

[10] https://www.perkins.org/about
[11] https://www.accreditedschoolsonline.org

more expensive are the tools that improve the lives and studies of the blind and partially sighted (Accredited Schools online, n. d.).

The website also describes how Faculties adapt to the blind and visually impaired by raising awareness and educating Faculty members, including assistive technologies, recording lectures, giving the blind and visually impaired more extra time for work and exams, free use of computers and other aids, and the like. In advance, they also provide useful information on how to find the right Faculty in the case of blindness and low vision (Accredited Schools online, n. d.).

### 4th. The Slovenian Association of Disabled Students

The Association of Students with Disabilities[12] also plays an important role in the study of blind and partially sighted students, giving a lot to raising awareness about disability. It is a non-governmental organisation that has been operating since 1996 and brings together students with various special needs. For this purpose, they organise various events, such as the event Accessible University. With the event, the Association wants to draw attention to the problems of students with disabilities and call for a university accessible to all. For this purpose, workshops are organised at this event, with the help of which the participants get acquainted with the world of disability. At the previous event, participants were able to walk with their eyes closed with a white cane, play board games for the blind and partially sighted and try out various technical aids. The Association emphasises that the study is adapted increasingly to students with disabilities, and many architectural barriers have already been removed, if not completely, at least partially. We can talk about many examples of good practice, but the Association still emphasises that many Faculties do not consider adjustments and are not accessible to students with disabilities (RTV SLO, 2016).

The Association also cooperates with Higher Education Institutes and offers them the following (Association of Students with Disabilities, n. d.):

- Advice to improve the accessibility of studies,
- Counselling on special adaptations for students with special needs,

[12] http://www.dsis-drustvo.si/en/

- Educational workshops and seminars on the needs of students with special needs,
- Training for tutors on providing support to students with special needs,
- Seminars and experiential workshops intended for students and employees for greater general awareness of special needs.

In Maribor, for many years, the Student Organisation of the University of Maribor, together with the Association of Students with Disabilities of Slovenia, has been organising the tender "Assistance to students with disabilities", to which students with the status of students with disabilities can apply (Kupčič, 2020). Students with disabilities can apply for the competition throughout the year, or until the funds are used up. They can apply for various aids, teaching aids, travel expenses, living expenses and other possible expenses incurred during their studies. In recent years, the Student Organisation has provided a computer monitor for blind and partially sighted students, for less eye strain of students with visual impairments, and a dictaphone, for recording lectures and easier follow-up of studies (Maribor24, 2017 and ŠOUM, 2017).

### 5th. Lions Club Slovenia

The Lions Club (Lionists) is the largest voluntary humanitarian organisation in the world. It has 1.35 million members and operates in 208 countries. There are around 1,400 members in Slovenia, in 55 clubs organised in District 129. Over the last twenty years, they have raised over € 4.5 million in charitable funds, and their mission is focused mostly on the blind and visually impaired. The latter comes from the inspiring deaf-mute writer, activist, and fighter for the marginalised Helen Keller. At a convention in Cedar Point in 1925, Helen addressed the Lions as “knights of the blind in the fight against darkness” and thus changed their mission. Initially, they worked to help the blind and visually impaired, and later to the global level with the Sight First project. Their mission is: “To empower volunteers to serve their communities, pursue humanitarian needs, promote peace and promote international understanding through the operation of Lions Clubs” (Lions District 129 Slovenia, n.d.).

Lionists are aware of the importance of future generations, and, as a result, in many campaigns they focus on children and adolescents in need, help in kindergartens, schools and higher education, and strive to improve the quality of life of children from socially

disadvantaged families. They offer the blind and partially sighted (Lions District 129 Slovenia, n.d.):

- Purchase of Braille lines for the visually impaired.
- Purchase of a PC adapted to the needs of people with sight loss.
- Purchase of reading devices for the visually impaired.
- Organisation of cataract operations in less developed countries.
- Assisting organisations for the blind and partially sighted in their work.
- Financing projects to improve the quality of life of the blind.
- Leading the blind and visually impaired to social events.

Lions attend and organise events for the blind and visually impaired and other vulnerable social groups consistently. This year, due to the pandemic, they are investing a lot of energy in raising awareness before the expansion of Covid-19, but, at the same time, they are still working for the blind and visually impaired. Thus, on October 15, 2020, they celebrated the day of the white cane and its general use among the blind, and in the legalisation of the rights of the blind and visually impaired. The Lions Club Izola has donated special Emergensee glasses for the visually impaired, which will clear the eyes of users (LIONS Slovenia, n.d.).

### 6th. Libraries

In the academic year 2011/2012, the University Library of Maribor arranged a corner for users with blindness and low vision. In the corner is a computer with a scanner, on which the software SuperNova Access Suite is installed (Zupančič et al., 2016), which enables the selection of magnification, speech support, screen reader and support for Braille screens (Diopta n. d.). The University Library Maribor also offers blind and partially sighted users an electronic magnifying glass and headphones donated by the Lions Club Piramida Maribor (Zupančič et al., 2016). In terms of content and technology, they have also adapted the website, where a blind or partially sighted user can adjust the text size and line spacing, change the font style and change the colour of the text and background.

As part of the EODOPEN project[13], the National and University Library of Slovenia plans to digitise more modern publications, where they will try to adapt the material to the

[13] https://eodopen.eu/

needs of the blind and visually impaired and people with reading disabilities. They want to customise functions for text navigation, for changing the appearance of text, image descriptions, using Braille or speech synthesis (Dostop, 2020). The National and University Library of Slovenia allows users to borrow e-books from Biblos, EBSCO and Audibook. Biblos and EBSCO offer mostly English titles, while Audibook offers 100 audio books in Slovene (NUK, n. d.).

#### iii. Conclusion

When reviewing the websites of various Slovenian Faculties, we did not notice that they would focus specifically on study adaptations for blind and partially sighted people. Probably the reason for this is the answer given by Blažič (2012) in her diploma work, where she examined the level of involvement in Higher Education programmes among the blind and visually impaired. She found out that we could not answer this question with certainty, as there was no official record to keep track of the number of blind and partially sighted people in education. Thus, neither the University of Ljubljana nor the Association of Students with Disabilities of Slovenia keep official records. She substantiated that the reason why this is not being done is the small number of blind and visually impaired students. In many cases, however, those blind or partially sighted students who are being educated are subject to finding relevant information on their own and asking for help from a suitable professor, tutors, or study colleagues.

# II. Key Findings from the Desk Review for the Deaf and Hard of Hearing

## i. Requirements of the Deaf and Hard of Hearing

### a. Requirements of the Deaf and Hard of Hearing

People with hearing loss can be classified into three different groups. The first group includes prelingually deaf people who lost their hearing immediately after birth or by the age of three. Because they never experienced the sound world on a psychosocial level, they did not learn voice-language communication based on auditory experience. Prelingually deaf people do not have auditory or linguistic perception, so their central communication takes place through sight. They use a non-verbal system of communication for communication and social interaction, such as sign language, movement, facial expressions, pantomime, etc. Due to difficulties in comprehensibility

and the “inability” to communicate, such persons can often be isolated (Association of Deaf and Hard of Hearing Associations of Slovenia, n. d.).

The second group are postlingually deaf people, which includes all those who became deaf after winning voice-language communication. Although these persons know and master auditory and linguistic perceptions, they obtain information in voice-language communication mainly through visual elements. They use mainly lip-reading, where under optimal conditions - frontal view, clear speech, no mustache - they understand about seventy percent of the message. If the conditions are not met, this percentage is much lower (Association of Deaf and Hard of Hearing Associations of Slovenia, n. d.).

The third group includes prelingual and postlingual deaf people. Communication needs to be adapted for deaf people. In doing so, it is important that we speak clearly and distinctly, not too fast or too slowly. Deaf people can listen, but have difficulty accepting individual voices that are less resonant (Association for Personal Assistance of Slovenia, 2020).

Besides these three groups, there is also a group of people who are deaf-blind and thus have a combination of hearing and vision loss.

For successful communication with a deaf or hard of hearing person, some guidelines need to be followed in 1-to-1 communication (U.S. Department of Education, 2019). In the education process, it applies especially to teachers.

- A person's attention needs to be gained before one starts talking.
- In case the person does not respond, it is appropriate to pat him/her on the shoulder, or gain attention with a more obvious visual sign.
- One must speak clearly and at a medium speed (no need to speak loudly or very slowly).
- One should look directly at the person(s)he/she is talking to.
- While talking, the apeaker should not cover his/her mouth or look elsewhere. When wearing masks is required, it is recommended to wear a shield instead of a mask.
- The speaker should avoid avoid standing / sitting under strong lights that can hide his/her face.

- If a sentence must be repeated, he/she should try to paraphrase it, as some words are difficult to read from the lips.
- The use of visual aids, gestures, and posture when the speaker wants to emphasise something.
- In the case of major communication problems, the speaker can also write down what has been said.

Following the abovementioned guidelines, one-to-one communication with a deaf or hard of hearing person can be successful. In fact, a major challenge for them is group activities, where more communicators and listeners are presented. In line with the above guidelines, group activities involving deaf or hard of hearing people should also consider (U.S. Department of Education, 2019) the following:

- Use of badges with the names of the participants.
- Introduction of the "Raise your hand" rule, whereby a participant who wants to say something raises his/her hand. The focus is thus on him/her. It is also very important that only one participant speaks at a time.
- Use of leaflets with the main topics of the activity, with the help of which a deaf or hard of hearing person distinguishes between individual activities within the activity.

The main language of communication for the deaf is the national sign language. National sign language for the deaf is based on the use of hands, facial expressions, eyes and lips and body movement. It is independent of spoken language as it develops within the deaf community (Association of Deaf and Hard of Hearing Societies of Slovenia, n.d.). Podboršek and Krajnc (2006) define sign language as "a form of communication where words are expressed by hand gestures that can express the meaning of individual words, thoughts or a whole sentence, depending on the context or complex series of ideas". They say sign language is complex, structured and alive, has a strong cultural base, and belongs to a large number of sign languages that are widespread throughout the world.

There are several national sign languages, such as Slovenian Sign Language (SZJ), American Sign Language (ASL - American Sign Language) and British Sign Language (BSL - British Sign Language). Slovenian sign language is, thus, not the same as other national

sign languages. Still, deaf people can communicate with each other, even though they do not know the exact sign of the second language.

The basic element of any national sign language is gestures. Gestures are like words made up of elements. In this language, these are not consonants and vowels, but elements of manual configuration, hand location and movement. Only a few gestures are stationary. The structure can be described as one- or two-handed execution of a movement in a certain place, which means that certain movements can be performed with one and others with two hands. In the case of a one-handed gesture, it does not matter whether the gesture is performed by the right or left hand. Gestures often mimic some work or movement, e.g. imitation of sewing with a needle illustrates sewing, they can also be used to describe an external characteristic, e.g. illustrating a cow by showing horns (Podboršek & Krajnc, 2006; Bergman, 1994).

Another opportunity for communication is International Sign (IS). It is not treated a language, and should be used only at international events if all other options fail. In IS, gestures from one's sign language are used, and mixed with iconic and simple gestures that most can understand (Bergman, 1994).

In addition to gestures, we also know the finger alphabet, where individual letters of the spoken language are formed with different finger postures. The one-handed finger alphabet is used in almost all countries, including Slovenia. The alphabet can be learned quickly, although it is more difficult to learn to read this alphabet (Podboršek and Krajnc, 2006; Podboršek, 1990).

### b. Use of Assistive Technologies in the Inclusion of Deaf and Hard of Hearing in Higher Education

In addition to the above-mentioned approaches and visual aids, support technologies are also available to the deaf and hard of hearing for flawless higher education (Pappas et al, 2018). The concept of accessibility has been of interest to standardisation organisations and scientists in recent years. Accessibility features have been used for new technologies, especially for web applications, leading to the emergence of Web Accessibility Standards (Batanero et al ,, 2019). The Web Content Accessibility Guidelines (WCAG) 2.0 cover a wide range of recommendations for increasing the accessibility of online content.

Adherence to these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive impairments, limited movement, speech disorders, photosensitivity and combinations thereof (w3c, 2018).

The educational needs of people with disabilities, such as deafness and partial hearing loss, seem rarely to be considered when developing e-learning systems. It is true that designing appropriate and user-friendly interfaces is not always an easy process. This may be since, although the label "deaf" indicates homogeneity of characteristics and needs, this is not always the case (Pappas et al, 2018).

### 1st. Visual Information Transmission Devices

The deaf and hard of hearing need primarily visual information. Verbalisation and abstraction need to be reduced by ensuring maximum use for receiving information. This can be achieved by visualising the sound, subtitles, video translations of the text into Slovene sign language and equipping classrooms for listening to a teacher or assistant, or we can include more pictures, photographs (Debevc, 2010).

- Visual warning devices

Visual warning devices help the deaf and hard of hearing by visualising sound. Alarm clocks, smoke detectors, timers, doorbells, babysitters and warning equipment are available on the phone, providing normally audible information in a visual or vibrating way. Some devices are standalone, and some can be adapted or connected to existing equipment (Laurent Clerc National Deaf Education Center, n.d.).

- Captions/subtitles

Captions/subtitles are especially important when accessing the media. For example, TVs include settings that allow you to play programmes with this feature. We can often see the "cc" logo, which indicates these inscriptions and captions/subtitles. They are usually visible at the bottom of the screen, but can also be placed elsewhere on the screen. They may also include additional information, such as noise and other important sounds in a film or show (Laurent Clerc National Deaf Education Center, n.d.).

- Real-time transcript

The deaf and hard of hearing need to be offered subtitles for each spoken text, if necessary, also offered descriptions of music or noise, and provide visual information for information that is transmitted differently than sound (Debevc, 2010). Real-time transcription systems allow you to translate a spoken word into English text instantly using a stenotype machine, computer, or real-time software. A common system is Communication Access Real-time Translation (CART), which translates word for word into text. Regardless of the system used, the captions are viewed on the screen, and the process from speech to final text is almost without delay (Laurent Clerc National Deaf Education Center, n.d.).

- Telecommunications

With the advent of modern technologies, the deaf and hard of hearing have increasing access to communication via text or video. The standard of technology for visual access to telephone communication was TTY devices, which were designed to provide text communication via landlines. Nowadays, TTY devices are obsolete. Instead, real-time text (RTT) is used. Phones are also known, which can be mobile or regular landlines. These phones, like the captions/subtitles on television, display text for what the caller is saying (Laurent Clerc National Deaf Education Center, n.d.).

- AAC systems

AAC systems (Augmentative and Alternative Communication) include all the ways we express our ideas and feelings without conversation. We all use these systems when we use facial expressions or gestures. People with severe speech or language problems need ACC systems to help them communicate. These systems can be very helpful at school, at work and in conversations with friends or family. We know systems without help, we only need our own body for these. These include gestures, speech, facial expressions. Others are help systems that require a tool or device. Here, we know paper and pencil, a computer screen that speaks for us, and so on. (American Speach Language Hearing Association, n. d.).

### 2nd. Assistive Technologies

In what follows, we list a few assistive technologies that can be used by deaf and hard of hearing users.

- *FM systems*

FM systems enable the direct transmission of sound from a microphone (worn by a lecturer) to hearing aids` users using radio waves. The transmitted sound has a constant volume, regardless of the person's distance from the microphone. Within FM systems, we distinguish two types, namely personal and audio-spatial. In personal FM systems, the speaker microphone is connected directly to the individual's hearing aid. On the contrary, sound-spatial FM systems are intended for a group of individuals. Namely, these are special speaker units that are placed strategically indoors or outdoors. Individuals sitting within range of a particular speaker unit can hear amplified sound (Laurent Clerc National Deaf Educational Center, n. d.).

- *Infrared loop systems*

Infrared loop systems, shorter infrared systems, are not as common as FM systems, but they are still used to provide high-quality sound for hearing aids users. The systems take advantage of a technology known as IR. For example, TV remote controls still work on this technology today. The sound signal from the microphone travels to a so-called infrared "radiator". The system emits infrared light based on these "radiators", which act on the listening area similarly to reflectors. The audio signal is sent via infrared light to personal IR portable receivers. The sound is of high quality when transmitted using this type of system (Gentner, 2012).

- *Audio induction loop systems*

Audio induction loop systems represent another branch of assistive technology for individuals who use hearing aids. Loops consist of one or more physical cables that create special areas in buildings where a speech signal is sent into space using an electromagnetic field. The sound is covered by hearing aids equipped with a telephone coil, cochlear implant processors (CI) or handheld receivers for individuals without coil-compatible hearing aids. In some European countries, these systems are mandatory under the Equality Act in certain public places (Archer and Shaw, n. d.).

- *Device interconnection systems*

This type of system is mainly about connecting to media devices, which include computers, televisions, tablets, smartphones, etc. Connection to devices is enabled in a direct and indirect way. In direct mode, hearing aids and cochlear implants are connected to media devices directly with cables or with wireless transmitters, while in indirect mode, an accessory is needed that is installed on a computer or hearing aid, only then can the devices be connected wired or wirelessly (Laurent Clerc National Deaf Educational Center, n. d.).

- *Hearing aids*

Hearing aids are devices designed to improve the hearing of people with hearing impairments. In most countries, they are considered medical devices. Modern hearing aids require configuration in terms of hearing loss, physical characteristics and lifestyle. The process of adjusting a hearing aid is performed by an audiologist or hearing aid professional (Kochkin, 2010). Hearing aids are available in various designs and shapes. We basically separate them into (FDA, n. d.):

  - **BTE (Behind The Ear)** - a hearing aid is worn behind the ear. With the help of the device, an ear plug is placed in the ear canal, with which we can hear the sound. Due to their size, these types of devices cover a wide range of hearing loss. We also know a smaller version of BTE hearing aids called mini BTE. Like the BTE, it fits behind or on the ear, but is much smaller, and a thin, invisible tube is used to connect the device to the ear canal.
  - **ITE (In The Ear)** - In-Ear hearing aids are the group of devices with the largest offer. In this case, the hearing aid is in the outer part of the ear canal. The entire hearing aid is in a shell that fills the outside of the ear. ITE appliances are larger than BTE AND CIC appliances, so they are more suitable for some people because they are easier to operate.
  - **ITC (In The Canal)** - hearing aids in the ear canal are less visible than ITE devices. Only the front panel of the hearing aid is in the visible area. It consists of a housing that is partly hidden in the ear canal and partly still visible. They are among the better hearing aids and amplify sound better than ITE and BTE hearing aids. The problem arises with their size, as they are difficult to manipulate due to their small size.

- **CIC (Completely In The Canal)** - hearing aids completely in the ear canal are the most powerful hearing aids available, and are positioned deep in the ear canal and virtually invisible. Like ITC devices, they improve hearing greatly, but they are small, making them difficult to operate.

In Slovenia, all citizens have the right to a hearing aid when it comes to hearing loss which cannot be improved with treatment. For a citizen to be entitled to a hearing aid at the expense of compulsory insurance, he also needs a confirmed rehabilitation effect of a hearing aid with tone and speech examination and testing of the amplifier characteristics (ZZZS, n. d.). Financial support can also be obtained from the State, while it is sufficient for between 1/5 and 1/3 of the cost of the hearing aid.

- *Cochlear Implant*

It is a medical-technical device that enables the ability to perceive sounds, listen and the related development of speech and language skills. The implant consists of an outer part that sits behind the ear and another part that is surgically placed under the skin (Association of Deaf and Hard of Hearing Societies of Slovenia, n. d.).

A cochlear implant differs from a hearing aid. The hearing aid amplifies the sound so that it can be detected by damaged ears. The cochlear implant, on the other hand, bypasses the damaged parts of the ear and stimulates the auditory nerve directly. The signals it generates are sent via a nerve to the brain, which it recognises as sound. Snail implant hearing is different from normal hearing, but allows many to recognise warning signals, understand other sounds in the environment and understand speech in person or by telephone (National Institute of Deafness and Other Communication Disorders, 2017).

### c. Inclusion of the Deaf and Hard of Hearing in Higher Education

In Slovenia, the Education of Deaf and Hard of Hearing Persons is a subject of the Placement of Children with Special Needs Act (ZUOPP-1). It determines the ways and forms of carrying out the education of minors and adults with special educational needs. Exceptionally, the provisions of ZUOPP-1 also apply to the education of adults over the age of 21, up to the age of 26, who are in continuous education (ZUOPP-1, 2011).

Schmidt and Čagran (2006) defined three approaches in the education of the deaf and hard of hearing: Oral, total communication and the bilingual / bicultural approach. The oral approach means that deaf people read from lips and try to speak orally. The total communication approach is a combination of sign and spoken language. The bilingual / bicultural approach, however, includes only sign language, which is considered the mother tongue of the deaf and hard of hearing. The first two approaches allow the deaf and hard of hearing to enrol in traditional educational institutions, while the third approach allows enrolment only in special schools that are adapted to it.

We can offer help to the deaf and hard of hearing in the educational process to make it easier to follow the lectures. Supportive visual media aids, such as graphs, Tables, and spreadsheets, are often used for computer education, as these individuals need to be more dependent on vision due to hearing impairment (Zaharudin et al., 2011). In Slovenia, an interpreter from SZJ (Slovenian Sign Language) is also offered as an aid, who translates the spoken content into Slovene sign language.

### d. Good Practices: Support for the Deaf and Hard of Hearing in Higher Education

#### 1st. Software for the Deaf and Hard of Hearing

Various assistive technologies help deaf and hard of hearing people to integrate into the educational process more easily. People with disabilities, with their special requirements and problems, are specific users who need ICT, as it enables them to grow personally, as well as in group communication, and to capture information more easily. At the same time, it is characteristic of people with disabilities that it is difficult to get an education and training in classical education and training, so it often happens that they do not complete the appropriate level of education, and that classical training is not successful. Unfortunately, there are very few people with disabilities who would complete successfully, for example, higher education, and later integrate into the social and work environment successfully. This problem is pronounced in deaf and hard of hearing people, who, according to the Association of Deaf and Hard of Hearing Societies of Slovenia, are also the least educated people in Slovenia (Tabaj et al., 2010). Classrooms and institutions currently use a variety of hardware and software to help students with hearing loss. Other support services are available to students online (Audibel Hearing Aid Center, n.d.).

E-textbooks are becoming more widespread in learning environments. Interactive features such as surveys, quizzes, exchange of notes and instructor notes, facilitate collaboration and interaction with the text, other students and the professor. Students with mild to moderate hearing loss often find it helpful to use digital recorders. Recordings of the lecture can be stored by students in the device and played back later. This can be especially useful in large seminars or locations that are not equipped with other listening aids (Audibel Hearing Aid Center, n.d.).

Along with PowerPoint presentations used by teachers, the deaf and hard of hearing have significant benefit in terms of retrieving information. Otherwise, in Slovenia, the deaf have a right to receive 100 hours of vouchers for free sign language interpretation of lectures. The costs that exceed 100 hours should be paid by universities, but it is not the practice, as it is not clear who finances these costs.

The market provides various solutions for the requirements and needs of deaf and hard of hearing users. These solutions include:

- Live subtitling programmes.
- Programmes for detecting sounds from the environment.
- Programmes for listening and amplifying sounds.
- Text-to-speech programmes.

In what follows, we provide some examples (mobile applications) from the market:

- *Google live transcribe & Sound* notifications uses ASR technology to translate speech into text. It translates the user's speech into text, which is displayed on the screen of the mobile phone. The application has support for more than 80 languages and dialects. The app also detects alerts on risky situations (e.g., smoke alarm, siren) and alerts the user via message, vibration, or visual alarm (Research at Google, 2020).
- *Subtitles viewer* is an application that offers the user subtitles for movies and TV series via mobile phone or tablet. The app is linked to the open-source database opensubtitles.com, where volunteers contribute subtitles. Subtitles are currently available in a variety of languages. The disadvantage of the application is that it does not have subtitles available in the Slovenian language, and, due to volunteers,

not all subtitles are available immediately after the release of the films (Craig Grummitt, 2014).

- The *Tap Tap* application causes the device to vibrate when it detects special sounds. A warning is then sent to the screen notifying the student of the alarm, shout, or other important noise. Sensitivity can be adjusted to cope with noisier or quieter environments. You can set the number of vibrations emitted by the application. You can disable it into sleep mode. The app does not have the ability to recognise voice or speech; it is designed to vibrate and flicker in response to loud sounds in the environment (Best Colleges, n.d.)
- *BioAid* improves sound clarity and adjusts the volume of external noise. The app converts a mobile device into a hearing aid by processing the microphone from the sound and then delivering the processed sound via headphones in real time (Best Colleges, n.d.)
- *Purple VRI* is a sign language interpretation application. Purple VRI for Android turns a tablet or phone into a fully functional "mobile interpreter" that helps in situations where interpreters are needed to convey communication to deaf, hard of hearing, or speech-impaired people and individuals who hear when they are in the same room.
- Based on Artificial Intelligence, the *AVA* application translates the spoken word into a text to the user. Captioning works in real time with 95% accuracy.
- *Pedius* is an application that creates voice messages from text. Deaf users can enter their message in text format, and the application will recognise the text and "read" it to the recipient of the message. Communication works in real time, and offers the user phone calls in text format.

## 2nd. Support for the Deaf and Hard of Hearing in Slovenia

According to the Act on the Use of Slovene Sign Language, deaf and hard of hearing pupils and students have the right to additional hours of a sign language interpreter due to additional needs related to education. Thus, instead of 30 hours, they are entitled to 100 hours of interpretation per year. These 100 hours are intended for the student's personal use, for example, for the preparation of a seminar paper with other students, but not for attending lectures at the Faculty (Association of Students with Disabilities of Slovenia, n. d.).

The deaf person acquires the right to an interpreter by applying for the right to an interpreter at the Center for Social Work. The Commission invites the applicant to an interview to check his/her knowledge of sign language, and then issues a decision based on the attached documentation and the interview. This gives the student 100 additional hours of interpretation per year. If a student wishes to exercise the right to the presence of a Slovene Sign Language interpreter at lectures and tutorials, he / she must make an application to the selected Faculty. If the Faculty rejects the application, the student can turn for help to the local Association, the Association of Slovenian Sign Language Interpreters, the Association of Students with Disabilities of Slovenia, or the Association of Deaf and Hard of Hearing Associations of Slovenia (Association of Students with Disabilities of Slovenia, n. d.).

The Rules on the study process of students with disabilities at the University of Maribor enable students with hearing impairments to have a sign language interpreter when taking the exam. The Rules on Students with Special Needs at the University of Primorska allow students the presence of an interpreter when conducting lectures and exercises, and when taking the exam. For some members of the University of Ljubljana, a deaf student has some interpretation hours covered based on an individualised plan (Status of a student with special needs, 2018).

### 3rd. Study Adjustments in the Premises of Universities

Most students with hearing loss use a hearing aid to make it easier to follow the lecture, which amplifies the sound and, thus, improves the comprehension of speech information. Nevertheless, a deaf student may have impaired communication in suboptimal conditions. Deaf students find it difficult to attend lectures in larger lecture halls, in rooms with poor acoustics, or in a noisy environment. They also find it harder to understand quiet and fast speaking. They help each other by listening to the speaker's lips, so they cannot record the material properly. It is characteristic of the deaf and hard of hearing that they need primarily visual information. A deaf or hard of hearing student can help him/herself to some extent with the help of technical aids such as a hearing aid, a cochlear implant, an induction loop in the room, and a wireless remote microphone. A deaf or hard of hearing

student should be provided with as many channels as possible for receiving information (Bera, Debevc, & Hurst, 2010).

Students should be able to visualise sounds, subtitles, translate into sign language, equip classrooms with wireless devices for listening to a higher education teacher. For deaf students who wear hearing aids, it is best to use a wireless microphone with a transmitter that the teacher has placed on his or her suit, and the student uses an inductive loop hung around his or her neck along with the receiver. It is also appropriate for deaf students to record a live lecture in the classroom, and to retype the spoken text as a transcript of the lecture (Bera, Debevc, & Hurst, 2010).

### 4th. Study Adjustments in the E-learning Process

Currently, technological development has provided access to a range of technological devices and applications for students with special needs. Easy access to digital cameras, smartphones, computers, mobile internet, including increasingly user-friendly editing tools and Web 2.0, accelerates the development of educational resources and, thus, opens up huge potential for the use of distance learning in education (Almeida , 2020).

In order to increase the accessibility of e-learning materials, it is necessary for the deaf and hard of hearing to: Offer subtitles for each spoken text; if necessary, provide a description of the music or noise in the subtitles (e.g. gentle, romantic music, road noise); provide visual information for information that is normally transmitted as sound (alarms, loudspeaker messages, etc.); important information must be highlighted and visible sufficiently so that the user also perceives it with peripheral vision (Bera, Debevc, & Hurst, 2010).

Technology has helped in language acquisition in a multitude of different forms, for example, through accessible online applications or online courses. A recent development is the integration of Virtual Reality as a medium for language learning. Such environments can be used in conjunction with ancillary devices such as depth cameras that can show the interface to the virtual world more seamlessly (Rho et al., 2020).

# III. Research Results

## i. Descriptive Statistics

In our study, we collected data overall from 63 respondents. As shown in Chart 1 the sample of respondents was well distributed between males and females, where 48% represents women and 52% represents men. The sample includes a narrow age range, from 19 to 30 years, as we focused on young people who attend higher education. Chart 2 shows that our respondents are, on average, 23 years old.

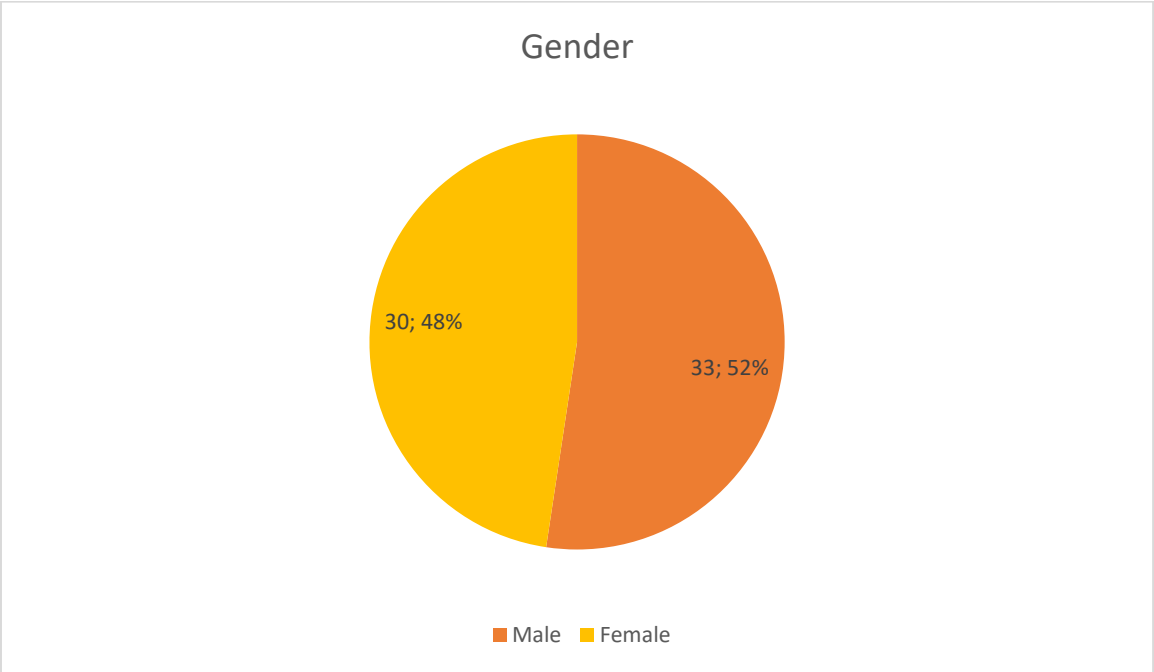


*Chart 1: Gender*

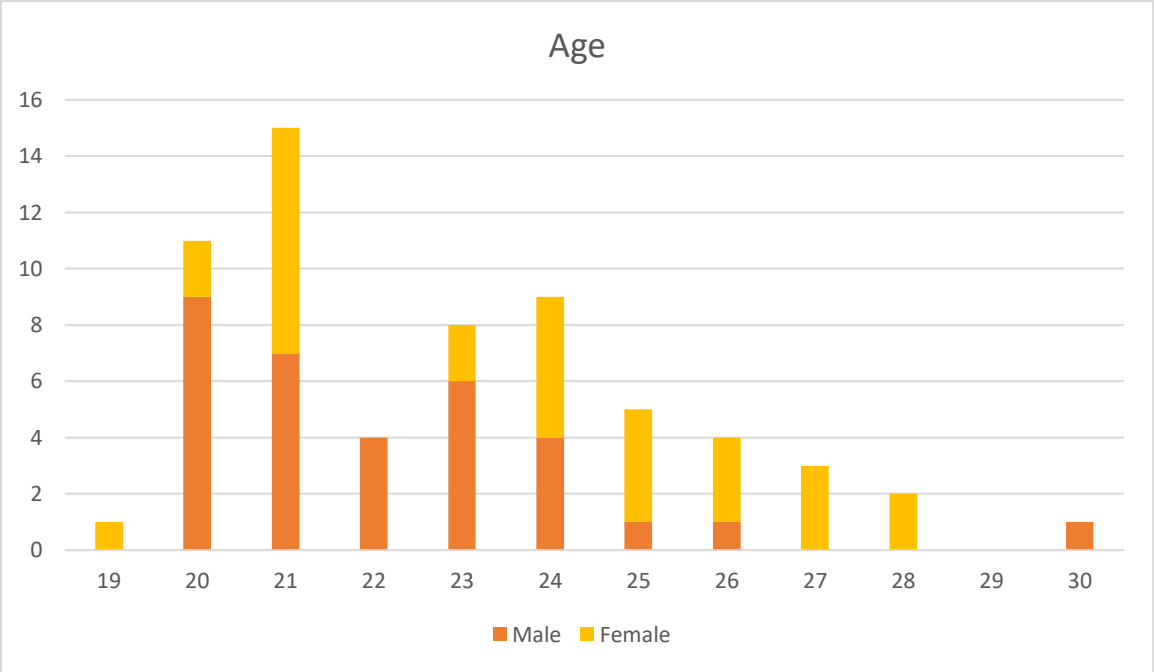


*Chart 2: Age*

As can be seen from Chart 3, the level of education is not that high, since 25% of respondents have completed secondary general and secondary vocational education, and the other 48% of respondents are still completing their tertiary education, meaning that, so far, they've also achieved either secondary general or secondary vocational education. Such results concerning the level of education were expected, since our research relates to students who are still studying.

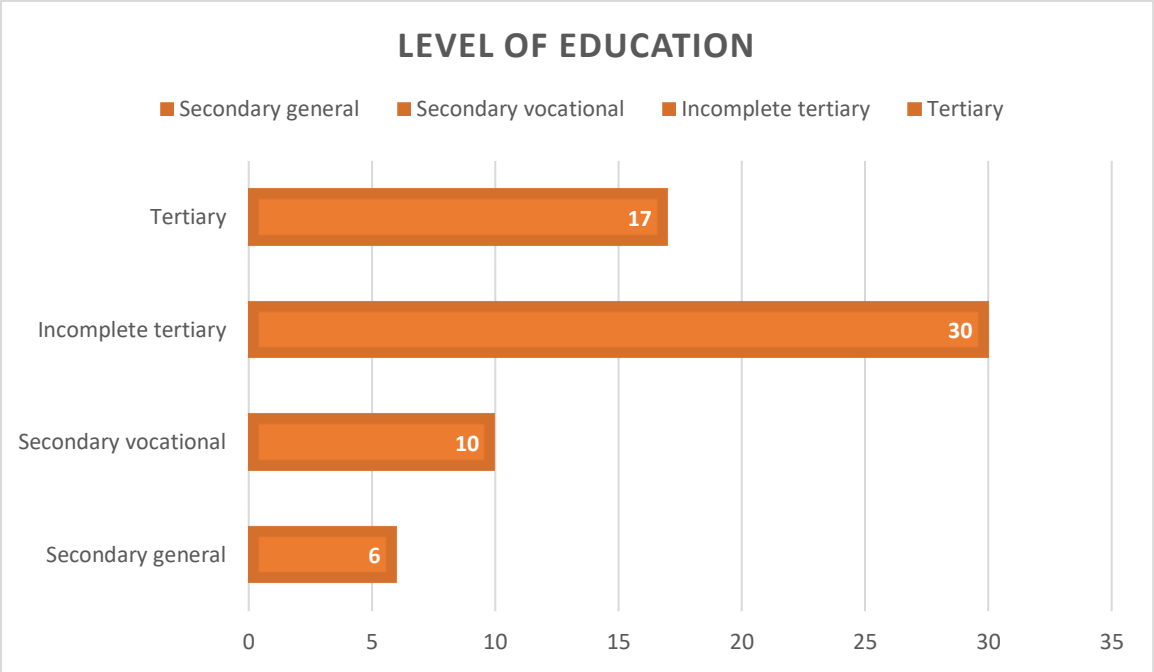


*Chart 3: Level of education*

### ii. Support with the Studying Process Analysis

According to the answers to the question about the *'need for support in the study process'* the sample was split in half between those who 'need/would need support' and those who stated that ´they don't need it´. As can be seen from Chart 4, 51% of the sample considered that they do not need any support in their study process, as they gave the least value (level 1 – not at all) to this question.

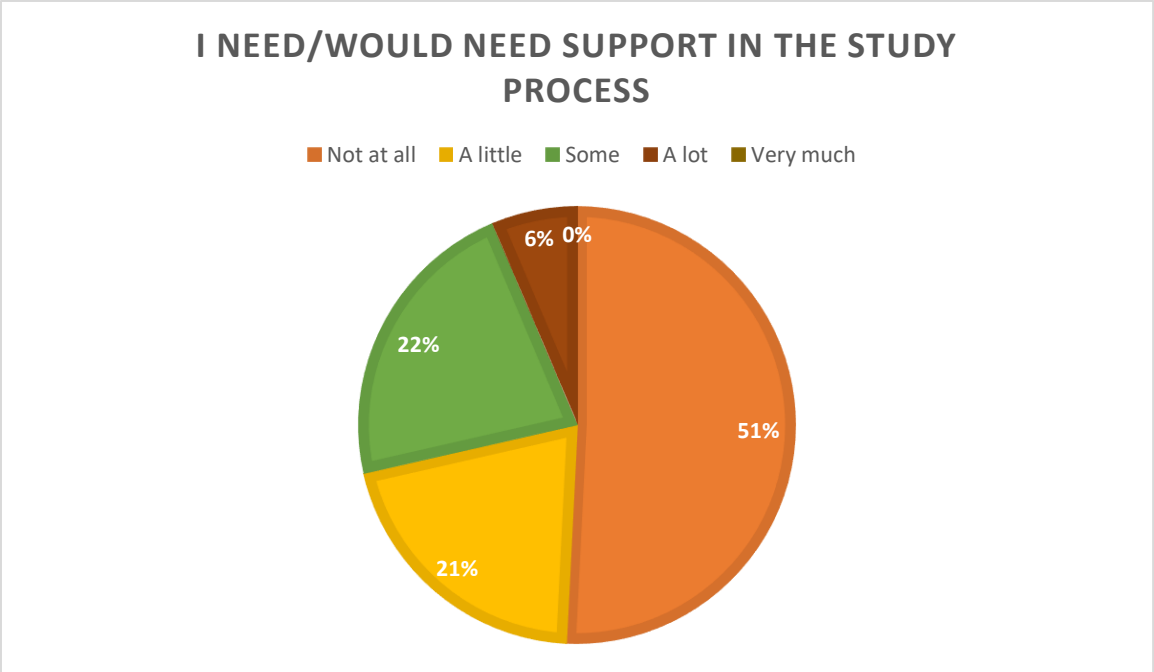


*Chart 4: I need/would need support in the study process*

From the rest of the respondents 21% claimed they would need *'a little'* support, 22% said that they would need *'some'* support, and only 6% stated they need/would need *'a lot'* of support in the study process. During data analysis we found out that 7 respondents that did not need support in the study process gave the lowest rating (level 1) to all of the following questions, which means they have never heard of assistive technologies, as they do not have any information about them and, consequently, do not use them either.

As we mentioned above, we split our sample between respondents who need and those who don't need support in the study process. This way, the first group of respondents answered (up to) 25 questions, while the second group answered 11 questions. First, we analysed the two groups' findings separately, and, in the end, comparatively to each other.

The first group of respondents (Group 1) that needs support in the study process was then asked about the need of support for different areas in the study process. As for those who 'need/would need support in the study process' only 3 respondents (Chart 5) estimated that they would need *'a lot'* of support for visual perception during their studies.

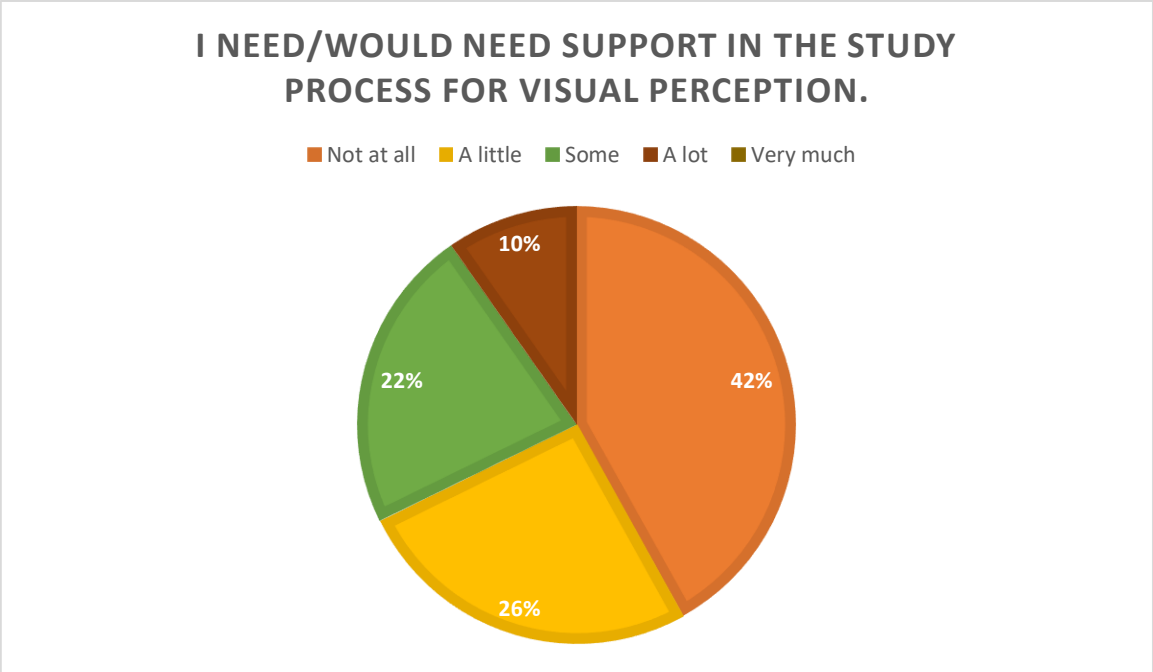


*Chart 5: I need/would need support in the study process for VISUAL PERCEPTION.*

Compared to the need for auditory support, there were more respondents who need visual support rather than auditory. The majority of the respondents (51%, as can be seen from Chart 6), do not need any kind of support regarding auditory perception.

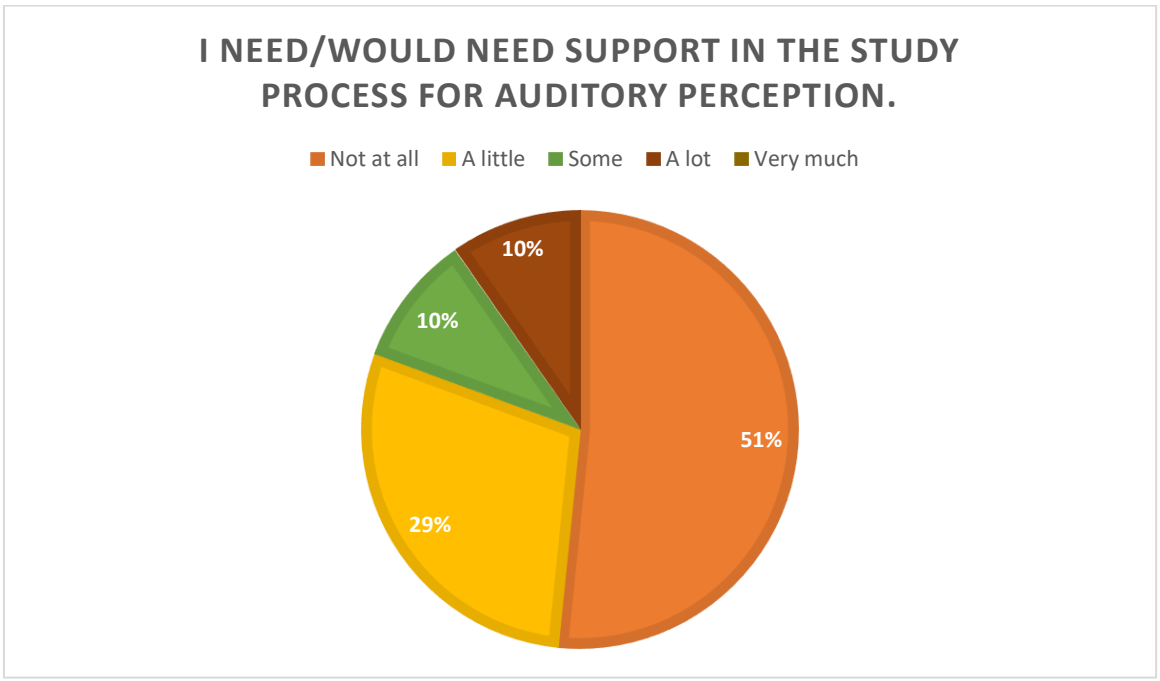


*Chart 6: I need/would need support in the study process for AUDITORY PERCEPTION.*

Concerning the question about the *'need for support in the study process for reading comprehension'*, Chart 7 shows that 29% of respondents would need *'a little'* support,

while 10% needed *'some'* and the other 10% *'a lot'* of support for 'reading comprehension' in the study process.

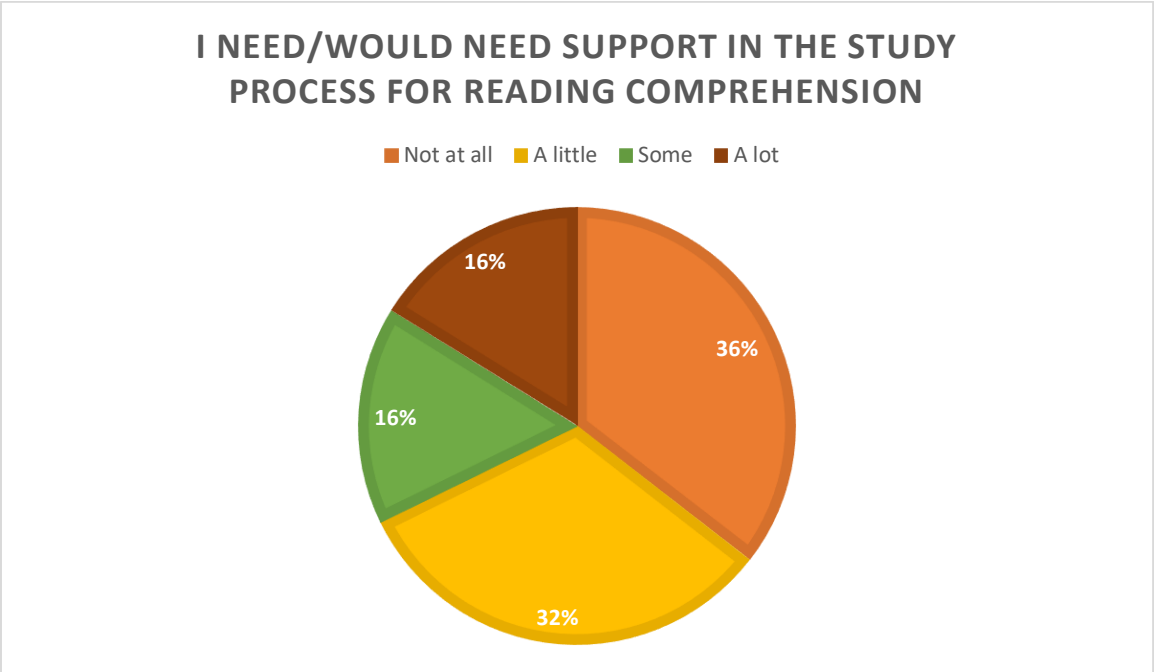


*Chart 7: I need/would need support in the study process for READING COMPREHENSION.*

As can be seen from Chart 8, the majority (58%) need support for comprehension of written text. Most of the respondents said they need 'a little' (26%) to 'some' support, while there was only 1 respondent that needed 'a lot' of support and 1 needed it 'very much'.

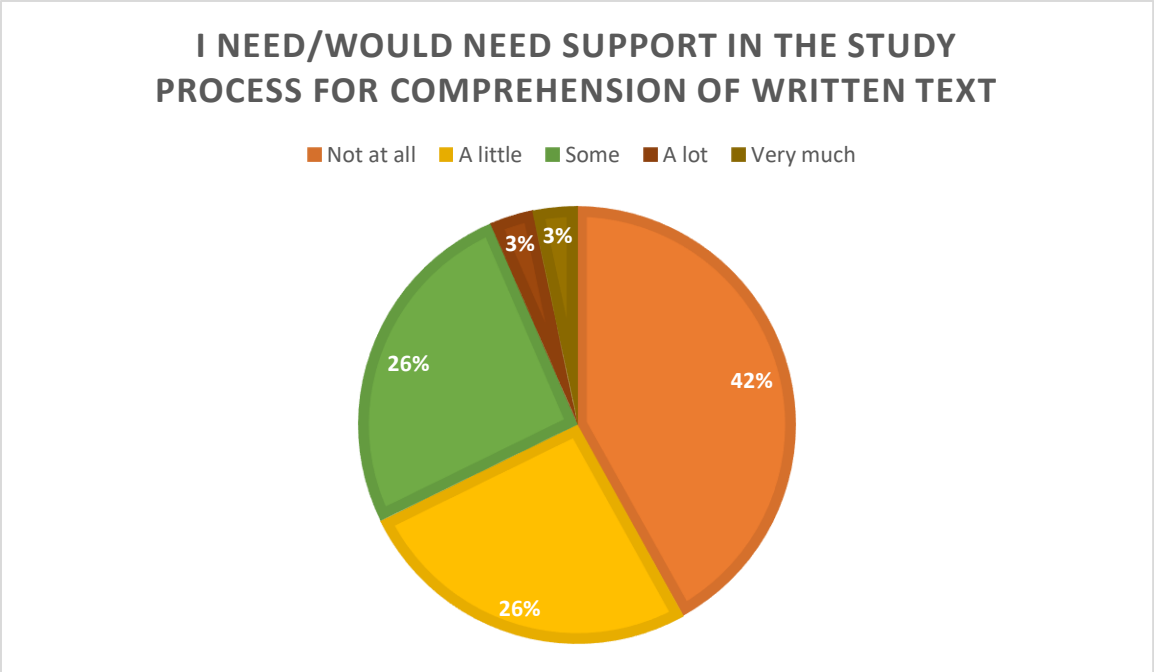


*Chart 8: I need/would need support in the study process for COMPREHENSION OF WRITTEN TEXT.*

As can be seen from Chart 9, the majority (70%) of respondents said that they need/would need from *'a little'* to *'not at all'* support for *'written expression'*.

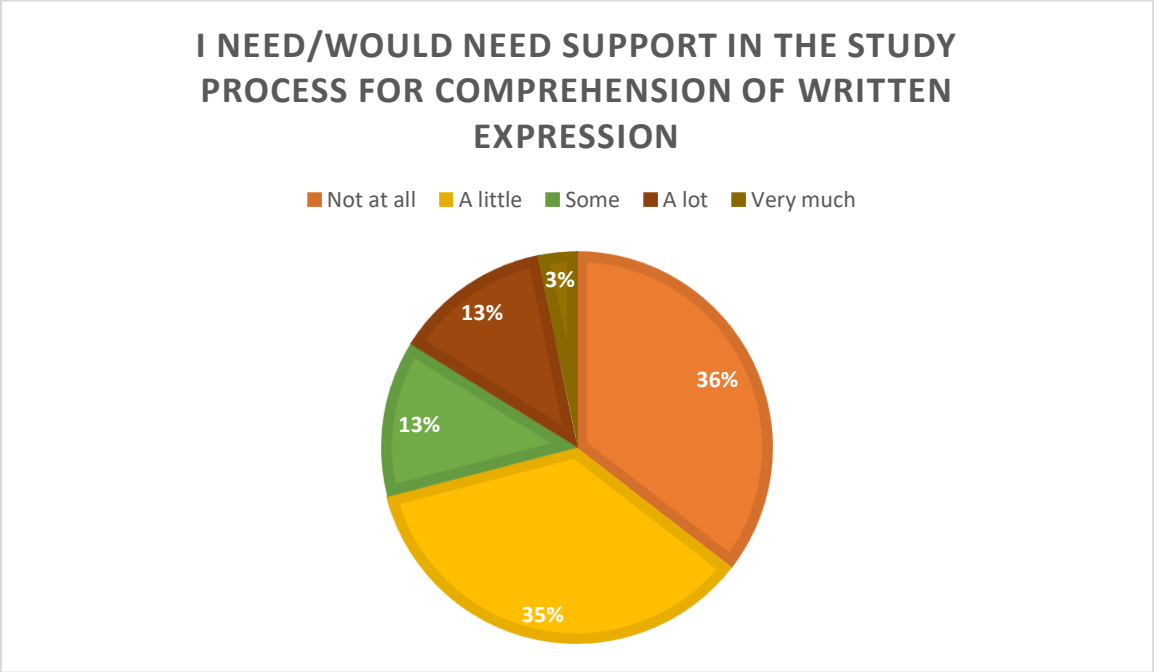


*Chart 9: I need/would need support in the study process for WRITTEN EXPRESSION.*

Chart 10 shows that only a small proportion of respondents (13%) stated they need/would need *'a lot'* to *'very much'* support for verbal communication, while 35% did not need support for verbal communication.

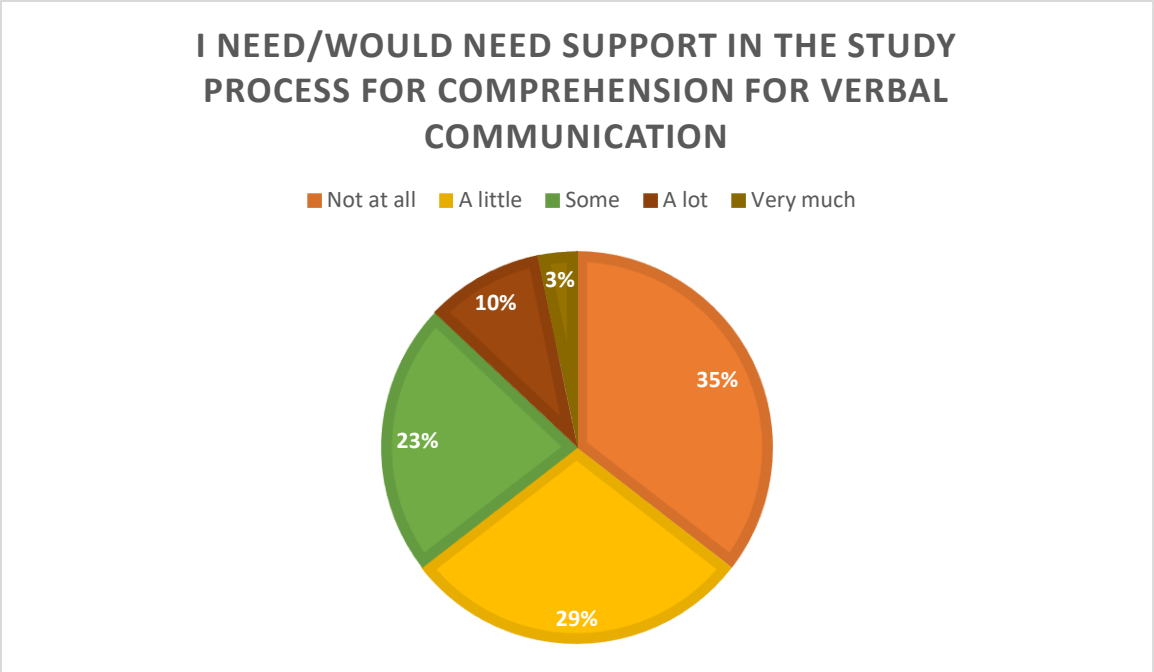


*Chart 10: I need/would need support in the study process for VERBAL COMMUNICATION.*

The results in Chart 11 show that 71% of respondents 'needed/would need support in the study process for emotional resilience'. 32% felt like they needed *'a little',* while 20% needed *'a lot'* to *'very much'* emotional support.

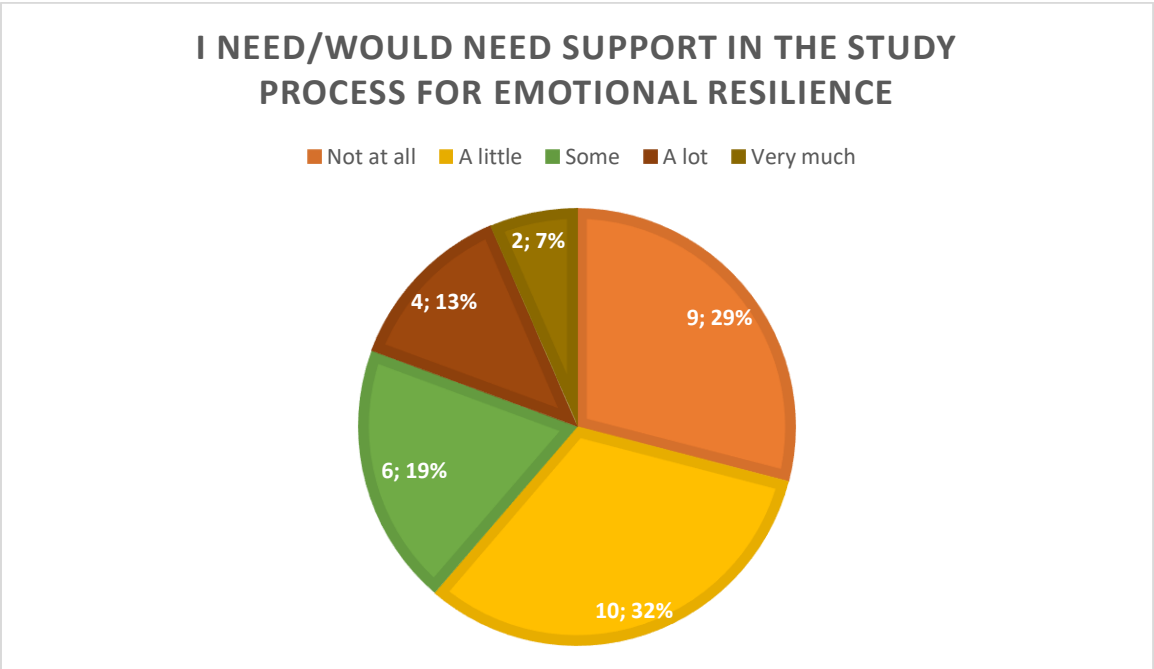


*Chart 11: I need/would need support in the study process for EMOTIONAL RESILIENCE.*

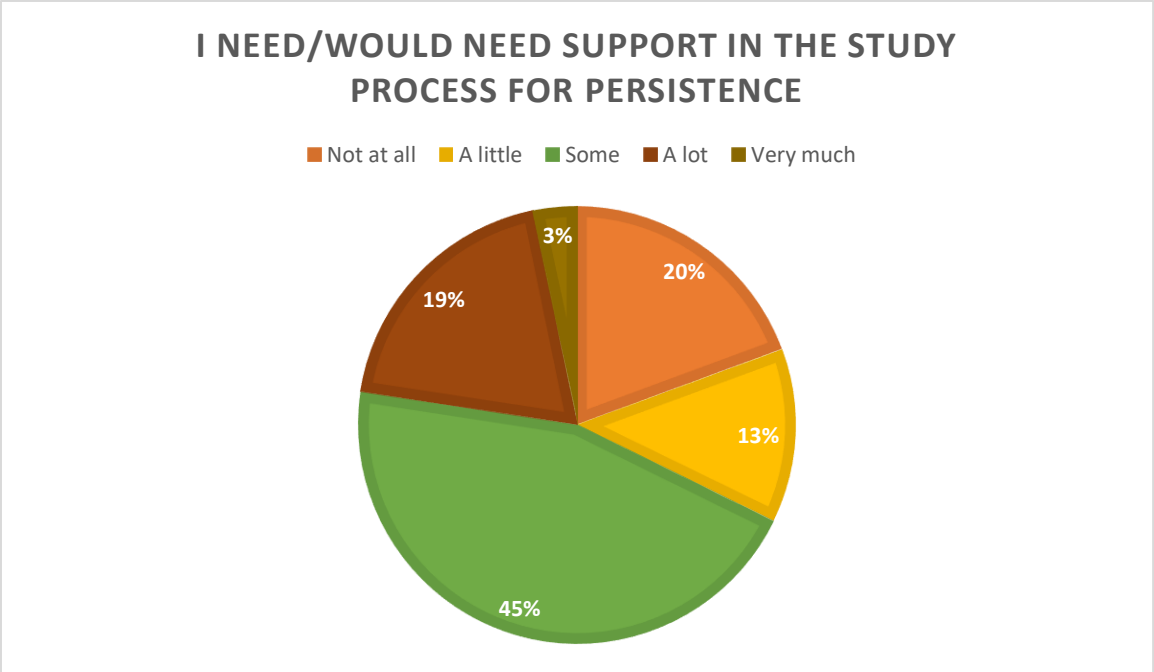


*Chart 12: I need/would need support in the study process for PERSISTENCE.*

Chart 12 shows that 80% of our respondents needed *'a little*' to *'very much'* support for *'persistence'* in their study process. Of this share of respondents, 45% needed *'some'* support, while 19% represents those who needed *'a lot'* support for persistence. Concerning question about support for *'mental stability'* in the study process, Chart 13 shows that 16% of respondents needed *'a lot'* of mental support and 19% needed *'very much'* support for mental stability.

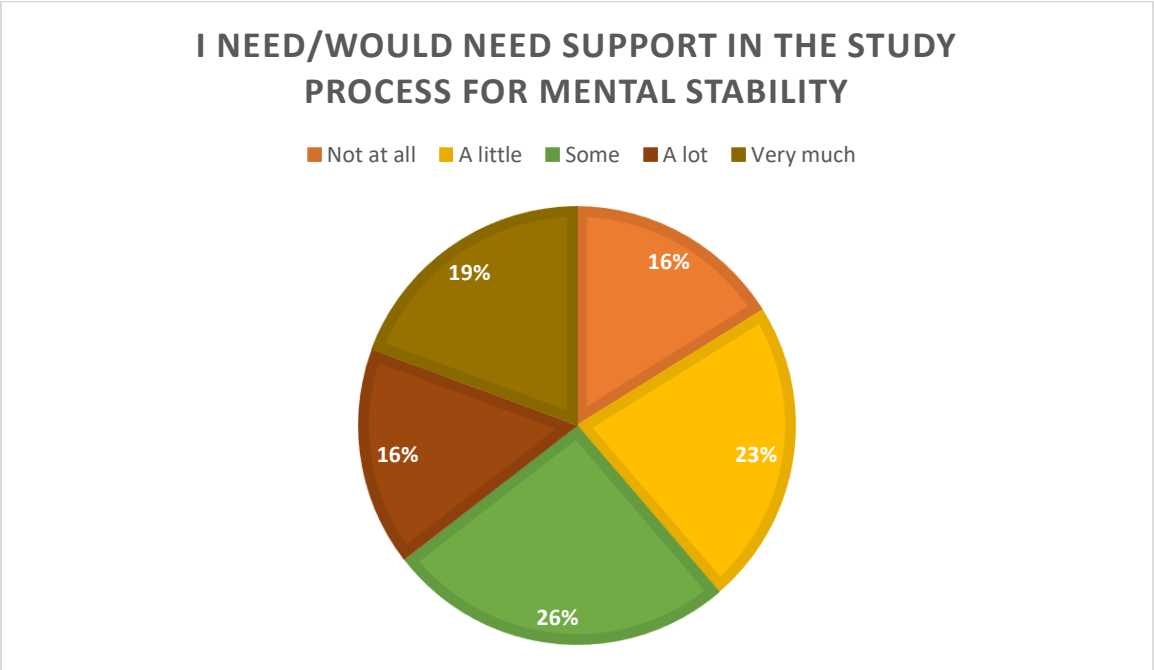


*Chart 13: I need/would need support in the study process for MENTAL STABILITY.*

However, compared to the previous results on the question for *'mental stability'*, it can be seen from Chart 14 that respondents needed less support with their physical state, since most of them answered with *'not at all'* (39%), *'a little'* (29%) and *'some'* (19%).

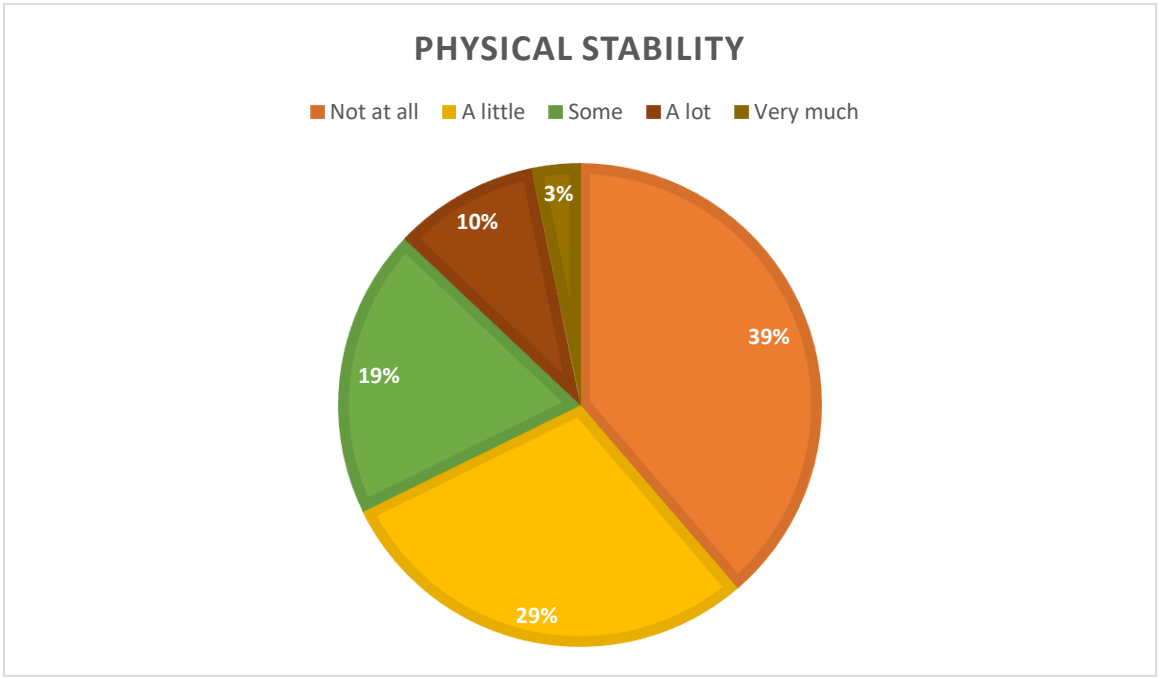


*Chart 14: I need/would need support in the study process for PHYSICAL STABILITY.*

The results from Chart 15 show that 61% of the respondents who *'need support in the study process'* say they don't need support for mobility. Based on these results, we can assume that most of the respondents do not have problems with mobility in their study process.

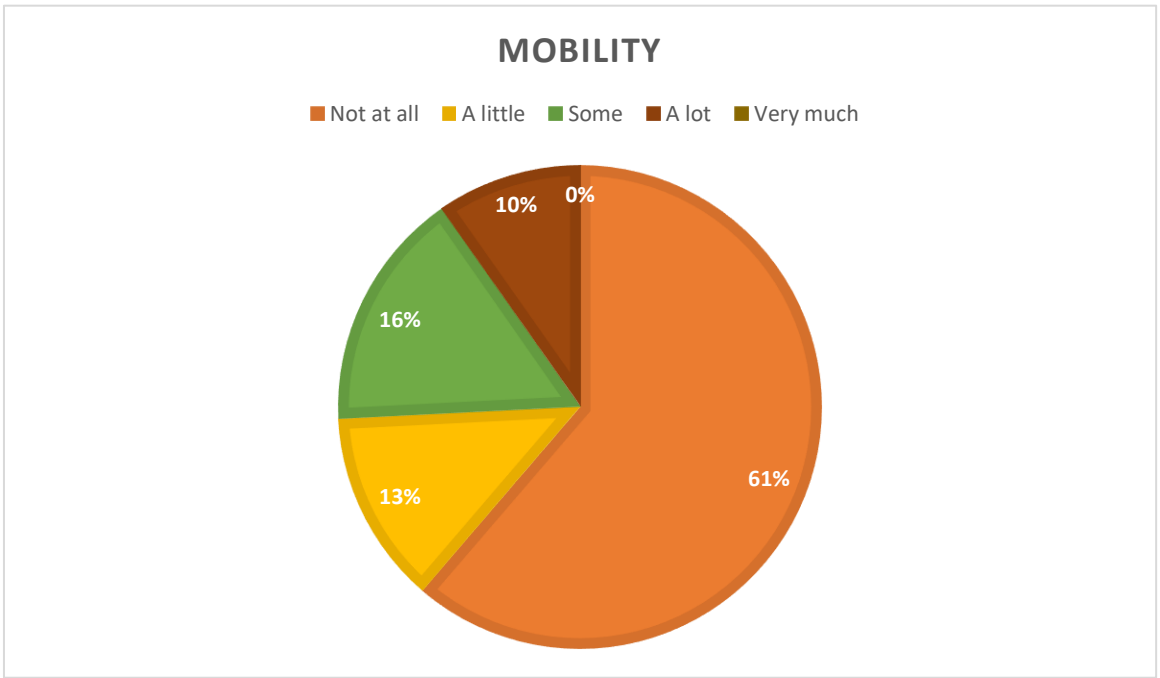

*Chart 15: I need/would need support in the study process for MOBILITY.*

Besides, the results in Chart 16 show that the majority (71%) also don't need support for customising their rooms. Most likely this 71% of respondents has no disabilities that would require room customisation such as adaptation or rearrangement of furniture.

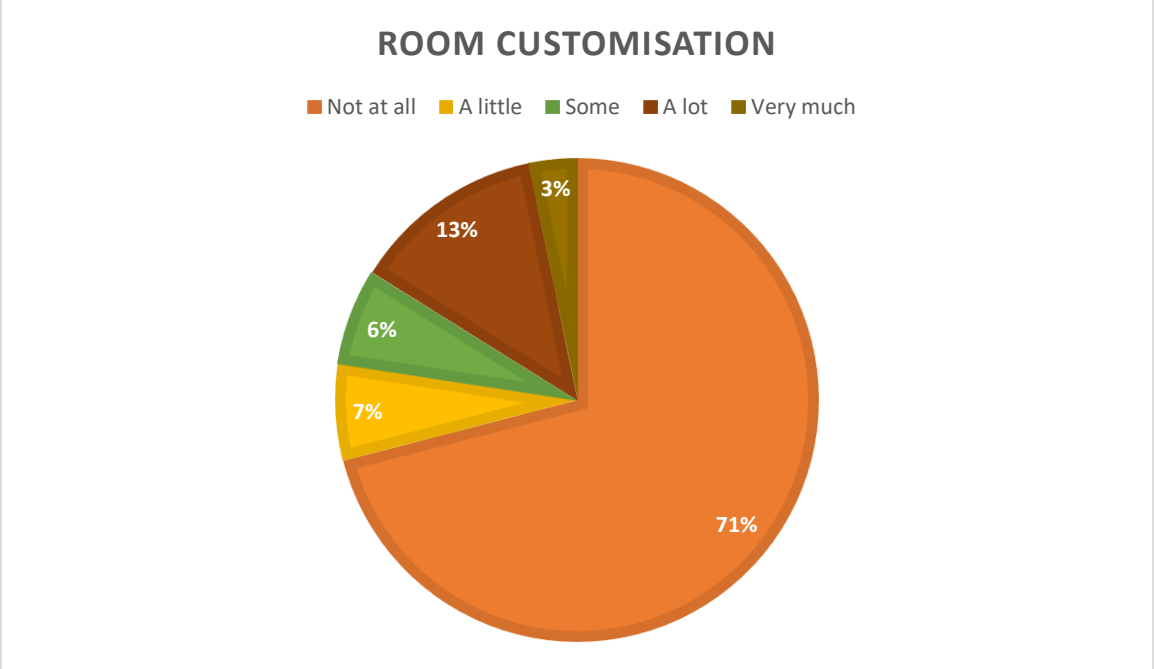


*Chart 16: I need/would need support in the study process for ROOM CUSTOMISATION.*

### iii. Requirements of Disabled Students in Higher Education

At this point in the analysis, we will analyse the following results of both groups of respondents separately, as well as comparatively. Be aware that the first group (Group 1) represents those who *'need/would need support in the study process'* and the second group (Group 2) represent those respondents that *'don't need any kind of support'*.

In the question about the information about assistive technologies the respondents from Group 1 declared on average to be informed; more specifically, 61% said that they have *'a little'* to *'a lot' of 'information about assistive technologies'.* Interestingly, 39% of those respondents that *'need/would need support in study process'* answered having no information about assistive technologies.

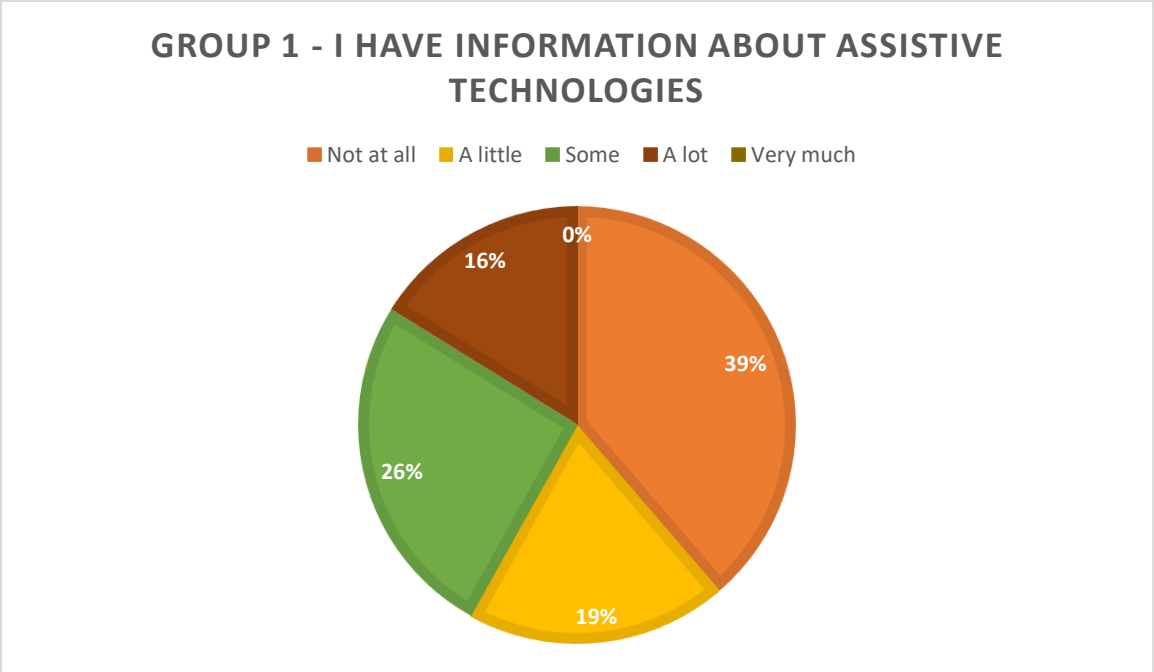


*Chart 17: I have information about assistive technologies.*

As for Group 2, Chart 18 shows that 53% of respondents who responded with *'not at all'* to the question *'I would want/need support in the study process'* stated they have *'a little'* to *'very much' 'information about assistive technologies'.* More precisely, 28% of respondents had *'a little'* and 19% *'some'* information about assistive technologies. Given that the respondents had little or no information about assistive technologies, we can conclude they may not even be aware that they would need them during their studies. If we compare the results from both groups, we see that those who need support in the study process have significantly more information about assistive technologies than those who stated that they don't need it.

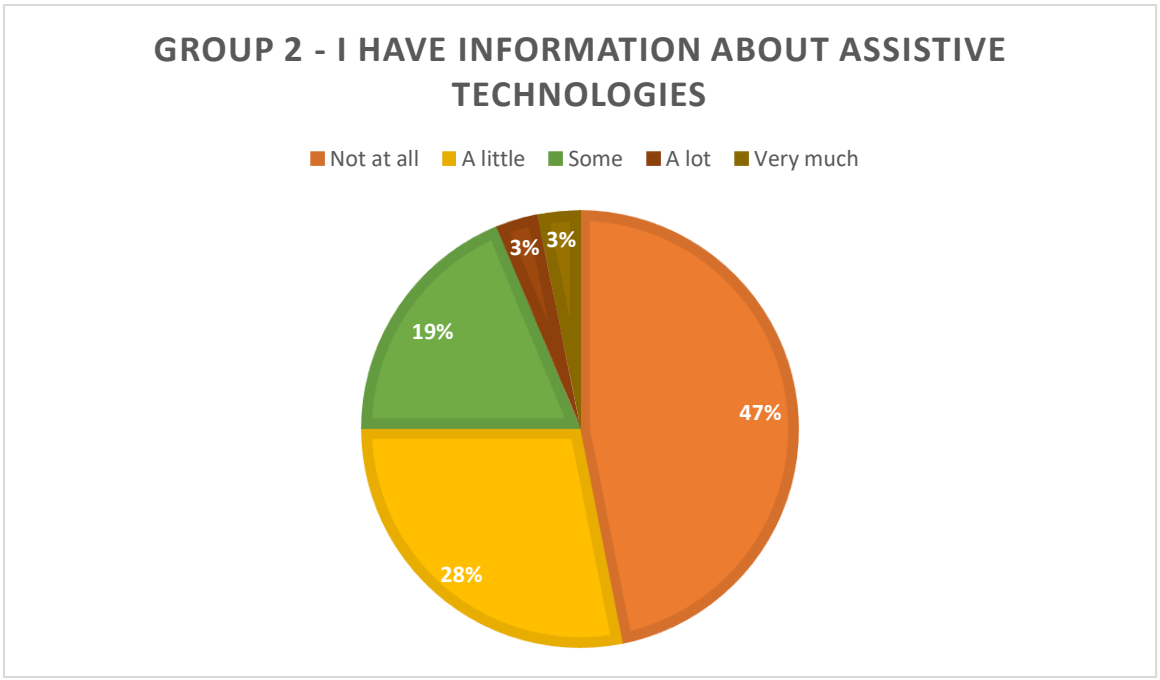


*Chart 18: I have information about assistive technologies.*

Chart 19 shows that 86% of the respondents who need some sort of support in the study process (Group 1) would like to use assistive technologies. On the other hand, as can be seen from Chart 20, 66% of the respondents that don't need support (Group 2) also would not like to use assistive technologies. According to the answers, we can assume that lack of knowledge about assistive technologies affects people's further intention of using it.

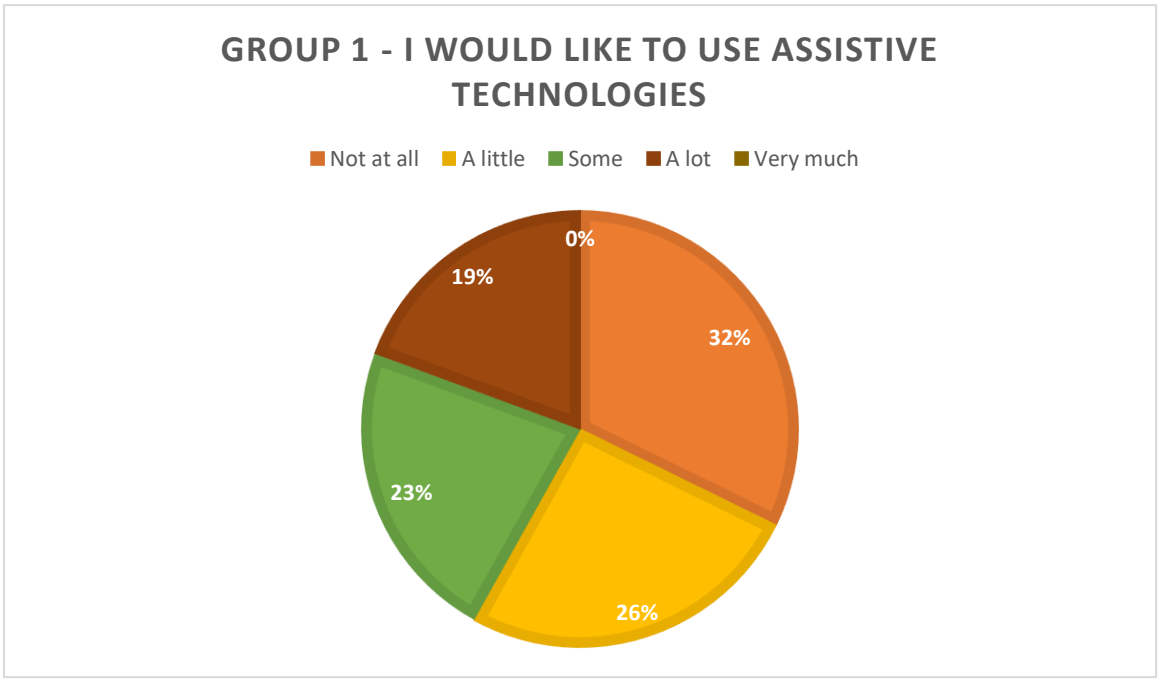


*Chart 19: I would like to use assistive technologies.*

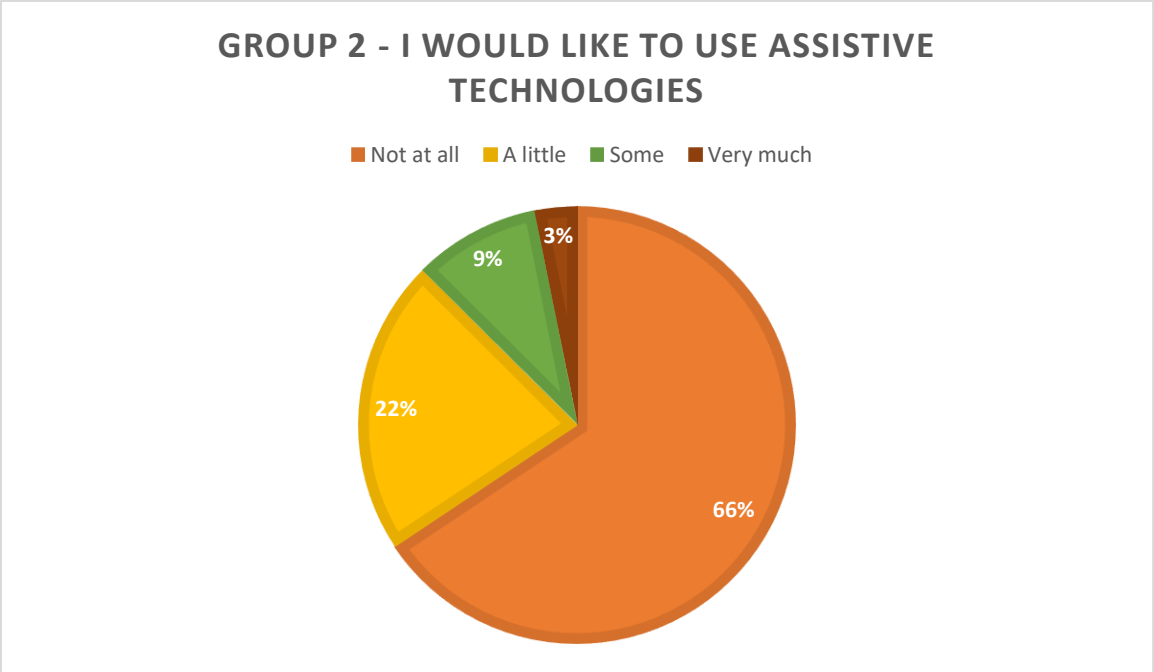


*Chart 20: I would like to use assistive technologies.*

Chart 21 shows that, despite the fact that 31 respondents 'need support in the study process, 68% of them does not use any assistive technologies to help them with their disabilities in the study process. Only 32% of respondents actually use assistive technologies. This question was followed by an open-ended question to find out which assistive technologies they use. We found out that the majority that claimed to be using assistive technologies didn't understand the concept of it fully.

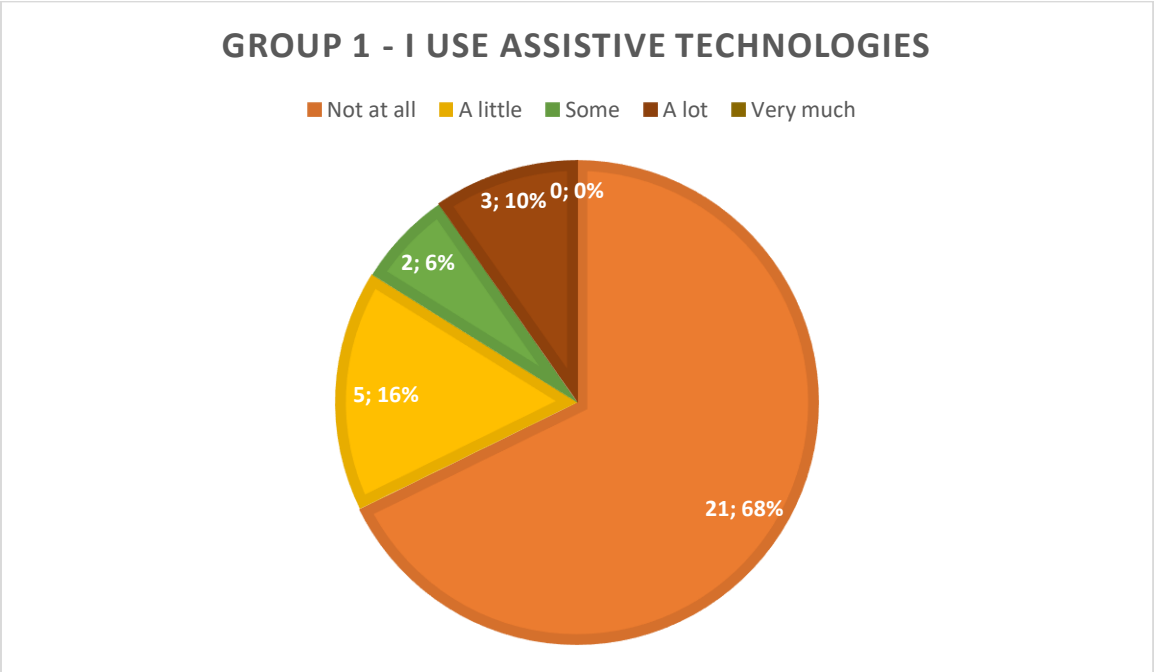


*Chart 21: I use assistive technologies.*

As expected, those who don't need support in the study process consequently don't use assistive technologies either. The results from Chart 22 show that only 3 respondents from Group 2 actually use assistive technologies, even though they do not feel the need for any kind of support in their study process. It turned out that one of the respondents did not understand what assistive technologies are, although he stated in the previous question that he uses them.

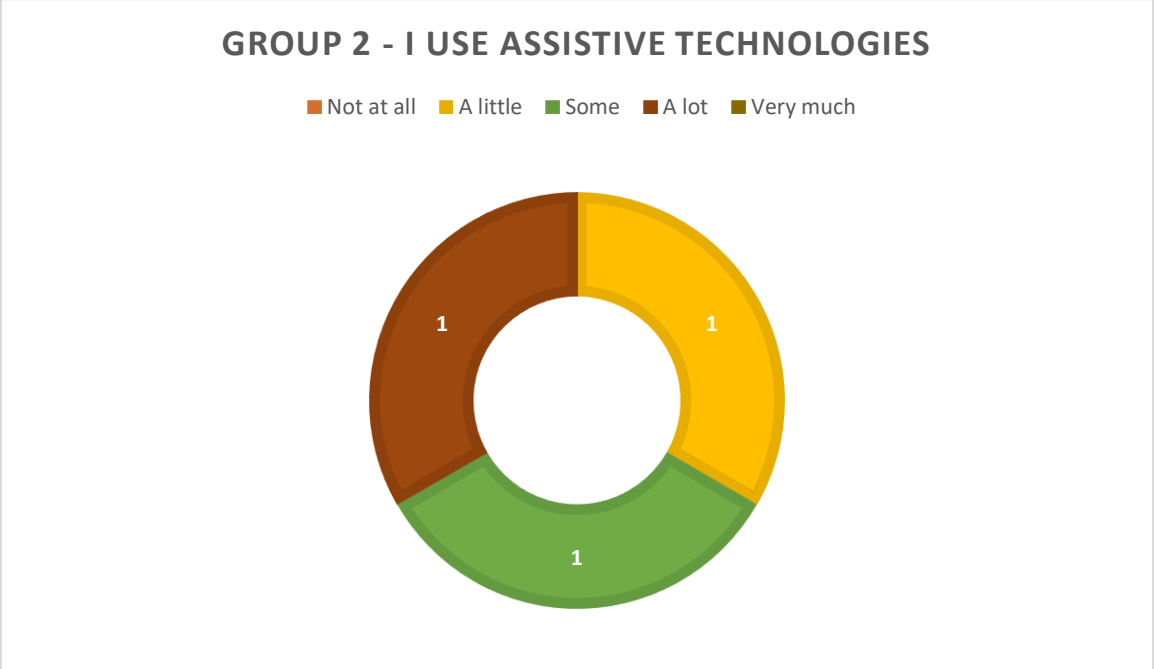


*Chart 22: I use assistive technologies.*

Regarding the need for additional assistive technologies in the study process, the sample of Group 1 is divided almost in half. As Chart 23 shows the majority (55%) of all respondents noted that they needed/would need additional assistive technologies. In the following question we tried to find out which additional assistive technologies our respondents need/would need in the study process. It turned out that some of the respondents may not have understood the question, or it might be that they do not know about any additional assistive technologies, since they answered to the following open-ended question with 'I don't know', or even left the question blank. Only 4 respondents stated they needed/would need colour coding notes, an audio book, speech to text (narration) software and a reading aid for dyslexia. On the other hand, all the respondents from Group 2 said they don't 'need additional assistive technologies in the study process'.

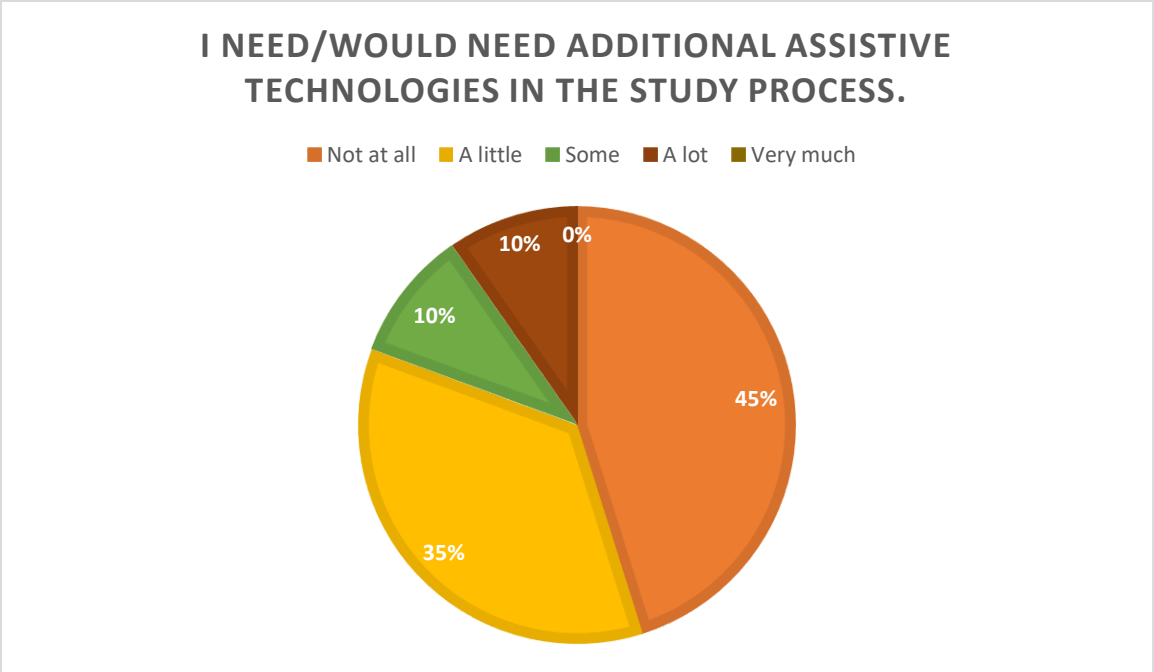


*Chart 23: I need/would need additional assistive technologies in the study process.*

# IV. Conclusions and Recommendations

## i. Key Results of Research (short summary)

From this survey analysis we can conclude that our respondents are not sufficiently informed about what assistive technologies are. We believe that the first step for the inclusion of students with disability in higher education is to inform them about what assistive technologies are available on the market or at their Faculties, and which ones could be used to help them in relation to their disabilities. Even though 49% of all of the respondents needed/would need support in the study process, only a small share of respondents actually uses assistive technologies to enhance their study process and daily living.

## ii. Recommendations for Future Action

In the following steps of the project, it would be intriguing to compare the results between the participating countries. Afterwards, it is recommended to learn and transfer good practices between the countries.

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