



# InSIDE: Including Students with Impairments in Distance Education

## Deliverable **DEV2.2** **Assessment of educational materials**

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## Abbreviations

Acronym	Term
HE	Higher education
HEI	Higher education institution
ICT	Information and communications technology
InSIDE	Including Students with Impairments in Distance Education
Iwl	Individual with impairments
JKU	Johannes Kepler University
LMD	Licence, Master, and Doctorate
UABT	University of Aboubekr Belkaid Tlemcen
UAE	Abdelmalek Essaadi University
UB2LA	Blida 2 University
UCA	Cadi Ayyad University
UIT	Ibn Tofail University
UM5R	University of Mohammed V in Rabat
UMMTO	Mouloud Mammeri University of Tizi-Ouzou
UOA	National and Kapodistrian University of Athens
UOM	University of Macedonia
US	University of Sousse
USFAX	University of Sfax
USTO	University of Sciences and Technology of Oran Mohamed Boudiaf
UTM	University of Tunis El Manar
ViHeMo	Visual, hearing, mobility/physical
WP	Work Package
MS Word	Microsoft Word

## About InSIDE

The aim of the project is to develop accessible DE programmes for individuals with ViHeMo impairments. The concrete aims are to: a) develop an accessible, inclusive and educationally effective model of DE that will deliver key competences for vocational rehabilitation, and provide opportunities for lifelong learning, skills enhancement, and personal fulfilment with the ultimate aim of suggesting an intelligent solution against the problems of limited access or high percentage of dropouts in HE in IwI, b) structure a strong cooperation between organisations with sound expertise in accessible and inclusive HE and organisations where both the modernisation of HE and the promotion of the right to education of IwI is imperative, and c) widen the horizons of local HE towards an international and intercultural education through DE programmes.

The overall objectives of the project are to:

- 1) Develop new and innovative, accessible and inclusive DE programmes improving the quality of HE for individuals with ViHeMo impairments and offering flexible learning and virtual mobility
- 2) Upgrade the facilities through establishing accessibility offices and acquiring assistive technology resulting in modernization of university services
- 3) Build capacity and professional development in administrative and teaching staff in developing and carrying out accessible and inclusive DE programmes, and operating the accessibility offices
- 4) Involve individuals with ViHeMo impairments in a user-center design so that accessibility and usability are achieved in conjunction, and the links between education and society are strengthened

The specific objectives of the project are:

- The preparation of the development stage through an extended literature review for precedent trials in DE for IwI
- The development of the most suitable educational material for IwI (ViHeMo) in terms of accessibility, usability and educational efficacy through the study of end-user requirements
- The adaptation of a course delivery system that best serves the needs of IwI (ViHeMo) in DE
- The foundation of accessibility services in HE so that SwI would be supported during their attendance in HE
- The training of advisors in the services of the accessibility offices, and the training of the trainers (advisors and representatives) so that they will be able to train the end-users (teaching staff and IwI)
- The examination of the regular co-operation of all the above to deliver inclusive DE courses effectively when learning and skill enhancement are concerned, considering end-users feedback too
- The dissemination and exploitation of the project deliverables on an international level.

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## Executive summary

The **Assessment of educational materials** is an extended deliverable resulting from two essential activities: a) the pilot testing where persons with visual, hearing or mobility impairment examined the accessibility and usability adequacy of the educational materials, and b) the research for the elicitation of the user requirements on the adapted (or the alternative forms of) educational material (TASK 2.2 Assessment of the adapted and the alternative materials with reference to their accessibility and usability adequacy as well as to the end-users' satisfaction). Specifically, the adapted educational material that was initially designed and developed in a preliminary version was consequently assessed on these two stages in order to design and develop the final version of accessible educational material. The present report presents the methodology, the instruments and the results of these two stages of assessment.

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## 1. A.2.2.3 “Implementation of the pilot tests”

### 1.1. Pilot Study of Individuals with Visual Impairments

#### 1.1.1. Participants

The participants of the study [Participant 1 (P1) - Participant 5 (P5)], totaling 5, were selected in line with usability test recommendations (e.g., Nielsen & Landauer, 1993). Among them, 4 were men and one was a woman (P2). Out of the 5 participants, 3 had total blindness (P1-P3) while 2 had low vision (P4-P5). The age of onset of blindness in individuals with total blindness was at around 2 months (n=2) and 11 years old (n=1). Four out of the 5 participants know Braille and use a screen reader (either NVDA or voiceover) on a daily basis, while one participant (P5) doesn't know Braille and doesn't use a screen reader.

Apart from the 5 participants (P1-P5), there were 3 additional participants (P6-P8) who evaluated specific educational material (verbal description material: P6 and P8 and video material: P7 & P8). Of the 3 participants, 2 were men with total blindness (P6 and P8) and 1 was a woman with low vision (P7). The age of onset of blindness in individuals with total blindness was at 18 (n=1) and 20 (n=1) years old. Two out of the 3 participants are knowledgeable in Braille and use a screen reader daily, while one participant (P7) doesn't know Braille and doesn't use a screen reader.

Reference:

Nielsen, J., & Landauer, T. K. (1993). A mathematical model of the finding of usability problems.

*Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems*, 206–213. <https://doi.org/10.1145/169059.169166>

#### 1.1.2. Instruments

The tools used for the present study are as follows: a) questionnaire for collecting demographic information of the participants, b) scenarios of activities for navigating accessible educational material, c) semi-structured interviews for evaluating the accessible educational material, and d) questionnaire on the usability of the accessible educational material. Additionally, there were comprehension questions on specific material - i.e., on images and video.

#### 1.1.3. Procedure

The process of the experiment consists of a set of structured steps for collecting data and evaluating accessible educational material. The use of multiple tools such as the semi-structured interview and the usability questionnaire can provide further information on how users interact with the accessible educational material and how useful they consider it to be. The steps were as follows:

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- Step 1. Participants answered the demographic questionnaire.
- Step 2. The scenario was implemented for each accessible educational material and comprehension questions were added where needed (e.g. images).
- Step 3. Participants independently explored the accessible educational material, thinking aloud and commenting on its accessibility.
- Step 4. The semi-structured interview was conducted.
- Step 5. The usability questionnaire was completed.

#### 1.1.4. Analysis

During the assessment of accessible educational material, the following variables were used to measure the effectiveness of the educational material in achieving the desired learning outcomes.

- Success/Unsuccess: This variable indicates whether the participant was successful or unsuccessful in completing the scenario.
- With/without help: This variable indicates whether the participant completed the scenario with or without assistance.
- Time: This variable measures the time taken by the participant to complete the scenario.
- Interruption for solution by himself, by help: This variable measures the number of times the participant was interrupted and needed help to find a solution to complete the scenario.
- Times of interruption: This variable measures the total number of interruptions experienced by the participant during the completion of the scenario.

By collecting and analyzing these variables, researchers and educators can identify areas where participants may be struggling or where the educational material needs improvement to better support learning outcomes.

#### 1.1.5. Results

The results for each accessible educational material are presented. The accessible educational material included the MS Word textbook, which was a book without (complex) images and tables. The same book was also examined in two other formats (DAISY-Textbook and Epub-Textbook). In order to compare the three formats, participants performed the same tasks in each format (word, DAISY, ePub). The next accessible educational material was examined, which was the Word-Samplebook. This book covered all possible cases of charts and tables. The same book was also examined in two other formats (DAISY-Samplebook and Epub-Samplebook). In order to compare the three formats, participants performed the same tasks in each format (word, DAISY, ePub). Other accessible educational materials were a ppt presentation, verbal descriptions of images, and an accessible video for people with visual impairments.

It is important to note that there is no available data for the Power Point and verbal description material for P5, and no data for the video material for P3, apart from the usability questionnaire. Also, P6 has only completed the verbal description material, P7 has completed the video material, and P8 has completed both the verbal description and video material.

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### Scenarios

Tables 1-3 present the results of an assessment of five participants' completion of a task involving a Word textbook.

The Table 1 shows that all five participants were successful in completing the task "Find chapter 2 'Institutional Framework of Education and Disability'". Three of the participants completed the task without any help, while two participants needed help once. The time taken to complete the task varied from 37 seconds to 313 seconds, with an average completion time of 118.8 seconds. Participants who needed help had to interrupt themselves or ask for help once during the task. In contrast, participants who completed the task without help did not need to interrupt themselves or ask for help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	With help	313	Yes (by help)	1
P2	success	Without help	45	No	0
P3	success	Without help	37	No	0
P4	success	Without help	125	No	0
P5	success	With help	74	Yes (by help)	1

Table 1. First task from MS Word - Textbook

The Table 2 displays that all five participants were successful in completing the task "Go to page 15" without help, as indicated by the "success" entries in the second column. The time taken to complete the task varied from 11 seconds to 41 seconds, with an average completion time of 28.4 seconds. No participant had any interruptions while solving the task, as indicated by the "no" entries in the fourth and fifth columns. Overall, the results suggest that the task was relatively easy for the participants, as they were able to complete it quickly and without any interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	21	No	0
P2	success	Without help	30	No	0

P3	success	Without help	11	No	0
P4	success	Without help	39	No	0
P5	success	Without help	41	No	0

Table 2. Second task from MS Word Textbook

Table 3 shows the results of the third task “Go to sub-chapter 5.1 “Assistive Technology: Definition” from the MS Word Textbook assessment. All participants were successful in completing the task without any help, except for one participant who needed help once during his solution. This participant interrupted his solution once by himself, while the other participants did not interrupt their solution at all, neither by themselves nor with help. The time it took to complete the task varied from 33 to 93 seconds, with an average completion time of 73.2 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	With help	93	Yes (by himself)	1
P2	success	Without help	86	No	0
P3	success	Without help	79	No	0
P4	success	Without help	33	No	0
P5	success	Without help	75	No	0

Table 3. Third task from MS Word Textbook

### Independent exploration

From the statements given during the independent exploration, the following themes can be identified for the participants' opinions on the accessible educational material (MS Word – Textbook):

- **Navigation:** Participants find the document navigation features helpful, such as using shortcuts (Ctrl + F) to search headers and the use of headings and table of contents.
- **Page numbering:** Participants suggest that page numbers should be located in the left corner and the size of the page numbering could be even bigger.
- **Clarity of content:** Participants appreciate the clear and helpful descriptions of links and references, and the use of bold to indicate headings. Several participants find the glossary useful for unfamiliar terms and organizations.
- **Usability issues:** One participant finds the program for accessibility (Supernova + NVDA) heavy and slow, particularly when navigating from page to page. This could potentially be a usability issue that needs to be addressed. Another participant mentions difficulty with the bullet point symbol on mobile devices, which could be a problem for users who primarily access the document on their phones.

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## Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All five participants had positive evaluations of the material when asked to provide a general comment.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Navigation:** Participants appreciated the shortcuts (Ctrl + f), table of contents for quick navigation, they would keep headings, links and glossary. They would appreciate the glossary at the end of the book.
- **Appearance/Format:** Participants would appreciate slightly increasing the font size of the titles. Generally, they would keep font and bullets or replace them with numbering when reading on their phone. This could be easily implemented by using a numbered list instead of bullet points in the document. It would also be important to ensure that the numbering is consistent throughout the document, and that it does not cause any confusion for the reader.
- **Page numbering:** Participants would keep placement of page numbers, the left alignment for ease of reading, and believe it is important to maintain the original numbering system.
- **Footnotes & Glossary:** Participants would skip the footnotes to save time or they prefer footnotes at the end of each page if they were to read the entire book

4. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative formats:** Participants prefer Word, but they suggest alternative formats such as PDF, HTML, and Epub.
- **Audio-book version:** One participant suggests a desire for an audio-book version.

Overall, the respondents suggest various alternative formats, such as Word, PDF, HTML, and Epub, as well as an audio-book version. The responses show that the preferred format varies based on personal preference and familiarity with the different formats. Some respondents also suggest the current format is suitable, indicating that they do not see a need for an alternative format.

5. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Exams
- Lectures
- Studying

Based on the answers given by the participants, it seems that the material provided would be useful for various tasks and activities during their university studies. The most common responses were in the areas of academic tasks such as assignments, exams, and general reading.

6. What are the advantages and disadvantages of this form of material?

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- Advantages
- Headings and descriptive links.
- Immediate access to information.
- Table of contents.
- Ease of recognition and structure of Word documents.
- User-friendliness.
- Ability to read books.
- Disadvantages
- Difficulty in finding paragraph boundaries.
- Navigating headers and subheadings.
- Robotic voice from the screen reader (NVDA).

Overall, the advantages and disadvantages mentioned by the interviewees are quite varied, with some focusing on navigation and structure, while others emphasize accessibility and ease of use. While some mention the robotic voice as a disadvantage, none of the interviewees discuss any potential issues with the accuracy of the voice or its potential impact on comprehension. In general, it seems that the advantages of using Word documents for reading and navigation outweigh the disadvantages, but it is important to consider individual preferences and needs when selecting a format for reading and accessing information.

### Usability Questionnaire

A usability questionnaire used to gather feedback from users regarding the accessibility, usability, and effectiveness of the material. The questionnaire aims to identify any potential issues or barriers that users may encounter when accessing or using the material. The feedback collected can then be used to improve the design and accessibility of the educational material, making it more effective and user-friendly for individuals with visual impairments. Additionally, the questionnaire can help ensure that the educational material meets accessibility standards and guidelines.

The questionnaire contained the following questions, for which the participants' answers are reported, and their interpretation is given.

1. How accessible is the material? - The respondents rated the accessibility of the material between 8 to 10, with an average score of 9. This suggests that the material is generally easy to access.
2. How difficult was it for you to use it? The respondents had varying difficulties using the material, with scores ranging from 1 to 8. However, the majority rated the difficulty as low with an average score of 3.6. This indicates that the material is generally easy to use.
3. To what extent is training required to be able to use it? - The scores for the amount of training required to use the material varied, with an average score of 5. However, the majority of respondents indicated that some level of training would be necessary.
4. Would you use it if it was available to you? The majority of respondents (4 out of 5) indicated that they would use the material if it was available to them, with an average score of 9.2.
5. Would you recommend others to use it? - The respondents indicated that they would recommend others to use the material, with an average score of 9.8.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The respondents indicated that the material would fill the gaps in knowledge to a significant extent, with an average score of 8.8.
7. Could you obtain the information/ knowledge provided by this material in another way? - The respondents were divided in their responses to this question, with some indicating that

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they could obtain the information through other means, while others indicated that the material provided unique information. The average score was 6.2.

8. Do you think that the material successfully meets the purpose for which it was built? - Respondents generally believed that the material successfully meets the purpose for which it was built, with an average score of 9.
9. How useful would this material be for your university studies? - The respondents rated the usefulness of the material for their university studies, with an average score of 9.6. This suggests that the material would be very useful for their studies.
10. How tedious is the material? The respondents rated the material as not very tedious, with an average score of 2.4.
11. How complex and complicated is the material? - The respondents rated the complexity and complication of the material, with an average score of 3.6. This suggests that the material is not very complex or complicated.
12. How much load (memory and attention) does the material's use require? - The scores for the amount of memory and attention required to use the material varied, with an average score of 5. This suggests that the material requires some level of attention and memory.
13. How satisfied are you with the use of this material? - The respondents rated their satisfaction with the use of the material, with an average score of 9.4.

#### DAISY – Textbook

#### Scenarios

Tables 4-6 represent the results of an assessment of five participants' completion of tasks involving a DAISY textbook.

The Table 4 shows that all five participants were successful in completing the task "Find chapter 2 'Institutional Framework of Education and Disability'". Three of the participants completed the task without any help, while two participants needed help once. Interruptions were made by two participants who completed the task with help. Both interrupted their work once and received help. The time taken to complete the task varied from 9 seconds to 774 seconds, with an average completion time of 210 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	With help	119	Yes (by help)	1
P2	success	With help	774	Yes (by help)	1
P3	success	Without help	130	No	0
P4	success	Without help	18	No	0
P5	success	Without help	9	No	0

Table 4. First task from DAISY- Textbook

The Table 5 displays that all five participants were successful in completing the task "Go to page 15" without help. The time to complete the task varied among the participants, with the fastest participant taking 36 seconds and the slowest taking 189 seconds and an average completion time of 87.4 seconds. None of the participants had any interruptions for a solution.

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Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	36	No	0
P2	success	Without help	189	No	0
P3	success	Without help	108	No	0
P4	success	Without help	68	No	0
P5	success	Without help	36	No	0

Table 5. Second task from DAISY Textbook

Table 6 shows the results of the third task “Go to sub-chapter 5.1 “Assistive Technology: Definition” from the DAISY Textbook assessment. All participants were able to successfully complete the task without any help. The amount of time it took the participants to complete the task varied, with the fastest time being 3 seconds and the slowest time being 68 seconds and an average completion time of 27.6 seconds. No participant needed to interrupt their work to ask for help in this task.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	25	No	0
P2	success	Without help	28	No	0
P3	success	Without help	68	No	0
P4	success	Without help	3	No	0
P5	success	Without help	14	No	0

Table 6. Third task from DAISY Textbook

### Independent exploration

From the statements given during the independent exploration, the following themes can be identified for the participants' opinions on the accessible DAISY material:

- **Organization:** Participants appreciated the organization of the DAISY format, with P1 stating that it is "very well organized" and P5 finding it "much more convenient."
- **Navigation:** Participants found the DAISY format to have more capabilities and allow for quicker movement if the user knows how to navigate it.
- **User Interface and Functionality:** Participants found the DAISY format to be more difficult than Word.
- **Page numbering:** Participants mentioned issues with the lack of visible page numbers within the text of the DAISY file, suggesting that it be made more distinguishable.

Overall, participants had mixed opinions on the accessibility of the DAISY format. While some appreciated the organization and convenience, others found it difficult to navigate or had issues with certain aspects such as page numbering.

## Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants gave a positive evaluation of the material. One participant emphasized that it was a very positive experience, possibly indicating a higher level of enthusiasm than the others.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- Many participants appreciate the navigation bar and find it useful in locating information within the text. Additionally, the majority of participants express a preference for the yellow highlighting of text during screen reading.
- There are also a few areas where participants have suggested changes. Some participants have suggested that page numbers should be announced within the book during screen reading, similar to Word. Others have suggested that a table of contents at the beginning of the book with the same format as in a Word file would be helpful. Additionally, some participants have suggested that annotations should be placed at the end of each page, rather than at the end of the book.
- One participant said that the page change should happen with some space and maybe a horizontal line from edge to edge.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- The majority of participants prefer the format of Microsoft Word. Three participants specifically mentioned preferring the Word format, while two others mentioned either Word or a combination of Word and another format (PDF or audio-book).

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Studying

The participants seemed to agree that the material would be helpful for them during their university studies, especially in reading, studying, and completing assignments.

5. What are the advantages and disadvantages of this form of material?

Based on the responses of the participants, the advantages and disadvantages of this form of material are as follows:

- Advantages:
- Option of various reading voices within the application.
- Possibility to choose from different screen readers.
- Speed in navigation.
- Ability to read and many settings regarding the appearance of the text.
- Disadvantages:

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- Not being able to open a link.
- Can't take notes by copy-pasting.
- Loss of page numbering within the text.
- Different format (a matter of habit).
- Not understanding the page change.

It is important to note that some participants listed the same advantages or disadvantages while others mentioned unique points. Overall, it can be concluded that the form of material has both advantages and disadvantages depending on the user's preferences and needs.

### Usability Questionnaire

The questionnaire contained the following questions, for which the participants' answers are reported, and their interpretation is given.

1. How accessible is the material? - The average response is 8.4 out of 10, indicating that the participants found the material to be generally accessible.
2. How difficult was it for you to use it? - The average response is 3.8 out of 10, indicating that the participants did not find the material very difficult to use.
3. To what extent is training required to be able to use it? - The average response is 5.2 out of 10, indicating that the participants believed that some training may be required to use the material effectively.
4. Would you use it if it was available to you? - The average response is 8.2 out of 10, indicating that the participants would likely use the material if it was available to them.
5. Would you recommend others to use it? - The average response is 8.8 out of 10, indicating that the participants would recommend the material to others.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7.8 out of 10, indicating that the participants believe the material would fill some gaps in their knowledge.
7. Could you obtain the information/ knowledge provided by this material in another way? - The average response is 8.2 out of 10, indicating that the participants believed that there are other ways to obtain the information/knowledge provided by the material.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 8.2 out of 10, indicating that the participants believed that the material successfully meets its purpose.
9. How useful would this material be for your university studies? - The average response is 9 out of 10, indicating that the participants found the material to be useful for their university studies.
10. How tedious is the material? - The average response is 3.4 out of 10, indicating that the participants did not find the material very tedious.
11. How complex and complicated is the material? - The average response is 4 out of 10, indicating that the participants did not find the material to be very complex or complicated.
12. How much load (memory and attention) does the material's use require? - The average response is 5 out of 10, indicating that the participants believed that the material's use requires some memory and attention load.
13. How satisfied are you with the use of this material? - The average response is 7.6 out of 10, indicating that the participants were somewhat satisfied with the use of the material.

*ePub – Textbook*

### Scenarios

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The results of an evaluation of five participants' performance on a task involving an ePub textbook are presented in Tables 7-9.

The Table 7 shows that all five participants were successful in completing the task "Find chapter 2 'Institutional Framework of Education and Disability'". The time it took to complete the task varied from 15 seconds to 79 seconds, with an average completion time of 46.8 seconds. None of the participants interrupted themselves while completing the task, but one participant required help from others during the task, resulting in a total of two interruptions. The other four participants completed the task without any interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	79	No	0
P2	success	Without help	25	No	0
P3	success	With help	68	Yes (by help)	2
P4	success	Without help	47	No	0
P5	success	Without help	15	No	0

Table 7. First task from ePub-Textbook

The Table 8 displays that all five participants were successful in completing the task "Go to page 15". The time it took to complete the task varied widely, with completion times ranging from 23 seconds to 203 seconds, and an average completion time of 101.8 seconds. None of the participants interrupted themselves while completing the task, but one participant required help from others during the task, resulting in a total of one interruption.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	48	No	0
P2	success	Without help	194	No	0
P3	success	With help	203	Yes (by help)	1
P4	success	Without help	23	No	0
P5	success	Without help	41	No	0

Table 8. Second task from ePub-Textbook

Table 9 shows the results of the third task "Go to sub-chapter 5.1 "Assistive Technology: Definition" from the MS Word Textbook assessment. All participants were successful in completing the task without help, and the time it took to complete the task varied from 25 seconds to 68 seconds, with an average completion time of 49.4 seconds. No participants interrupted themselves or required help during the task, resulting in a total of zero interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	52	No	0
P2	success	Without help	64	No	0
P3	success	Without help	68	No	0
P4	success	Without help	38	No	0
P5	success	Without help	25	No	0

Table 9. Third task from ePub-Textbook

### Independent exploration

During the independent exploration of the ePub textbook, the participants commented the following: "It's very nice because it's like a regular book.", "it confused me more than other book formats (Word, DAISY)".

### Semi-structured interview

The semi-structured interview consisted of 6 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants rated the material positively. One participant found the material to be more complicated than the other two formats (presumably Word and DAISY), but also noted that the DAISY format was more accessible despite not knowing it beforehand.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Navigation:** Participants discussed the ease or difficulty of navigating through the document and suggested changes such as improving the location of the table of contents.
- **Appearance:** Participants expressed opinions on the appearance of the document and suggested changes such as keeping the appearance of a book (left and right page at the same time).
- **Page numbering:** Participants suggested adding page numbers within the document for ease of navigation.
- **Footnotes:** Participants suggested changes to the placement of footnotes within the text to prevent confusion.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Multiple Formats (DAISY/PDF/Word):** Some respondents preferred having the same material available in multiple formats.
- **Specific Formats for Specific Needs:** One respondent preferred using Word for searching or formatting, and ePub for reading.
- **Audio-book:** One respondent preferred using an audio-book.

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- **DAISY:** One respondent preferred using DAISY format.

Overall, the respondents suggested that having access to the same material in different formats can be helpful, and each person has different preferences based on their specific needs.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Reading
- Exams

The participants mentioned different ways in which the material could be helpful during their university studies. Some saw it as useful for academic tasks such as articles and assignments, while others emphasized its relevance to reading and exam preparation. Additionally, some participants mentioned that the material could serve both educational and entertainment purposes.

5. What are the advantages and disadvantages of this form of material?

Based on the responses of the participants, the advantages and disadvantages of the form of material are as follows:

- Advantages:
- Navigation: Proper chapter distribution.
- Integrated Reader.
- Appearance.
- Easy page finding.
- Disadvantages:
- Cannot copy-paste.
- Difficulty navigating the menu.
- Lags behind in speed compared to Word.
- Page number not specified within the text
- Single page view (1 page at a time and not 2-2).
- Font.

Overall, it can be concluded that the form of material has both advantages and disadvantages depending on the user's preferences and needs.

6. What are the advantages and disadvantages of each alternative form/ format of material?

Word

- Advantages:
- Ability to edit text.
- Notes at the end of each page.
- Automatic page numbering.
- Ability to add voice and adjust settings.
- Disadvantages:
- Cannot be read correctly on mobile (e.g., bullet points).
- Copy and paste limitations.

DAISY

- Advantages:

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- Notes at the end of the book.
- Ability to add voice and adjust settings.
- Navigation in headers and pages.
- Structure of the navigation bar.
- Integrated voice.
- Highlighting during reading.
- Disadvantages:
- Footnotes at the end of the book
- Does not have page numbering within the text.

#### ePub

- Advantages:
- Ability to have an integrated voice.
- Easy reading on mobile.
- Structure.
- Disadvantages:
- Difficulty in navigation.
- Inability to edit text.
- Contents are not convenient.

#### Usability Questionnaire

1. How accessible is the material? - The average score (7.2 out of 10) suggests that the material is somewhat accessible, but there is room for improvement.
2. How difficult was it for you to use it? - The average score (5.4 out of 10) suggests that the material is somewhat difficult to use, but there is potential to make it more user-friendly.
3. To what extent is training required to be able to use it? - The average score (6.4 out of 10) suggests that some training is required to use the material effectively, but the level of training required varies.
4. Would you use it if it was available to you? - The average score (6.2 out of 10) suggests that the availability of the material alone may not be enough to motivate usage, but there is potential for increased usage with improvements to the material.
5. Would you recommend others to use it? The average score (7.2 out of 10) suggests that while some individuals may recommend the material to others, overall it may not be highly recommended.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average score (6.0 out of 10) suggests that the material may not be very effective in filling gaps in knowledge.
7. Could you obtain the information/ knowledge provided by this material in another way? - The average score (9.2 out of 10) suggests that the information/knowledge provided by the material could be obtained through other sources.
8. Do you think that the material successfully meets the purpose for which it was built? - The average score (6.2 out of 10) suggests that the material only partially meets the purpose for which it was built.
9. How useful would this material be for your university studies? - The average score (6.8 out of 10) suggests that the material may not be very useful for university studies.
10. How tedious is the material? - The average score (4.6 out of 10) suggests that the material is not very tedious.

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11. How complex and complicated is the material? - The average score (5.0 out of 10) suggests that the material is moderately complex and complicated.
12. How much load (memory and attention) does the material's use require? - The average score (5.0 out of 10) suggests that the material's use requires a moderate amount of memory and attention.
13. How satisfied are you with the use of this material? - The average score (5.4 out of 10) suggests that the respondents are somewhat satisfied with the use of the material, but there is room for improvement.

#### Word – Samplebook

#### Scenarios

Tables 10-13 provide information on the results of an assessment of five participants' completion of a task involving a Word Samplebook.

The Table 10 shows that all five participants were successful in completing the task "Find from the section 'Recent Theoretical Approaches' the subsection 'Developmental Neuroscience'". Three participants completed the task without any help, while two participants received help. Participants who received help took longer to complete the task than those who did not receive help. The time it took to complete the task varied from 25 seconds to 292 seconds, with an average completion time of 114 seconds. Two participants interrupted themselves while completing the task, resulting in one interruption.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	84	No	0
P2	success	With help	292	Yes (by help)	1
P3	success	Without help	54	No	0
P4	success	Without help	25	No	0
P5	success	With help	115	Yes (by help)	1

Table 10. First task from Word - Samplebook

The Table 11 displays that all five participants were successful in completing the task "Go to the subsection 'Ethology and Evolutionary Developmental Psychology', read the first three sentences of this subsection ('Ethology deals with... its modern foundations') and identify whether any of these sentences have been marked as important by the author." The time it took to complete the task varied from 78 seconds to 884 seconds, with an average completion time of 282.4 seconds. None of the participants interrupted themselves while completing the task, but one participant required help from others during the task, resulting in a total of one interruption. The other four participants completed the task without any interruptions.



Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	78	No	0
P2	success	With help	884	Yes (by help)	1
P3	success	Without help	113	No	0
P4	success	Without help	208	No	0
P5	success	Without help	129	No	0

Table 11. Second task from Word - Samplebook

Table 12 shows the results of the third task "Find in the subsection 'Information Processing' the beginning and the end of figure 1.4." The time it took to complete the task varied from 79 seconds to 485 seconds, with an average completion time of 209.2 seconds. None of the participants interrupted themselves while completing the task or required any help from others during the task. Therefore, there were no interruptions during the task for any of the participants.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	485	No	0
P2	success	Without help	178	No	0
P3	success	Without help	212	No	0
P4	success	Without help	79	No	0
P5	success	Without help	92	No	0

Table 12. Third task from Word - Samplebook

Table 13 shows the results of the third task "Go to the section 'Example 6: Column Graph', and find the alternative text, the caption, and the verbal description of the image." The time it took to complete the task varied from 92 seconds to 199 seconds, with an average completion time of 148 seconds. Four out of five participants completed the task without any help or interruptions, but one participant required help from others during the task, resulting in a total of one interruption.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	156	No	0
P2	success	Without help	92	No	0
P3	success	With help	199	Yes (by help)	1

P4	success	Without help	158	No	0
P5	success	Without help	135	No	0

Table 13. Fourth task from Word - Samplebook

### Independent exploration

During the independent exploration of the Word – Samplebook, the answers of the participants can be broadly classified into five main themes:

- **The importance of headings, graphs, links, asterisks and alternative text.** The answers describe the importance of using headings, graphs, and links to navigate easily and quickly. The participants prefer to work with Word because it is accessible. The participants also find asterisks helpful in indicating the importance of a sentence. They suggest that the asterisk should be placed at the beginning of an important sentence for better comprehension. They also discuss the importance of alternative text for images and how it informs the reader about the content.
- **The role of verbal description for images and graphs.** Verbal descriptions for images are found to be very helpful. They prefer a verbal description for bar graphs and find that the wording in descriptions of maps and charts is perfect.
- **The use of tables and lists.** The participants find tables to be more useful than verbal descriptions for presenting data in a graph, while text with bullet points is more helpful than table structure.
- **The position of images in the document.** The participants find that the beginning and end of an image should be defined for convenience. Also, the participants suggest placing images at the end of a chapter or book to avoid interrupting the flow of text.
- **Personal preferences for different types of images and descriptions.** The response emphasizes the convenience of having an explanation for an image, which can help remember the text better. However, they prefer less description for simple images. The participants find that if a graph contains data, presenting it in table form is faster and easier than a verbal description. They suggest that converting a table with text into a list format is useful. They also find that the combination of an image and verbal description is helpful for understanding complex images, such as the myelination chart. They find that a verbal description is useful for graphs such as Down syndrome (image 2 from the verbal descriptions of images), while a table is more convenient for images such as the human brain (image 3 from the verbal descriptions of images). They suggest that personal preferences play a role in deciding which form of description to use.

### Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants provide a clear positive evaluation of the material being discussed.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

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- **Layout and design.** Individuals suggested changing the layout by placing images after each chapter for better readability and they also mentioned keeping the delineation of images and keeping them separate from the rest of the text for emphasis.
- **Asterisk.** Individuals suggested moving the asterisk to the beginning of the sentence to indicate its importance, while other participant suggested keeping it at the end since it was already explained at the beginning of the book. Individuals mentioned keeping the repetition of the word 'asterisk' at the beginning and end of the important sentence.
- **Verbal descriptions.** Individuals mentioned keeping the verbal descriptions for all types of graphs, finding them useful and supportive.
- **Overall satisfaction.** Individuals expressed satisfaction with the book's design and content and did not suggest any major changes.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative formats.** Some participants suggested alternative formats such as pdf, DAISY, wordpad, ePub, and audio-book.
- **Uncertainty about alternative formats.** Some participants were unsure and needed to see other formats before making a decision.

Overall, the participants were open to the idea of obtaining the same information in other formats, but their preferences varied.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Lectures
- Reading
- Exams

All participants agreed that the material would be useful in assignments, reading, exams, and lectures during their university studies. Overall, the participants recognized the value of the material in supporting their academic pursuits and enhancing their learning experience in various contexts.

5. What are the advantages and disadvantages of this form of material?

Based on the responses of the participants, the advantages and disadvantages of the form of material are as follows:

- Advantages:
- Easy to use.
- Provides alternative text for images.
- Easy to navigate.
- Provides information that may not be easily perceived with reduced vision.
- Helps to understand images.
- Marking of important sentences.
- Disadvantages:
- Image placement.
- Complexity of graphs.

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Overall, the participants had a positive view of the material and identified several advantages. These included the ease of use, provision of alternative text for images, ease of navigation, assistance with understanding images, and marking of important sentences. While a few participants did mention some disadvantages, they were relatively minor and did not significantly detract from the overall benefits of the material.

### Usability Questionnaire

1. How accessible is the material? - The average response is 9.6 out of 10, indicating that the participants found the material to be highly accessible.
2. How difficult was it for you to use it? - The average response is 2 out of 10, indicating that the participants did not find the material very difficult to use.
3. To what extent is training required to be able to use it? - The average response is 3.6 out of 10, indicating that the participants believe some level of training may be required to use the material.
4. Would you use it if it was available to you? - The average response is 9.6 out of 10, indicating that the participants would likely use the material if it was available to them.
5. Would you recommend others to use it? - The average response is 9.2 out of 10, indicating that the participants would likely recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7.2 out of 10, indicating that the participants believe the material will fill some gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 5.2 out of 10, indicating that the participants believe that some of the information provided in the material may be obtained through other means.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 9.4 out of 10, indicating that the participants believe that the material successfully meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 9.6 out of 10, indicating that the participants believe the material would be highly useful for their university studies.
10. How tedious is the material? - The average response is 3.8 out of 10, indicating that the participants did not find the material very tedious.
11. How complex and complicated is the material? - The average response is 4.2 out of 10, indicating that the participants did not find the material very complex or complicated.
12. How much load (memory and attention) does the material's use require? - The average response is 5.2 out of 10, indicating that the participants believe that the material requires some level of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 9.4 out of 10, indicating that the participants are highly satisfied with the use of the material.

### DAISY – Samplebook

#### Scenarios

Tables 14-17 provide information on the results of an assessment of five participants' completion of a task involving a DAISY Samplebook.

The Table 14 shows that all five participants were successful in completing without any help or interruption the task "Find from the section 'Recent Theoretical Approaches' the subsection 'Developmental Neuroscience'". The average time it took to complete the task across all participants

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was 42.6 seconds. The range of completion times was 11 seconds to 80 seconds. Overall, the results suggest that the first task in the DAISY-Samplebook study was relatively easy for participants to complete, with most participants completing it in under one minute without any help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	80	No	0
P2	success	Without help	79	No	0
P3	success	Without help	15	No	0
P4	success	Without help	11	No	0
P5	success	Without help	28	No	0

Table 14. First task from DAISY - Samplebook

The Table 15 displays that all five participants were successful in completing the task "Go to the subsection 'Ethology and Evolutionary Developmental Psychology', read the first three sentences of this subsection ('Ethology deals with... its modern foundations') and identify whether any of these sentences have been marked as important by the author." All participants completed the task without any help or interruptions, indicating that the task may have been relatively easy or straightforward for them. The average time it took to complete the task was 42.2 seconds, with the fastest completion time being 27 seconds and the slowest being 66 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	30	No	0
P2	success	Without help	66	No	0
P3	success	Without help	40	No	0
P4	success	Without help	27	No	0
P5	success	Without help	48	No	0

Table 15. Second task from DAISY - Samplebook

Table 16 shows the results of the third task "Find in the subsection 'Information Processing' the beginning and the end of figure 1.4." All participants were successful in completing the task without any help. The time it took to complete the task varied greatly among the participants, ranging from 27 seconds to 203 seconds, with an average completion time of 114.6 seconds. The average time for those who completed the task was 114.6 seconds. There were no interruptions during the task by either the participants or help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	203	No	0
P2	success	Without help	167	No	0
P3	success	Without help	140	No	0
P4	success	Without help	36	No	0
P5	success	Without help	27	No	0

Table 16. Third task from DAISY - Samplebook

Table 17 shows the results of the fourth task "Go to the section 'Example 6: Column Graph', and find the alternative text, the caption, and the verbal description of the image." All five participants succeeded in completing the task. The time it took to complete the task varied from 39 seconds to 193 seconds, with an average completion time of 88.6 seconds. The average time for those who completed the task without help was 88 seconds. There were no interruptions during completion of the task.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	53	No	0
P2	success	Without help	193	No	0
P3	success	Without help	46	No	0
P4	success	Without help	39	No	0
P5	success	Without help	109	No	0

Table 17. Fourth task from DAISY - Samplebook

### Independent exploration

During the independent exploration of ePub Samplebook, responses are related to the quality of graphs and images in a digital format, specifically in relation to the DAISY format. Individuals acknowledge that the graphs in the digital format being evaluated are just as good as those in Word, and the images have a clear beginning and end. Individuals also suggest that this digital format may be better than the DAISY textbook, possibly because it is easier to navigate without having to find specific pages. However, the individuals do point out that the disadvantage of DAISY is the need to navigate pages.

In addition, the respondents describe the graphs as more distinct, larger, and vivid and they also mention the quality of letters. Finally, the respondents suggest that DAISY books are gaining ground, indicating a positive trend in the popularity of this format.

### Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

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1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants evaluated the material positively. Some participants provided additional comments regarding the material, with one stating that it was equally as good as Word, and another mentioning that they found the navigation bar more convenient than in Word. Overall, the responses suggest that the material was well-received by the participants.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Voice and Navigation:** Participants appreciated the use of Innoetics for voice and found the navigation easy with the arrows and Ctrl + I keys.
- **Images:** Participants suggested changes to the image placement, recommending they be placed at the end of each chapter. They also recommended keeping the image boundary, but moving it to the end of the chapter.
- **Page Layout and Contents:** Participants recommended keeping the existing format for verbal description, alternative text, font, and colors. They also appreciated the contents bar and found it more useful than a table of contents.
- **Underlining:** Participants valued the underlining when reading the text from the integrated screen reader.
- **Page numbering:** Participants suggested adding page numbering within the text.

Overall, the participants had positive opinions on the material and suggested minor changes to improve image placement, page layout, and navigation methods, while valuing the features such as voice, underlining, and contents bar.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative formats:** Participants mentioned alternative formats that could be used to obtain the same information, including Word and audio-book.
- **No alternative:** One participant mentioned that there was no other way to obtain the same information as provided by the material.

Overall, the participants seem to have mixed opinions on whether or not the information/knowledge provided by the material could be obtained in another way. While some suggested alternative formats such as Word and audio-book, others did not mention any alternatives.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Studying (graphics)
- Exams

Several participants mentioned the usefulness of the material for exams and academic tasks such as assignments. One participant specifically mentioned the usefulness of the material for studying graphics.

5. What are the advantages and disadvantages of this form of material?

Based on the responses of the participants, the advantages and disadvantages of the form of material are as follows:

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- Advantages:
- Ease of navigation.
- Clear images and font.
- Underlining and navigation bar.
- Availability on mobile phones.
- Disadvantages:
- Lack of ability to make changes to the text.
- Lack of page numbering.
- Inability to add a page.

Overall, it can be concluded that the form of material has both advantages and disadvantages depending on the user's preferences and needs.

### Usability Questionnaire

1. How accessible is the material? - The average response is 9.2 out of 10, indicating that the participants found the material to be highly accessible.
2. How difficult was it for you to use it? - The average response is 2.4 out of 10, indicating that the participants did not find the material very difficult to use.
3. To what extent is training required to be able to use it? - The average response is 4 out of 10, indicating that some training may be required to use the material effectively, but the majority of participants found it relatively easy to use.
4. Would you use it if it was available to you? - The average response is 8.8 out of 10, indicating that the participants would be likely to use the material if it was available to them.
5. Would you recommend others to use it? - The average response is 8.2 out of 10, indicating that the participants would be likely to recommend the material to others.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7.6 out of 10, indicating that the participants believe the material has the potential to fill gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 7.4 out of 10, indicating that while the information/knowledge provided by the material may be available elsewhere, it may not be as easily accessible or comprehensive.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 9.2 out of 10, indicating that the participants believe the material successfully meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 9 out of 10, indicating that the participants believe the material would be highly useful for their university studies.
10. How tedious is the material? - The average response is 3.6 out of 10, indicating that the participants did not find the material to be very tedious.
11. How complex and complicated is the material? - The average response is 4.2 out of 10, indicating that the participants did not find the material to be very complex or complicated.
12. How much load (memory and attention) does the material's use require? - The average response is 5.2 out of 10, indicating that the participants found the material to require some degree of memory and attention, but not excessively so.
13. How satisfied are you with the use of this material? - The average response is 8.6 out of 10, indicating that the participants were generally satisfied with the use of the material.

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## Scenarios

Tables 18-21 provide information on the results of an assessment of five participants' completion of a task involving a ePub Samplebook.

The Table 18 shows that all five participants were successful in completing the task "Find from the section 'Recent Theoretical Approaches' the subsection 'Developmental Neuroscience'". Three participants completed the task without any help, while one participant completed it with help and one interruption. The time it took to complete the task varied widely, from 28 seconds to 658 seconds, with an average completion time of 183.2 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	53	No	0
P2	success	With help	658	Yes (by help)	1
P3	success	Without help	128	No	0
P4	success	Without help	28	No	0
P5	success	Without help	49	No	0

Table 18. First task from ePub - Samplebook

The Table 19 displays that all five participants were successful in completing the task "Go to the subsection 'Ethology and Evolutionary Developmental Psychology', read the first three sentences of this subsection ('Ethology deals with... its modern foundations') and identify whether any of these sentences have been marked as important by the author." The time to complete the task varied widely, ranging from 45 seconds to 384 seconds, with an average time of 188.6 seconds. Two participants interrupted themselves or received help once, while the remaining participants completed the task without any interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	384	Yes (by help)	1
P2	success	Without help	45	No	0
P3	success	Without help	302	Yes (by help)	1
P4	success	Without help	138	No	0
P5	success	Without help	74	No	0

Table 19. Second task from ePub - Samplebook

Table 20 shows the results of the third task "Find in the subsection 'Information Processing' the beginning and the end of figure 1.4." All five participants in this task were successful in solving the problem without help, and none of them interrupted themselves or were interrupted by help. The average time taken to solve the problem was 94.6 seconds, with a range of 53 seconds to 178 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	62	No	0
P2	success	Without help	178	No	0
P3	success	Without help	53	No	0
P4	success	Without help	77	No	0
P5	success	Without help	103	No	0

Table 20. Third task from ePub - Samplebook

Table 21 shows the results of the fourth task "Go to the section 'Example 6: Column Graph', and find the alternative text, the caption, and the verbal description of the image." All participants completed the task successfully and without interruptions from help. Therefore, the times of interruption column is zero for all participants. The average time taken to solve the problem was 222.2 seconds, with a range of 83 seconds to 410 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	83	No	0
P2	success	Without help	410	No	0
P3	success	Without help	125	No	0
P4	success	Without help	316	No	0
P5	success	Without help	177	No	0

Table 21. Fourth task from ePub - Samplebook

### Independent exploration

The participants were pointing out that the ePub Thorium reader, which is a reading application for ePub books, consistently uses the word "caption" when referring to captions, which is a correct and appropriate term to use. The use of the term "caption" when referring to a caption seems to be appreciated by the participants, perhaps indicating that the use of clear and accurate terminology in instructional materials is important to them.

## Semi-structured interview

The semi-structured interview consisted of 6 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- The participants' evaluations of the material are mostly positive, but with some variation in the degree of positivity and recognition of negative aspects.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Navigation:** Participants would change the navigation to the contents as they find it difficult to use, would change the page numbering. Also, some participants mentioned the importance of having an asterisk at the beginning of an important sentence.
- **Visual elements.** Participants would keep the bullets and the mention of the word "caption" from the screen reader at the time it reads the image caption. They suggested changing the images at the end of each chapter and mentioned not liking the font used in the material.
- **General structure.** Participants would change the page numbering, color loss in the important sentence and the bold writing which doesn't look good.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Preferred Alternative Formats:** Respondents preferred other formats such as DAISY, Word or even Wordpad, PDF.
- **No Preference.**

Overall, the respondents expressed a preference for having the material available in multiple formats, with the most commonly mentioned formats being DAISY and Word. One respondent (P4) did not express a preference for any specific formats but indicated that having the material available in multiple formats was desirable.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Reading
- Exams

The participants mentioned different ways in which the material could be helpful during their university studies.

5. What are the advantages and disadvantages of this form of material?

Based on the responses of the participants, the advantages and disadvantages of the form of material are as follows:

- Advantages:
- Easily used on mobile devices.
- Small file format easily readable on a portable device.
- Uses the word "caption" when referring to image captions.
- Modern and visual appealing appearance.

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- Disadvantages:
- Cannot edit the text.
- Navigation can be difficult and requires a combination of movements.
- Writing the beginning of the image on one page and moving the image to the next page.
- Absence of pages.

Overall, the advantages and disadvantages suggest that the material format may be suitable for certain purposes and preferences, but not necessarily for everyone or every use case.

#### 6. What are the advantages and disadvantages of each alternative form/ format of material?

##### Word

- Advantages:
- Ability to edit text.
- Notes at the end of each page.
- Automatic page numbering.
- “Traditionally super accessible”.
- Easy navigation (especially compared to Epub).
- Disadvantages:
- Cannot be read correctly on mobile (e.g., bullet points).

##### DAISY

- Advantages:
- Notes at the end of the book.
- Clear images and content more accessible than the other two formats.
- Easier navigation compared to Epub.
- Structure of the navigation bar compared to word, ePub.
- Disadvantages:
- Footnotes at the end of the book
- Does not have page numbering within the text.
- Inability to edit the book.

##### ePub

- Advantages:
- Specifies dots and captions.
- Disadvantages:
- Lags in navigation
- Requires more training to navigate
- Bold writing doesn't stand out
- Images and numbering are not clear.

#### Usability Questionnaire

1. How accessible is the material? - The average response is 7.0 out of 10, indicating that the participants generally found the material to be reasonably accessible.
2. How difficult was it for you to use it? - The average response is 5.2 out of 10, suggesting that the participants did not find the material overly difficult to use.
3. To what extent is training required to be able to use it? - The average response is 6.0 out of 10, indicating that the participants believed that some level of training may be necessary to use the material effectively.

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4. Would you use it if it was available to you? - The average response is 6.2 out of 10, implying that the participants showed a moderate inclination to use the material if it was accessible to them.
5. Would you recommend others to use it? - The average response is 6.4 out of 10, suggesting that the participants were somewhat inclined to recommend the material to others.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 5.8 out of 10, indicating that the participants had mixed opinions on the material's ability to fill existing knowledge gaps.
7. Could you obtain the information/ knowledge provided by this material in another way? - The average response is 9.6 out of 10, suggesting that the participants believed it would be challenging to obtain the same information/knowledge through alternative means.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 7.0 out of 10, indicating that the participants generally felt that the material fulfilled its intended purpose.
9. How useful would this material be for your university studies? - The average response is 6.8 out of 10, suggesting that the participants perceived the material to be moderately useful for their university studies.
10. How tedious is the material? - The average response is 5.0 out of 10, implying that the participants did not find the material excessively tedious.
11. How complex and complicated is the material? - The average response is 5.0 out of 10, indicating that the participants had a neutral perception of the material's complexity and complication level.
12. How much load (memory and attention) does the material's use require? - The average response is 5.8 out of 10, suggesting that the participants believed the material's use required a moderate amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 6.4 out of 10, indicating that the participants expressed a moderate level of satisfaction with the use of the material.

#### *Power Point presentation*

#### **Scenarios**

Tables 22-26 provides information on the results of an assessment of four participants' completion of a task involving a Power Point presentation. Participant 5 did not complete the task, so there are no results recorded for them.

The Table 22 shows the results of the first task from Power Point for four participants. Four participants were successful in completing the task "Find the table that is in the presentation", with three of them completing it without any help. The time taken to complete the task varied widely, ranging from 5 seconds to 266 seconds, with an average completion time of 115.75 seconds. Only one participant required help to complete the task, and they interrupted once to receive help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	39	No	0
P2	success	With help	153	Yes (by	1

				help)	
P3	success	Without help	266	No	0
P4	success	Without help	5	No	0

Table 22. First task from Power Point

The Table 23 shows that all four participants were successful in completing the task "Find slide 2" and without any help. The completion time ranged from 5 seconds to 27 seconds, with an average completion time of 12 seconds. There were no interruptions in the completion of the task, indicating that the participants were able to complete it smoothly without requiring additional assistance or stopping to find a solution.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	27	No	0
P2	success	Without help	10	No	0
P3	success	Without help	5	No	0
P4	success	Without help	6	No	0

Table 23. Second task from Power Point

Table 24 shows the results of the third task " Find all the images that exist in the presentation.". All four participants were successful in completing the task without help, with completion times ranging from 7 to 128 seconds. The average completion time for the task is 71.5 seconds. No interruptions were recorded for any of the participants, meaning they completed the task without any external help or guidance.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	101	No	0
P2	success	Without help	50	No	0
P3	success	Without help	128	No	0
P4	success	Without help	7	No	0

Table 24. Third task from Power Point

Table 25 shows the results of the fourth task "Find the slide that has the title "Genetic Bases". The fourth task from Power Point had four participants who all succeeded in completing the task without help. The time taken to complete the task ranged from 22 seconds to 72 seconds, with an average time of 37 seconds. There were no interruptions during the task for any of the participants.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	27	No	0
P2	success	Without help	27	No	0
P3	success	Without help	72	No	0
P4	success	Without help	22	No	0

Table 25. Fourth task from Power Point

Table 26 shows the results of the fifth task "Find on which slides there is numbering of dots". All participants were successful in completing the task without any help. The time taken to complete the task ranged from 24 seconds to 52 seconds. The average time taken was around 40 seconds. There were no interruptions during the task for any of the participants.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	34	No	0
P2	success	Without help	50	No	0
P3	success	Without help	52	No	0
P4	success	Without help	24	No	0

Table 26. Fifth task from Power Point

### Independent exploration

During the independent exploration of the Power Point (ppt) material, the answers of the participants can be broadly classified into four main themes:

- **Accessibility:** Participants expressed surprise that the ppt was accessible and praised its ability to describe images.
- **Usefulness:** Participants found the ppt to be very helpful, indicating that it fulfilled its purpose.
- **Navigation:** Minor technical navigation issues arise because participants are not familiar with the use of this particular material.
- **Overall evaluation:** Participants provided an overall positive evaluation of the ppt, using the phrases "I really liked" and describing it as "very good."

### Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants evaluated the material positively.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Positive evaluation of the material:** “It is useful”, “it is helpful”.
- **Keeping the material as it is:** “I wouldn’t change anything”, “I would keep the existing format”.
- **Keeping most of the material, but making a minor change:** For example, changing the background color to gray.
- **Suggestion to improve the material:** For example, making the table more recognizable, like in Word.

All participants had a positive evaluation of the material and were generally satisfied with it. It seems that the material was well-received by the participants and met their expectations.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative formats:** All four participants mentioned that they could obtain the same information or knowledge provided by the material using a Word document. One participant also mentioned the possibility of using a PDF document. The main reason for preferring Word was the participants' familiarity with the program.

The participants seem to value the flexibility and familiarity of Word documents over the specific format of the provided educational material.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Studying
- Exams

Overall, the participants found the material to be useful in various academic contexts, such as presentations, assignments, exams, studying, and as supplementary material in education. One participant had a more specific application in mind, using the material for presenting a project or a thesis.

5. What are the advantages and disadvantages of this form of material?

Based on the responses of the participants, the advantages and disadvantages of the form of material are as follows:

- Advantages:
- Clear images and font.
- Creating a list is helpful.
- Ability to have the main points from a material.
- Ability to insert audio, text, video and present it.
- Ability to play with shapes and make it as accessible as you want in terms of image.
- Bullets, numbering, and generally lists facilitate.
- Disadvantages:
- Lack of ability to make changes to the text

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Overall, the participants mentioned more advantages than disadvantages of this form of material. One participant also mentioned not being familiar enough with some features such as alternative text for images.

### Usability Questionnaire

1. How accessible is the material? - The average response is 8.25 out of 10, indicating that the participants found the material to be quite accessible.
2. How difficult was it for you to use it? - The average response is 3.5 out of 10, indicating that the participants did not find the material very difficult to use.
3. To what extent is training required to be able to use it? - The average response is 4.75 out of 10, indicating that some level of training may be required to use the material effectively.
4. Would you use it if it was available to you? - The average response is 8.75 out of 10, indicating that the participants would be likely to use the material if it was available to them.
5. Would you recommend others to use it? - The average response is 8.75 out of 10, indicating that the participants would be likely to recommend the material to others.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 8 out of 10, indicating that the participants believe the material has the potential to fill gaps in knowledge.
7. Could you obtain the information/ knowledge provided by this material in another way? - The average response is 6.75 out of 10, indicating that some participants believe the information could be obtained through other means.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 9 out of 10, indicating that the participants believe the material is successful in meeting its purpose.
9. How useful would this material be for your university studies? - The average response is 9 out of 10, indicating that the participants believe the material would be quite useful for their university studies.
10. How tedious is the material? - The average response is 3.25 out of 10, indicating that the participants did not find the material very tedious.
11. How complex and complicated is the material? - The average response is 4 out of 10, indicating that the participants did not find the material very complex or complicated.
12. How much load (memory and attention) does the material's use require? - The average response is 6 out of 10, indicating that the participants found the material to require some level of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 8.5 out of 10, indicating that the participants were generally satisfied with the use of the material.

### Verbal descriptions

#### Scenarios

Tables 27-32 provide information on the results of an assessment of five participants' completion of a task involving verbal descriptions of images.

The Table 27 shows the results of the first verbal description of images. Six participants were successful in completing the task "Go to image 1. Listen to it as many times as you need. Then, describe to us what is in the image.", completing it without any help. The range of time taken by the participants to provide the first image is from 36 to 120 seconds. The average time taken by the participants to provide the first image is 74.5 seconds. None of the participants required any

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interruption for solution either by themselves or with help. Therefore, the times of interruption are all zero.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	65	No	0
P2	success	Without help	62	No	0
P3	success	Without help	54	No	0
P4	success	Without help	110	No	0
P6	success	Without help	36	No	0
P8	success	Without help	120	No	0

Table 27. First image from verbal description of the images

The Table 28 displays that all six participants were successful in completing the task " Go to image 2. Listen to it as many times as you need. Then, describe to us what is in the image.". The time to complete the task varied widely, ranging from 21 seconds to 109 seconds, with an average time of 48.5 seconds. None of the participants required any interruption for solution either by themselves or with help, so the times of interruption are all zero.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	109	No	0
P2	success	Without help	54	No	0
P3	success	Without help	37	No	0
P4	success	Without help	21	No	0
P6	success	Without help	45	No	0
P8	success	Without help	25	No	0

Table 28. Second image from verbal description of the images

Table 29 shows the results of the third task " Go to image 3. Listen to it as many times as you need. Then, describe to us what is in the image.". All six participants were successful in completing the task without help, with completion times ranging from 38 to 300 seconds. The average completion time for the task is 118.5 seconds. No interruptions were recorded for any of the participants, meaning they completed the task without any external help or guidance.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	133	No	0
P2	success	Without help	85	No	0
P3	success	Without help	56	No	0
P4	success	Without help	38	No	0
P6	success	Without help	300	No	0
P8	success	Without help	99	No	0

Table 29. Third image from verbal description of the images

Table 30 shows the results of the fourth task "Go to image 4. Listen to it as many times as you need. Then, describe to us what is in the image". The fourth task from Power Point had six participants who all succeeded in completing the task without help. The time taken to complete the task ranged from 34 seconds to 482 seconds, with an average time of 146.3 seconds. There were no interruptions during the task for any of the participants.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	96	No	0
P2	success	Without help	79	No	0
P3	success	Without help	88	No	0
P4	success	Without help	34	No	0
P6	success	Without help	482	No	0
P8	success	Without help	99	No	0

Table 30. Fourth image from verbal description of the images

Table 31 shows the results of the fifth task "Go to image 5. Listen to it as many times as you need. Then, describe to us what is in the image.". All participants were successful in completing the task with no interruptions or help needed for any of them. The time to complete the task ranged from 12 seconds to 173 seconds, with an average time of 50.1 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	23	No	0
P2	success	Without help	33	No	0
P3	success	Without help	12	No	0

P4	success	Without help	36	No	0
P6	success	Without help	173	No	0
P8	success	Without help	24	No	0

Table 31. Fifth image from verbal description of the images

Table 32 shows the results of the fifth task "Go to image 5. Listen to it as many times as you need. Then, describe to us what is in the image.". All participants were successful in completing the task without any help. The time taken to complete the task ranged from 20 seconds to 345 seconds. The average time taken was 102.8 seconds. There were no interruptions during the task for any of the participants.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	80	No	0
P2	success	Without help	66	No	0
P3	success	Without help	66	No	0
P4	success	Without help	20	No	0
P6	success	Without help	345	No	0
P8	success	Without help	40	No	0

Table 32. Sixth image from verbal description of the images

### Comprehension questions

For each image, there were 2 to 3 comprehension questions. Regarding the participants' performance:

- Image 1: All participants answered correctly to both comprehension questions, which were: 1.1 "Which way is the discus thrower facing?" and 1.2 "Are the discus thrower's feet firmly on the ground?"
- Image 2: Five of the participants answered correctly to two of the three comprehension questions, while one participant answered correctly to all three questions, which were: 2.1 "Are the trends of both lines, Down syndrome and chromosomal abnormalities, increasing?", 2.2 "At what age does the risk for Down syndrome and chromosomal abnormalities increase rapidly?", and 2.3 "Based on the impact on births, is the risk for Down syndrome greater than the risk for chromosomal abnormalities?"
- Image 3: Three of the participants answered one of the two questions correctly, two participants answered both questions correctly, while one participant did not answer either of the questions, which were as follows: 3.1 Which areas of the cerebral cortex develop more rapidly? 3.2 What does the vertical axis indicate and what does the horizontal axis indicate?
- Image 4: All participants answered both of the following questions correctly: 4.1 Is the shape of the eye completely spherical? 4.2 Is the choroid located in the anterior or posterior part of the eye?
- Image 5: All participants answered both of the following questions correctly: 5.1 What is located around the nucleus? 5.2 What is the nucleus of an atom composed of?

- Image 6: All participants answered both of the following questions correctly: 6.1 Where is Jerusalem located on the map? 6.2 Where is Cappadocia located on the map?

### Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants evaluated the material positively.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Positive evaluation of the material:** “helpful”, “satisfied”.
- **Keeping most of the material, but making a minor change:** For example, “the text could be shorter”, “I would put less information”.

Overall, the participants evaluated the material positively, finding it helpful and informative. Most participants expressed a desire to keep most of the material as is, with some minor changes such as reducing the amount of information or removing specific details. These suggestions may reflect a preference for a more concise approach to presenting information.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative formats:** All participants mentioned that they could obtain the same information or knowledge provided by the material using audio-visual form (combined with verbal descriptions) or visual or audio form.

All participants suggested that audio-visual material (combined with verbal descriptions) would be the most effective alternative form for learning the content. Some participants specifically mentioned this form as their preferred option. One participant suggested that visual material could also be useful, but not in all cases, while other participant also mentioned that audio alone would be helpful for some topics.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Studying
- Exams
- Lectures
- In lessons that include graphs, for example, mathematics, statistics.

The participants have different ideas about where the material would be most helpful in their university studies. Some participants feel that the material would be most helpful in lectures, particularly in laboratory settings or in lessons such as mathematics. Other participants see the material as being useful for assignments and studying, they think the material would be useful for studying and exams.

5. What are the advantages and disadvantages of this form of material?

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Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
- **Detailed information and descriptions:** The material provides detailed information and descriptions, which some participants found very helpful in understanding the content.
- **Understandable and concise:** Some participants found the material easy to understand and concise, leaving no room for questions.
- **Provides the whole picture:** The material includes all the necessary information to understand the content.
- **The provision of immediate and fast information.**
- Disadvantages:
- **Too much information:** Some participants found the descriptions to be too long and detailed, making it tiresome and overwhelming.
- **Complex graphs:** Some participants found the graphs to be too complex, making the description more difficult to understand.
- **Unnecessary information:** Some participants found some of the information to be unnecessary or not useful.

In general, the participants seemed to appreciate the detailed information and descriptions provided by the material, but some found it overwhelming or unnecessary.

#### Usability Questionnaire

1. How accessible is the material? - The average response is 8.8 out of 10, indicating that the participants found the material to be highly accessible.
2. How difficult was it for you to use it? - The average response is 1.4 out of 10, indicating that the participants did not find the material difficult to use.
3. To what extent is training required to be able to use it? - The average response is 2 out of 10, indicating that the participants did not believe that extensive training was required to use the material.
4. Would you use it if it was available to you? - The average response is 9.6 out of 10, indicating that the participants would use the material if it was available to them.
5. Would you recommend others to use it? - The average response is 9.4 out of 10, indicating that the participants would highly recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 8.8 out of 10, indicating that the participants believed the material would fill gaps in their knowledge to a high extent.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 6.2 out of 10, indicating that some participants believed that they could obtain the information provided by the material in other ways.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 8.2 out of 10, indicating that the participants believed the material successfully meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 9 out of 10, indicating that the participants found the material to be highly useful for their university studies.
10. How tedious is the material? - The average response is 3.2 out of 10, indicating that the participants did not find the material to be very tedious.

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11. How complex and complicated is the material? - The average response is 3.8 out of 10, indicating that the participants did not find the material to be very complex or complicated.
12. How much load (memory and attention) does the material's use require? - The average response is 7 out of 10, indicating that some participants found the material to require a moderate amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 8.8 out of 10, indicating that the participants were highly satisfied with the use of the material.

### Comprehension questions

Comprehension questions were asked to the research participants (P1, P2, P4, P5, P7, P8), after watching the video. Most participants (4 out of 6) answered correctly to both comprehension questions, while two participants answered correctly to one of the questions. The questions were the following: Q1: In what space is the man when he starts talking? Q2: What is inside the man's head? How would you describe it?

In addition, three out of the six participants preferred to watch the video first and then listen to the accompanying word file, with the visual description of the video, while the other three did it the other way around (first the word file, that is the visual description, and then the video).

### Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants evaluated the material positively. The majority of the participants found the material useful and informative, with clear descriptions and helpful visuals.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Positive evaluation of the material:** All participants expressed a positive evaluation of the material.
- **Audio description to the video:** Some participants suggested minor changes to the material. For example, they suggested adding an audio description to the video and so, removing the accompanying Word file ("The video was good, but the Word file was tiresome. It reads the words from the video and the words from the description, so it was a bit tiring. Especially if the video was longer, it would create a problem. I would prefer if it was simultaneous, a video that has an integrated audio description.").
- **Reader screen description:** Some participants suggested changing the reader screen description in the table of the Word document (column 1, row 1, column 1 row 2, etc.).

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative format:** Participants suggest improvements to the material, such as embedding the description of the image in the video or providing the description without the need for accompanying text.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Exams
- Lectures

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Most participants found the material helpful in the context of lectures or presentations where movies or videos are shown. Some participants also found it useful for research or information search, while one participant found it helpful for assignments and exams.

#### 5. What are the advantages and disadvantages of this form of material?

Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
- **Provides detailed information and descriptions:** Participants found that the material provides detailed information and descriptions that can be helpful in understanding the content.
- **Allows for better understanding:** Some participants found that the material helped them understand things that they may not have noticed in the video alone.
- **Helps with research and information search:** Participants found the material useful for research and information search.
- Disadvantages:
- **Requires focus and attention:** Some participants found that the material requires focus and attention to fully understand the information provided.
- **Distracting or tiresome:** Some participants found that the material can be distracting or tiresome, especially when listening to the description and watching the video separately.
- **Disrupts the flow of the video:** Some participants found that the accompanying file disrupts the flow of the video, and would prefer it to be embedded in the original video.
- **Screen reader can be confusing:** Some participants found the screen reader description (such as "row 1, row 2") to be confusing or tiresome.

Overall, the participants generally found the material to be useful and informative, but noted that it may require additional focus and attention to fully understand the information provided. They also suggested that improvements could be made to make the material less distracting and more seamlessly integrated into the original video.

#### Usability Questionnaire

The usability questionnaire was completed by 7 participants (P1, P2, P3, P4, P5, P7, P8).

1. How accessible is the material? - The average response is 9.5 out of 10, indicating that the participants found the material to be highly accessible.
2. How difficult was it for you to use it? - The average response is 1.5 out of 10, indicating that the participants did not find the material difficult to use.
3. To what extent is training required to be able to use it? - The average response is 2.2 out of 5, indicating that the participants felt that some level of training may be required to use the material.
4. Would you use it if it was available to you? - The average response is 7.5 out of 10, indicating that the participants would likely use the material if it were available to them.
5. Would you recommend others to use it? - The average response is 8.5 out of 10, indicating that the participants would likely recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7 out of 10, indicating that the participants have varying opinions on how well the material fills gaps in their knowledge.

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7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 5.5 out of 10, indicating that the participants felt that some of the information in the material could be obtained elsewhere.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 8.2 out of 10, indicating that the participants generally felt that the material meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 6.7 out of 10, indicating that the participants had mixed opinions on the usefulness of the material for their university studies.
10. How tedious is the material? - The average response is 2.8 out of 10, indicating that the participants did not find the material tedious.
11. How complex and complicated is the material? - The average response is 2.1 out of 10, indicating that the participants did not find the material complex and complicated.
12. How much load (memory and attention) does the material's use require? - The average response is 3.4 out of 10, indicating that the participants did not find the material to require a significant amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 8.4 out of 10, indicating that the participants were generally satisfied with the use of the material.

#### *Tactile microcapsule*

Tactile microcapsule was as an education tool in 6 subjects of knowledge (Discobolus, Chromosomal abnormalities, Brain development, Eye, Atom and Byzantine empire). Each had three tasks, along with two comprehension questions. Tasks were marked with "Success" if completed successfully and "Unsuccess" if they were not. Time spent in each task, the existence of interruptions and their duration and the need of additional help were also collected as data. Every subject is presented in four tables below (Tables 1 to 24 present Tasks 1 to 3 and comprehension questions for every subject).

#### **Scenarios**

##### *Discobolus*

In task 1 (Locate the disc), 5 participants were successful in completing it in 10 to 72 seconds, while 1 participant was unsuccessful. 4 participants did not require any help. No interruptions were documented in this task.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	36	No	0
P2	Success	Without help	10	No	0
P3	Success	Without help	62	No	0
P6	Success	Without	72	No	0
P8	Unsuccess	-	-	-	-

Table 33. First task from TACTILE MICROCAPSULE (Discobolus)

Task 3 (Locate the head of the discobolus) was successfully completed by everyone, in an average of 7.4 second (Range: 1-30). 2 participants required help and there were no interruptions

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	1	No	0
P2	Success	Without	4	No	0
P3	Success	Without help	30	No	0
P6	Success	Without	1	No	0
P8	Success	Without	1	No	0

Table 34: Second task from TACTILE MICROCAPSULE (Discobolus)

In task 3 (locate the torso of his body) only one participant was not successful. Average completion time was 33.5 seconds (Range: 5-102), 2 participants needed help and no interruptions were made.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	9	No	0
P2	Success	Without help	102	No	0
P3	Unsuccess	-	-	-	-
P6	Success	Without	18	No	0
P8	Success	Without	5	No	0

Table 35. Third task from TACTILE MICROCAPSULE (Discobolus)

Every participant answered correctly to both comprehension questions (Which way has the discobolus turned his back? Does the Discobolus his feet firmly on the ground?).

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Wrong	Correct
P3	Wrong	Correct
P6	Wrong	Correct
P8	Correct	Correct

Table 36. Comprehension questions (Discobolus)

#### *Chromosomal abnormalities*

In Task 1 (Locate the line representing Down's syndrome.) only one participant was successful, without help, in 2 seconds and with no interruption.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	2	No	0
P2	Unsuccess	-	-	-	-
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Unsuccess	-	-	-	-

Table 37. First task from TACTILE MICROCAPSULE (Chromosomal abnormalities)

4 participants were successful without help in task 2 (Locate the mother's age at 35 years). They needed 2 to 75 seconds without help or interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	2	No	0
P2	Success	Without help	2	No	0
P3	Success	Without help	75	No	0
P6	Success	Without help	15	No	0
P8	Unsuccess	-	-	-	-

Table 38. Second task from TACTILE MICROCAPSULE (Chromosomal abnormalities)

All participants were successful in Task 3 (Locate the horizontal axis), in 1 to 38 seconds. One participant had 1 interruption by himself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	2	No	0
P2	Success	Without help	1	No	0
P3	Success	Without help	8	No	0
P6	Success	With	38	Yes By himself	1
P8	Success	Without help	2	No	0

Table 39. Third task from TACTILE MICROCAPSULE (Chromosomal abnormalities)

One participant answer correctly to all questions (Is the course of both lines, Down syndrome and chromosomal abnormalities, upward? From what age onwards does the risk of Down's syndrome and chromosomal abnormalities increase rapidly? On a per-birth impact basis, is the risk for Down

syndrome greater than the risk for chromosomal abnormalities?). The others were correct in the first and wrong to the second two questions.

Participants	Question 1	Question 2	Question 3
P1	Correct	Correct	Correct
P2	Correct	Wrong	Wrong
P3	Correct	Wrong	Wrong
P6	Correct	Wrong	Wrong
P8	Correct	Wrong	Wrong

Table 40. Comprehension questions (Chromosomal abnormalities)

### *Brain development*

In the first task (Locate the line representing the auditory and visual areas of the cerebral cortex), 4 participants were successful, 2 with help, in 16 to 150 seconds. 1 had a single interruption by himself and another interrupted twice by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without	48	NO	0
P2	Success	With help	150	Yes by herself	1
P3	Unsuccess	-	-	-	-
P6	Success	Without	16	No	0
P8	Success	With	64	Yes by help	2

Table 41. First task from TACTILE MICROCAPSULE (Brain Development)

All were successful in the second task (Locate the line representing the prefrontal cortex), 3 of them without help, in 2 to 184 seconds. 2 participants had one interruption each.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without	2	No	0
P2	Success	Without	40	No	0
P3	Success	With help	184	Yes by himself	1
P6	Success	Without	38	No	0
P8	Success	With	19	Yes by help	0

Table 42. Second task from TACTILE MICROCAPSULE (Brain Development)

In the third task only 2 participants were successful without help in 48 to 100 seconds. There was no interruption documented.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Unsuccess	-	7	No	0
P2	Success	Without	100	No	0
P3	Success	Without	48	No	0
P6	Unsuccess	-	-	-	-
P8	Unsuccess	-	-	-	-

Table 43. Third task from TACTILE MICROCAPSULE (Brain Development)

Only one participant answered correctly to both comprehension questions (Which areas of the cerebral cortex are growing fastest? What does the vertical axis and the horizontal axis indicate?). In summary, 3 were correct in the first and 2 in the second question.

Participants	Question 1	Question 2
P1	Wrong	Correct
P2	Correct	Correct
P3	Correct	Wrong
P6	Correct	Wrong
P8	Wrong	Wrong

Table 44. Comprehension questions (Brain Development)

### Eye

4 participants were successful in the first task (Locate the iris) in 63 to 214 seconds. One required help and totally 3 participants interrupted (1 of them twice).

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	With	95	Yes By help	1
P2	Success	Without	214	Yes By herself	2
P3	Success	Without	63	No	0
P6	Success	Without	90	Yes By himself	1
P8	Unsuccess	-	-	-	-

Table 45. First task from TACTILE MICROCAPSULE (Eye)

Again, 4 participants were successful in 13 to 150 seconds in the second task (Locate the optic nerve). 1 had a single interruption by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	13	No	0
P2	Success	Without help	90	Yes by help	1
P3	Success	Without help	14	No	0
P6	Success	Without help	150	No	0
P8	Unsuccess	-	-	-	-

Table 46. Second task from TACTILE MICROCAPSULE (Eye)

The same 4 participants were successful in the third task (Locate the pupil.) in 11 to 81 seconds without help or interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	11	No	0
P2	Success	Without help	81	No	0
P3	Success	Without help	15	No	0
P6	Success	Without help	44	No	0
P8	Unsuccess	-	-	-	-

Table 47. Third task from TACTILE MICROCAPSULE (Eye)

All 5 participants answered correctly to both questions (Is the shape of the eye completely spherical? Is the retina located in the anterior or posterior part of the eye?).

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Correct	Correct
P3	Correct	Correct
P6	Correct	Correct
P8	Correct	Correct

Table 48. Comprehension questions (Eye)

#### Atom

3 participants were successful in the first task (Locate the core), in 1 to 33 seconds, without help or interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	1	No	0
P2	Success	Without help	18	No	0
P3	Unsuccess	-	-	-	-
P6	Success	Without help	33	No	0
P8	Unsuccess	-	-	-	-

Table 49. First task from TACTILE MICROCAPSULE (Atom)

Only 1 participant was successful in the second task (Locate the electrons and protons) in 38 second by using help and having one interruption.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	With	38	Yes by help	1
P2	Unsuccess	-	-	-	-
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Unsuccess	-	-	-	-

Table 50. Second task from TACTILE MICROCAPSULE (Atom)

3 were successful in the third task (Locate the electron orbits) in 5 to 30 seconds. One participant used help and had one interruption by himself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	5	No	0
P2	Unsuccess	-	-	-	-
P3	Unsuccess	-	-	-	-
P6	Success	Without help	14	No	0
P8	Success	Without help	30	Yes by himself	1

Table 51. Third task from TACTILE MICROCAPSULE (Atom)

All participants answered correctly in both questions (What's floating around the core? What is the nucleus of the atom made of?).



Participants	Question 1	Question 2
P1	Correct	Correct
P2	Correct	Correct
P3	Correct	Correct
P6	Correct	Correct
P8	Correct	Correct

Table 52. Comprehension questions (Atom)

### *Byzantine empire*

4 participants were successful in the first task (Locate Constantinople), without help, in 54 to 398 seconds. 2 of them had one interruption each by themselves.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	119	Yes By himself	1
P2	Success	Without help	398	No	0
P3	Success	Without help	54	No	0
P6	Success	Without help	103	Yes By himself	1
P8	Unsuccess	-	-	-	-

Table 53. First task from TACTILE MICROCAPSULE (Byzantine empire)

The same 4 participants successfully completed the second task (Locate Spain), without help, in 10 to 137 seconds. 1 was interrupted once by him/herself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	78	Yes by himself	1
P2	Success	Without help	137	No	0
P3	Success	Without help	10	No	0
P6	Success	Without help	119	No	0
P8	Unsuccess	-	-	-	-

Table 54. Second task from TACTILE MICROCAPSULE (Byzantine empire)

The third task (Locate Tangier area) was also successfully completed by the same 4 participants, without help, in 2 to 162 seconds, without help or interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	30	No	0
P2	Success	Without help	93	No	0
P3	Success	Without help	2	No	0
P6	Success	Without help	162	No	0
P8	Unsuccess	-	-	-	-

Table 55. Third task from TACTILE MICROCAPSULE (Byzantine empire)

3 participants answered correctly to both questions (Where on the map is Jerusalem located? Where on the map is Cappadocia?) and 2 answered wrong.

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Wrong	Wrong
P3	Correct	Correct
P6	Correct	Correct
P8	Wrong	Wrong

Table 56. Comprehension questions (Byzantine empire)

### Semi-structured interview

The answers in the five questions are presented below.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants evaluated the material positively.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Positive evaluation of the material:** 3 participants mentioned understandable graph details and one found the different textures in the various surface areas helpful.
- **Suggested changes:** There were 3 mentions for small signs and the need for more texture and the addition of legends with descriptions. One participant suggested to divide the material in smaller parts.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative format:** All suggested audio-tactile and/or verbal description. One also suggested tiger prints.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

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- 3 answered in lectures and 2 in homework.
- Courses with diagrams
- Practical courses
- Books, signs for moving around the university

#### 5. What are the advantages and disadvantages of this form of material?

Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
- Understandable
- Accessible
- Detailed
- Disadvantages:
- Need for familiarization with the material
- Less distinguishable than tiger prints
- Texts too close to each other.

#### Usability Questionnaire

1. How accessible is the material? - The average response is 8 out of 10, indicating that the participants found the material to be very accessible.
2. How difficult was it for you to use it? - The average response is 5.8 out of 10, indicating that the participants had some difficulties in using it.
3. To what extent is training required to be able to use it? - The average response is 5.4 out of 10, indicating that the participants felt that some level of training may be required to use the material.
4. Would you use it if it was available to you? - The average response is 7 out of 10, indicating that the participants would likely use the material if it were available to them.
5. Would you recommend others to use it? - The average response is 9.4 out of 10, indicating that the participants would very likely recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7.6 out of 10, indicating that the participants believe that the material fills gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 8.4 out of 10, indicating that the participants felt that many of the information in the material could be obtained elsewhere.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 7.2 out of 10, indicating that the participants generally felt that the material meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 7 out of 10, indicating that the participants believe the material is useful for their university studies.
10. How tedious is the material? - The average response is 5 out of 10, indicating that some participants found the material tedious and some did not.
11. How complex and complicated is the material? - The average response is 5.4 out of 10, indicating that the participants had mixed opinions on the complexity and complication of the material.

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12. How much load (memory and attention) does the material's use require? - The average response is 7.2 out of 10, indicating that the participants believe that the material requires a significant amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 7.2 out of 10, indicating that the participants were generally satisfied with the use of the material.

### *Tactile tiger prints*

#### **Scenarios**

##### *Discobolus*

In the first task (Locate the disc) 3 participants were successful, without help, in 1 to 93 seconds, without interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without	93	No	0
P2	Success	Without	6	No	0
P3	Unsuccess	-	-	-	-
P6	Success	Without	1	No	0
P8	Unsuccess	-	-	-	-

Table 57. First task from TACTILE TIGER (Discobolus)

All were successful in the second task (Locate the head of the Discobolus), in 1 to 90 seconds, without help. One participant had 2 interruptions by him/herself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without	90	Yes (by himself)	2
P2	Success	Without	3	No	0
P3	Success	Without	2	No	0
P6	Success	Without	1	No	0
P8	Success	Without	1	No	0

Table 58. Second task from TACTILE TIGER (Discobolus)

Only 2 participants were successful in the third task (Locate the torso of his body.), without help, in 2 to 7 seconds, without interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Unsuccess	-	2	No	0
P2	Success	Without	7	No	0
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Success	Without	2	No	0

Table 59. Third task from TACTILE TIGER (Discobolus)

2 participants answered correctly to both questions. Totally, 2 were correct in the first question and 5 were correct in the second.

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Wrong	Correct
P3	Wrong	Correct
P6	Wrong	Correct
P8	Correct	Correct

Table 60. Comprehension questions (Discobolus)

#### *Chromosomal abnormalities*

In the first task (Locate the line representing Down's syndrome) 2 participants were successful. One without help in 1 second without interruptions. The other used help and completed the task in 236 seconds after 2 interruptions by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	1	No	0
P2	Success	With help	236	Yes by help	2
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Unsuccess	-	-	-	-

Table 61. First task from TACTILE TIGER (Chromosomal abnormalities)

In the second task (ate the mother's age at 35 years) 4 participants were successful, without help, in 2 to 45 seconds, without interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	2	No	0
P2	Success	Without help	45	No	0
P3	Success	Without help	2	No	0
P6	Success	Without help	7	No	0
P8	Unsuccess	-	-	-	-

Table 62. Second task from TACTILE TIGER (Chromosomal abnormalities)

In the third task (Locate the horizontal axis) all were successful, without help, in 1 to 14 seconds, with no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	2	No	0
P2	Success	Without help	14	No	0
P3	Success	Without help	1	No	0
P6	Success	Without help	1	No	0
P8	Success	Without help	10	No	0

Table 63. Third task from TACTILE TIGER (Chromosomal abnormalities)

3 answered correctly in the first comprehension question (Is the course of both lines, Down syndrome and chromosomal abnormalities, upward?), 1 in the second (From what age onwards does the risk of Down's syndrome and chromosomal abnormalities increase rapidly?) and the same one in the third (On a per-birth impact basis, is the risk for Down syndrome greater than the risk for chromosomal abnormalities?).

Participants	Question 1	Question 2	Question 3
P1	Wrong	Correct	Correct
P2	Wrong	Wrong	Wrong
P3	Correct	Wrong	Wrong
P6	Correct	Wrong	Wrong
P8	Correct	Wrong	Wrong

Table 64. Comprehension questions (Chromosomal abnormalities)

*Brain development*

2 were successful in the first task (Locate the line representing the auditory and visual areas of the cerebral cortex). One without help in 110 second and with no interruption. The other required help and completed in 16 seconds before one interruption by him/herself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without	110	No	0
P2	Unsuccess	-	-	-	-
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Success	With	16	Yes by help	1

Table 65. First task from TACTILE TIGER (Brain Development)

3 participants were successful in the second task (Locate the line representing the prefrontal cortex). Two of the without help in 1 to 36 seconds, without interruptions and 1 with help, in 97 seconds and 3 interruptions by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	1	No	0
P2	Success	Without help	36	No	0
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Success	With	97	Yes by help	3

Table 66. Second task from TACTILE TIGER (Brain Development)

All 5 participants were unsuccessful in the third task (Locate the line that represents the language areas of the cerebral cortex and shows the time of myelination).

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Unsuccess	-	1	0	0
P2	Unsuccess	-	-	-	-
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Unsuccess	-	-	-	-

Table 67. Third task from TACTILE TIGER (Brain Development)

3 were correct in the first comprehension question (h areas of the cerebral cortex are growing fastest?) and 2 answered correctly in the second (What does the vertical axis and the horizontal axis indicate?).

Participants	Question 1	Question 2
P1	Wrong	Correct
P2	Correct	Correct
P3	Correct	Wrong
P6	Wrong	Wrong
P8	Correct	Wrong

Table 68. Comprehension questions (Brain Development)

### Eye

4 participants were successful in the first task (Locate the iris) in 2 to 210 seconds. 1 required help and had one interruption by him/herself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	13	No	0
P2	Success	Without	60	No	0
P3	Success	Without	210	Yes By himself	1
P6	Success	Without	2	No	0
P8	Unsuccess	-	-	-	-

Table 69. First task from TACTILE TIGER (Eye)

The same 4 participants were successful in the second task (Locate the optic nerve), all without help, in 2 to 210 seconds. 1 of them had one interruption by him/herself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	8	No	0
P2	Success	Without help	76	No	0
P3	Success	Without help	70	No	0
P6	Success	Without help	2	No	0
P8	Unsuccess	-	-	-	-

Table 70. Second task from TACTILE TIGER (Eye)



Again, the 4 participants were also successful in the third task (Locate the pupil). 2 without help in 8 seconds with no interruptions. 2 required help and completed the task in 70 to 76 seconds without interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	8	No	0
P2	Success	Without	84	No	0
P3	Success	Without help	80	No	0
P6	Success	Without	8	No	0
P8	Unsuccess	-	-	-	-

Table 71. Third task from TACTILE TIGER (Eye)

All participants answered correctly in both comprehension questions.

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Correct	Correct
P3	Correct	Correct
P6	Correct	Correct
P8	Correct	Correct

Table 72. Comprehension questions (Eye)

#### Atom

Only 2 participants successfully completed the first task (Locate the core). One without help, in 21 seconds and no interruptions. The other with help, in 90 seconds and 2 interruptions by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	With	90	Yes by help	2
P2	Success	Without	21	No	0
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Unsuccess	-	-	-	-

Table 73. First task from TACTILE TIGER (Atom)

Only 1 participant was successful in the second task (Locate the electrons and protons), with help, in 200 seconds and 1 interruption by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Unsuccess	-	-	-	-
P2	Success	With	200	Yes by help	1
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Unsuccess	-	-	-	-

Table 74. Second task from TACTILE TIGER (Atom)

3 participants were successful in the third task (Locate the electron orbits). 2 of the without help in 2 to 20 seconds and no interruptions. 1 required help to complete the task in 270 seconds having 1 interruption by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	2	No	0
P2	Success	With help	270	Yes by help	1
P3	Unsuccess	-	-	-	-
P6	Unsuccess	-	-	-	-
P8	Success	Without help	20	No	0

Table 75. Third task from TACTILE TIGER (Atom)

All participants answered correctly in both comprehension questions.

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Correct	Correct
P3	Correct	Correct
P6	Correct	Correct
P8	Correct	Correct

Table 76. Comprehension questions (Atom)

### *Byzantine empire*

3 participants were successful in the first task (Locate Constantinople), without help, in 3 to 65 second and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	10	No	0
P2	Unsuccess	-	-	-	-
P3	Success	Without help	65	No	0
P6	Success	Without help	3	No	0
P8	Unsuccess	-	-	-	-

Table 77. First task from TACTILE TIGER (Byzantine empire)

4 participants were successful in the second task (Locate Spain), without help, in 5 to 58 second and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without Help	5	No	0
P2	Success	Without Help	41	No	0
P3	Success	Without Help	58	No	0
P6	Success	Without Help	26	No	0
P8	Unsuccess	-	-	-	-

Table 78. Second task from TACTILE TIGER (Byzantine empire)

3 were successful in the third task (Locate Tangier area), without help, in 1 to 7 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	1	No	0
P2	Unsuccess	-	-	-	-
P3	Success	Without help	7	No	0
P6	Success	Without help	1	No	0
P8	Unsuccess	-	-	-	-

Table 79. Third task from TACTILE TIGER (Byzantine empire)

3 answered correctly and 2 wrongly in both comprehension questions (Where on the map is Jerusalem located? Where on the map is Cappadocia?).

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Wrong	Wrong
P3	Correct	Correct
P6	Correct	Correct
P8	Wrong	Wrong

Table 80. Comprehension questions (Byzantine empire)

### Semi-structured interview

The answers in the five questions are presented below.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants evaluated the material positively.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Positive evaluation of the material:** 3 participants mentioned that the information was understandable.
- **Suggested changes:** Some mentioned that details were not clear and larger distance are needed between Braille symbols, and between details in diagrams.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative format:** All suggested audio, tactile or both and some suggested verbal description as well.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- 3 answered in lectures and 2 in homework.
- Courses
- Practical courses
- Books, signs for moving around the university

5. What are the advantages and disadvantages of this form of material?

Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
- One mentioned it helped to create the image in his mind
- Disadvantages:
- Could not understand details
- Needed experience

- Texts to narrow.
- Some region textures where not clear
- Can be used only by Braille readers

### Usability Questionnaire

1. How accessible is the material? - The average response is 7.6 out of 10, indicating that most participants found the material to be very accessible.
2. How difficult was it for you to use it? - The average response is 6.2 out of 10, indicating that some participants had difficulties in using it.
3. To what extent is training required to be able to use it? - The average response is 5.8 out of 10, indicating that the participants felt that some level of training may be required to use the material.
4. Would you use it if it was available to you? - The average response is 6.6 out of 10, indicating that the participants would likely use the material if it were available to them.
5. Would you recommend others to use it? - The average response is 8.6 out of 10, indicating that the participants would likely recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7.4 out of 10, indicating that the participants believe that the material fills gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 8.4 out of 10, indicating that the participants felt that many of the information in the material could be obtained elsewhere.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 6.4 out of 10, indicating that some of the participants generally felt that the material meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 6.4 out of 10, indicating that some participants believe the material is useful for their university studies.
10. How tedious is the material? - The average response is 5.6 out of 10, indicating that some participants found the material tedious and some did not.
11. How complex and complicated is the material? - The average response is 6.4 out of 10, indicating that some participants found the material complex.
12. How much load (memory and attention) does the material's use require? - The average response is 7.6 out of 10, indicating that the participants believe that the material requires a significant amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 7.2 out of 10, indicating that the participants were generally satisfied with the use of the material.

### Audio-tactile

### Scenarios

#### *Discobolus*

In the first task (Locate the disc) all 5 participants were successful. 4 did not require help and they completed the task in 3 to 5 seconds with no interruptions. 1 participant completed in 98 seconds with help and 2 interruptions by help.

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Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	With	98	Yes (by help)	2
P2	Success	Without	5	No	0
P3	Success	Without	3	No	0
P6	Success	Without	3	No	0
P8	Success	Without	5	No	0

Table 81. First task from AUDIO-TACTILE (Discobolus)

All 5 were successful in the second task (Locate the disc), without help in 1 second and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	1	No	0
P2	Success	Without help	1	No	0
P3	Success	Without help	1	No	0
P6	Success	Without help	1	No	0
P8	Success	Without help	1	No	0

Table 82. Second task from AUDIO-TACTILE (Discobolus)

All were also successful in the third task (Locate the disc). 3 did not require help and completed the task in 10 to 33 seconds with no interruptions. 2 needed help and completed the task in 29 and 34 seconds, with 1 interruption each by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	With	29	Yes (by help)	1
P2	Success	Without	33	No	0
P3	Success	Without	12	No	0
P6	Success	With help	34	Yes (by help)	1
P8	Success	Without	10	No	0

Table 83. Third task from AUDIO-TACTILE (Discobolus)

3 participants answered correctly in both comprehension questions (Which way has Discobolus turned his back? Does the Discobolus have his feet firmly on the ground?). 2 participants were correct in the second but wrong in the first question)

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Wrong	Correct
P3	Correct	Correct
P6	Wrong	Correct
P8	Correct	Correct

Table 84. Comprehension questions (Discobolus)

### *Chromosomal abnormalities*

In the first task (Locate the line representing Down's syndrome) 4 participants were successful, without help, in 3 to 16 seconds with no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	17	No	0
P2	Success	Without help	3	No	0
P3	Unsuccess	-	-	-	-
P6	Success	Without help	10	No	0
P8	Success	Without help	16	No	0

Table 85. First task from AUDIO-TACTILE (Chromosomal abnormalities)

In the second task (Locate the mother's age at 35 years) all were successful without help, in 2 to 140 seconds. Only 1 participant had 1 interruption by him/herself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	41	No	0
P2	Success	Without help	2	No	0
P3	Success	Without help	140	No	0
P6	Success	Without help	22	No	0
P8	Success	Without help	39	yes by himself	1

Table 86. Second task from AUDIO-TACTILE (Chromosomal abnormalities)

All were also successful in the third task (Locate the horizontal axis). 4 did not require help and completed the task in 2 to 180 seconds with no interruptions. 1 required help and completed in 18 seconds with 1 interruption by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	15	No	0
P2	Success	Without help	5	No	0
P3	Success	Without help	180	No	0
P6	Success	With help	18	Yes By help	1
P8	Success	Without help	2	No	0

Table 87. Third task from AUDIO-TACTILE (Chromosomal abnormalities)

All participants answered correctly in the first and third comprehension question and only 1 was correct in the second (Is the course of both lines, Down syndrome and chromosomal abnormalities, upward? From what age onwards does the risk of Down's syndrome and chromosomal abnormalities increase rapidly? On a per-birth impact basis, is the risk for Down syndrome greater than the risk for chromosomal abnormalities?).

Participants	Question 1	Question 2	Question 3
P1	Correct	Correct	Correct
P2	Correct	Wrong	Correct
P3	Correct	Wrong	Correct
P6	Correct	Wrong	Correct
P8	Correct	Wrong	Correct

Table 88. Comprehension questions (Chromosomal abnormalities)

#### *Brain development*

All 5 participants were successful in the first task (Locate the line representing the auditory and visual areas of the cerebral cortex) in 2 to 92 seconds. Only 1 of them needed help and had 1 interruption.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without	2	No	0
P2	Success	With help	92	No	1
P3	Success	Without	20	No	0
P6	Success	Without	3	No	0
P8	Success	Without	20	No	0

Table 89. First task from AUDIO-TACTILE (Brain Development)

4 participants were successful in the second task (Locate the line representing the prefrontal cortex), in 1 to 25 seconds without help or interruptions.



Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without	1	No	0
P2	Unsuccess	-	-	-	-
P3	Success	Without	25	No	0
P6	Success	Without	1	No	0
P8	Success	Without	10	No	0

Table 90. Second task from AUDIO-TACTILE (Brain Development)

4 participants were also successful in the third task (Locate the line that represents the language areas of the cerebral cortex and shows the time of myelination). 3 of them without help, in 30 to 75 seconds and no interruptions. 1 required help, completed the task in 38 seconds and had 1 interruption by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	With	38	Yes, By help	1
P2	Success	Without	30	No	0
P3	Success	Without	72	No	0
P6	Success	Without	45	No	0
P8	Unsuccess	-	-	-	-

Table 91. Third task from AUDIO-TACTILE (Brain Development)

2 participants answered correctly in the first comprehension question (Which areas of the cerebral cortex are growing fastest?) and 2 were correct in the second (What does the vertical axis and the horizontal axis indicate?).

Participants	Question 1	Question 2
P1	Wrong	Correct
P2	Correct	Correct
P3	Wrong	Wrong
P6	Correct	Wrong
P8	Wrong	Wrong

Table 92. Comprehension questions (Brain Development)

Eye

All 5 participants were successful in the first task (Locate the iris), without help, in 2 to 139 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	28	No	0
P2	Success	Without help	2	No	0
P3	Success	Without help	139	No	0
P6	Success	Without help	112	No	0
P8	Success	Without help	109	No	0

Table 93. First task from AUDIO-TACTILE (Eye)

All were again successful in the second task (Locate the optic nerve), without help, in 2 to 15 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without	15	No	0
P2	Success	Without	2	No	0
P3	Success	Without	2	No	0
P6	Success	Without	2	No	0
P8	Success	Without	2	No	0

Table 94. Second task from AUDIO-TACTILE (Eye)

All were also successful in the third task (Locate the pupil), without help, in 1 to 165 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	133	No	0
P2	Success	Without	2	No	0
P3	Success	Without help	1	No	0
P6	Success	Without	4	No	0
P8	Success	Without	165	No	0

Table 95: Third task from AUDIO-TACTILE (Eye)

4 participants answered correctly to both comprehension questions (Is the shape of the eye completely spherical? Is the retina located in the anterior or posterior part of the eye?) and 1 participant was correct only in the second)

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Wrong	Correct
P3	Correct	Correct
P6	Correct	Correct
P8	Correct	Correct

Table 96. Comprehension questions (Eye)

## Atom

All 5 participants were successful in the first task (Locate the core), without help, in 2 to 65 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	8	No	0
P2	Success	Without help	2	No	0
P3	Success	Without help	65	No	0
P6	Success	Without help	2	No	0
P8	Success	Without	48	No	0

Table 97. First task from AUDIO-TACTILE (Atom)

Only 2 participants successfully completed the second task (Locate the electrons and protons), without help, in 5 and 30 seconds, with no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	30	No	0
P2	Unsuccess	-	-	-	-
P3	Unsuccess	-	-	-	-
P6	Success	Without help	5	No	0
P8	Unsuccess	-	-	-	-

Table 98. Second task from AUDIO-TACTILE (Atom)

3 participants were successful in the third task (Locate the electron orbits), without help, in 8 to 13 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	10	No	0
P2	Unsuccess	-	-	-	-
P3	Unsuccess	-	-	-	-
P6	Success	Without help	13	No	0
P8	Success	Without help	8	No	0

Table 99. Third task from AUDIO-TACTILE (Atom)

All participants answered correctly to both comprehension questions (What's floating around the core? What is the nucleus of the atom made of?)

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Correct	Correct
P3	Correct	Correct
P6	Correct	Correct
P8	Correct	Correct

Table 100. Comprehension questions (Atom)

### *Byzantine Empire*

All 5 participants were successful in the first task (Locate Constantinople). 4 without help, in 15 to 141 seconds and no interruptions. 1 participant required help, completed the task in 185 seconds and had 1 interruption by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	With help	185	By help	1
P2	Success	Without	59	No	0
P3	Success	Without	141	No	0
P6	Success	Without	15	No	0
P8	Success	Without	49	No	0

Table 101. First task from AUDIO-TACTILE (Byzantine empire)

All 5 were again successful in the second task (Locate Spain), without help, in 5 to 25 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	5	No	0
P2	Success	Without help	6	No	0
P3	Success	Without help	21	No	0
P6	Success	Without help	14	No	0
P8	Success	Without help	22	No	0

Table 102. Second task from AUDIO-TACTILE (Byzantine empire)

4 participants were successful in the third task (Locate Tangier area), without help, in 1 to 65 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	Success	Without help	1	No	0
P2	Success	Without help	65	No	0
P3	Success	Without help	1	No	0
P6	Success	Without help	1	No	0
P8	Unsuccess	-	-	-	-

Table 103. Third task from AUDIO-TACTILE (Byzantine empire)

4 participants answered correctly to both comprehension questions (Where on the map is Jerusalem located? here on the map is Cappadocia?) and 1 was wrong in the first and correct in the second question.

Participants	Question 1	Question 2
P1	Correct	Correct
P2	Wrong	Correct
P3	Correct	Correct
P6	Correct	Correct
P8	Correct	Correct

Table 104. Comprehension questions (Byzantine empire)

### Semi-structured interview

The answers in the five questions are presented below.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants evaluated the material positively.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Positive evaluation of the material:** Easily accessible material. 3 would keep it as it is.
- **Suggested changes:** One mentioned that she/he would differentiate the textures and generalize the image.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative format:** Some suggested audio, tactile or both and some suggested verbal description as well. One suggested combination with tactile microcapsule.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- In mathematics, statistics classes
- In specific courses, in homework
- lectures, homework
- Books, signs for moving around the university

5. What are the advantages and disadvantages of this form of material?

Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
- Has sound
- Easily accessible information
- Better perception of the areas
- Disadvantages:
- Needs training
- The necessary touchpad is expensive

### Usability Questionnaire

1. How accessible is the material? - The average response is 9 out of 10, indicating that most participants found the material to be accessible at a very high level.
2. How difficult was it for you to use it? - The average response is 3 out of 10, indicating most did not had difficulties in using it.
3. To what extent is training required to be able to use it? - The average response is 5 out of 10, indicating that the participants felt that some level of training may be required to use the material.
4. Would you use it if it was available to you? - The average response is 9.6 out of 10, indicating that the participants would certainly use the material if it were available to them.
5. Would you recommend others to use it? - The average response is 9.6 out of 10, indicating that the participants would certainly recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 9.6 out of 10, indicating that the participants believe that the material can be important in filling gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 6.4 out of 10, indicating that the participants felt that some of the information in the material could be obtained elsewhere.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 9.2 out of 10, indicating that most participants felt that the material meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 9.2 out of 10, indicating that most participants believe the material is useful for their university studies.
10. How tedious is the material? - The average response is 4.2 out of 10, indicating that participants found the material not very tedious.
11. How complex and complicated is the material? - The average response is 4.8 out of 10, indicating that some participants found the material complex.

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12. How much load (memory and attention) does the material's use require? - The average response is 7.8 out of 10, indicating that the participants believe that the material requires a significant amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 9 out of 10, indicating that the participants were very satisfied with the use of the material.

### Math

3 participants (p1, p2 and p3) completed 1 scenario with 4 tasks using the "Math" material.

#### Scenarios

In the first task (Listen to mathematical equation 1 and repeat what you heard) all 3 participants were successful in 62 to 120 seconds. 1 required help and had 1 interruption. 2 of them listened to the equation 3 times and 1 listen to it 6 times.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of repetition
P1	Success	With help	120	Yes by help	3
P2	Success	Without		No	3
P3	Success	Without	62	No	6

Table 105. First Task MATH

In the second task (Listen to mathematical equation 2 and repeat what you heard) all 3 participants were also successful in 2 to 5 seconds without help or interruptions. 1 participant listened to the equation 5 times.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of repetition
P1	Success	Without help	5	No	1
P2	Success	Without help		No	5
P3	Success	Without help	2	No	1

Table 106. Second Task MATH

In the third task (Listen to mathematical equation 3 and repeat what you heard) 2 participants were successful, without help, in 18 and 45 seconds with no interruptions. One of them listened to the equation 5 times and the other 2 times.



Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of repetition
P1	Unsuccess	-		-	-
P2	Success	Without	45	No	5
P3	Success	Without	18	No	2

Table 107. Third Task MATH

2 participants were successful in the fourth task (Listen to mathematical equation 4 and repeat what you heard) in 40 and 55 seconds. One of the had an interruption by help. Both listened to the equation 3 times.

### Semi-structured interview

The answers in the five questions are presented below.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- 2 participants evaluated the material positively and 1 neutral.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Suggested changes:** One suggested the usage of more simple expressions and one support that the screen reader needs to be updated to spell every letter correctly.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative format:** One suggested microcapsule paper, written formulas, or shapes. 2 suggested Braille instead and one of them the Nemeth code.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- In mathematics, statistics classes
- In homework

5. What are the advantages and disadvantages of this form of material?

Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
- Doesn't need print and you can easily write it
- Disadvantages:
- Needs training
- Spelling difficulties

### Usability Questionnaire

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1. How accessible is the material? - The average response is 6.67 out of 10, indicating that some participants had mixed opinions about the material's accessibility.
2. How difficult was it for you to use it? - The average response is 7.67 out of 10, indicating most had difficulties in using it.
3. To what extent is training required to be able to use it? - The average response is 6.67 out of 10, indicating that the participants felt that some level of training may be required to use the material.
4. Would you use it if it was available to you? - The average response is 4 out of 10, indicating that the participants would probably not use the material if it were available to them.
5. Would you recommend others to use it? - The average response is 5 out of 10, indicating that the participants may or may not recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 4.67 out of 10, indicating that the participants believe that the material is not so important in filling gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 9.33 out of 10, indicating that the participants felt that the information in the material could be obtained elsewhere.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 6 out of 10, indicating that participants felt that the material may or may not meet its intended purpose.
9. How useful would this material be for your university studies? - The average response is 4.67 out of 10, indicating mixed beliefs about the usefulness of the material for their university studies.
10. How tedious is the material? - The average response is 6.67 out of 10, indicating that some participants found the material tedious.
11. How complex and complicated is the material? - The average response is 8.33 out of 10, indicating that the participants found the material complex.
12. How much load (memory and attention) does the material's use require? - The average response is 9 out of 10, indicating that the participants believe that the material requires a significant amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 3.33 out of 10, indicating that the participants were not satisfied with the use of the material.

### Chem

2 participants (p1 and p2) completed 1 scenario with 4 tasks using the "Chem" material.

### Scenarios

In the first task (Listen to chemical equation 1 and repeat what you heard) both participants were unsuccessful.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of repetition
P1	Unsuccess	-	-	-	5
P2	Unsuccess	-	-	-	8

Table 108. First Task CHEM

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In the second task (Listen to chemical equation 2 and repeat what you heard) they were both successful. One without help in 1 second and the other with help, in 5 seconds. Both listened to the chemical equation 5 times.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of repetition
P1	Success	With help	5	Yes by help	5
P2	Success	Without		No	5

Table 109. Second Task CHEM

In the third task (Listen to chemical equation 3 and repeat what you heard) both participants were unsuccessful.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of repetition
P1	Unsuccess	-	-	-	-
P2	Unsuccess	-	-	-	-

Table 110. Third Task CHEM

In the fourth task (Listen to chemical equation 4 and repeat what you heard) both were again unsuccessful.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of repetition
P1	Unsuccess	-	-	-	-
P2	Unsuccess	-	-	-	-

Table 111. Fourth Task CHEM

### Semi-structured interview

Only one participant answered the questions. The answers in the five questions are presented below.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- The participant evaluated the material positively.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Suggested changes:** The participant could not understand some expressions (probably the need to be simplified).

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative format:** The participant suggested Braille or the Nemeth code.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- In chemistry courses

5. What are the advantages and disadvantages of this form of material?

Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
- Doesn't need print
- Easily distributed to students
- Disadvantages:
- Signs and letters were confusing

### Usability Questionnaire

The questionnaire was completed by both participants.

1. How accessible is the material? – One answered 5 and the other 7 out of 10.
2. How difficult was it for you to use it? - One answered 6 and the other 8 out of 10.
3. To what extent is training required to be able to use it? - One answered 5 and the other 6 out of 10.
4. Would you use it if it was available to you? - One answered 3 and the other 6 out of 10.
5. Would you recommend others to use it? - One answered 9 and the other 4 out of 10.
6. To what extent do you believe it will fill gaps of your existent knowledge? - One answered 4 and the other 6 out of 10.
7. Could you obtain the information/knowledge provided by this material in another way? – Both answered 9 out of 10.
8. Do you think that the material successfully meets the purpose for which it was built? - Both answered 5 out of 10.
9. How useful would this material be for your university studies? - One answered 2 and the other 5 out of 10.
10. How tedious is the material? - One answered 7 and the other 2 out of 10.
11. How complex and complicated is the material? - One answered 6 and the other 2 out of 10.
12. How much load (memory and attention) does the material's use require? - One answered 10 and the other 8 out of 10.
13. How satisfied are you with the use of this material? - One answered 4 and the other 5 out of 10.

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## Scenarios

3 participants with low vision (P4, P5 and P7) completed 2 tasks with the Visual image material.

In the first task (Identify the sub-concepts that exist in the category "precipitation") all 3 were successful, without help, in 61 to 75 seconds. One had 3 interruptions by him/herself.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P4	Success	Without	75	No	0
P5	Success	Without	73	Yes by himself	3
P7	Success	Without	61	No	0

Table 112. First task VISUAL IMAGE (Low vision)

All 3 were also successful in the second task (Identify which category the sub-concept stratus belongs to), without help, in 18 to 33 seconds and no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P4	Success	Without	33	No	0
P5	Success	Without	19	No	0
P7	Success	Without	18	No	0

Table 113. Second task VISUAL IMAGE (Low vision)

## 15.2 Semi-structured interview

The answers in the five questions are presented below.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants evaluated the material positively.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Suggested changes:** Addition of verbal description in the beginning, different circle design, more compact images and closer to each other.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative format:** Combination with audio, audio-tactile or verbal descriptions.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- In reading maps, graphs and shades
- In courses with tables and presentations
- In homework or studying

5. What are the advantages and disadvantages of this form of material?

Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
- The information is received easier visually
- Good opinion about the frame and the colors
- Disadvantages:
- Small lines

### Usability Questionnaire

1. How accessible is the material? - The average response is 9 out of 10, indicating that some participants believe the material is very accessible.
2. How difficult was it for you to use it? - The average response is 1.33 out of 10, indicating most found it easy to use.
3. To what extent is training required to be able to use it? - The average response is 1 out of 10, indicating that the participants felt no need for training.
4. Would you use it if it was available to you? - The average response is 9.67 out of 10, indicating that the participants would certainly use the material if it were available to them.
5. Would you recommend others to use it? - The average response is 9.67 out of 10, indicating that the participants would certainly recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 9.67 out of 10, indicating that the participants believe that the material is important in filling gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 5 out of 10, indicating that the participants felt that the information in the material could not be easily obtained elsewhere.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 9.67 out of 10, indicating that participants felt that the material meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 9.67 out of 10, indicating strong beliefs about the usefulness of the material for their university studies.
10. How tedious is the material? - The average response is 1.67 out of 10, indicating that the participants have not found the material tedious.
11. How complex and complicated is the material? - The average response is 3.33 out of 10, indicating that the participants did not find the material complex.
12. How much load (memory and attention) does the material's use require? - The average response is 4.67 out of 10, indicating that the participants believe that the material does not require a significant amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 9.33 out of 10, indicating that the participants were satisfied at a high degree with the use of the material.

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### Visual-audio-tactile (for low vision)

The 3 participants with low vision (P4, P5 and P7) also completed the same 2 tasks with the Visual-audio-tactile material.

#### Scenarios

In the first task all were successful, without help, in 18 to 68 seconds with no interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P4	Success	Without	37	No	0
P5	Success	Without	18	No	0
P7	Success	Without	68	No	0

Table 114. First task VISUAL-AUDIO-TACTILE (Low vision)

All 3 were also successful in the second task. 2 without help, in 3 and 7 seconds and 1 with help, in 153 seconds and 3 interruptions by help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P4	Success	With	153	Yes By help	3
P5	Success	Without	3	No	0
P7	Success	Without	7	No	0

Table 115. Second task VISUAL-AUDIO-TACTILE (Low vision)

#### Semi-structured interview

The answers in the five questions are presented below.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- 2 participants evaluated the material positively and 1 negatively.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

- **Suggested changes:** The audio feedback is useful. 2 types of tactile feedback are enough. Addition of a verbal initial description.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Alternative format:** Combination with audio, visual-audio or verbal descriptions.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- In reading maps, graphs and shades

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- In courses with tables and presentations
- In homework or studying

#### 5. What are the advantages and disadvantages of this form of material?

Based on the participants' responses, we can group the advantages and disadvantages of the material into the following themes:

- Advantages:
  - Easier to read shapes
  - Easy to operate
  - More information from the sound
  - No need to magnify
- Disadvantages:
  - Not bolded lines
  - Tactile does not help concentration to the Visual and audio

#### Usability Questionnaire

1. How accessible is the material? - The average response is 9 out of 10, indicating that some participants believe the material is very accessible.
2. How difficult was it for you to use it? - The average response is 1.33 out of 10, indicating most found it easy to use.
3. To what extent is training required to be able to use it? - The average response is 1 out of 10, indicating that the participants felt no need for training.
4. Would you use it if it was available to you? - The average response is 6.67 out of 10, indicating that some participants would use the material if it were available to them.
5. Would you recommend others to use it? - The average response is 8.67 out of 10, indicating that the participants would recommend others to use the material.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7.67 out of 10, indicating some participants believe that the material is important in filling gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 7 out of 10, indicating that the participants felt that the information in the material might be obtained elsewhere.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 9 out of 10, indicating that participants felt that the material meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 8.33 out of 10, indicating strong beliefs about the usefulness of the material for their university studies.
10. How tedious is the material? - The average response is 2 out of 10, indicating that the participants have not found the material tedious.
11. How complex and complicated is the material? - The average response is 2 out of 10, indicating that the participants did not find the material complex.
12. How much load (memory and attention) does the material's use require? - The average response is 3.33 out of 10, indicating that the participants believe that the material does not require a significant amount of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 7.67 out of 10, indicating that the participants were satisfied with the use of the material.

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## 1.2. Pilot Study of Individuals with Mobility Impairments

### 1.2.1. Participants

The participants of the study [Participant 1 (P1) - Participant 5 (P5)] were 5, of which 4 were men and one was a woman (P1). Mobility impairments occurred in their lower and upper extremities (n=5). The following demographic data are missing for a participant (P1). Participants gave the following answers about the functionality of their hands: 1. I handle objects with difficulty, I need help preparing or modifying the activities. My performance is slow and can be achieved with limited success regarding the activity's quantity and quality. I can be independent only if the activities have been adapted for me. (n=2), 2. I can only handle selected (very specific) easy objects and only in adapted activities. Usually, I only perform parts of an entire activity with much effort and limited success. I need continuous support, assistance, and/or adapted equipment (n=1). 3. I cannot handle objects as I have limited ability to perform even simple actions. I need total assistance (n=1).

Furthermore, participants with mobility impairments gave the following answers about their commute: 1. Most of the time, I need walking aids to walk anywhere. Usually, I need another person's assistance or specialized equipment to get up from the floor, from the bed, or from the chair. When climbing stairs, I usually need assistance or at least supervision from someone else. I need a wheelchair for outdoor environments (n=1). 2. Almost everywhere, I use a wheelchair on my own (either an electric or manual wheelchair). However, almost always, I need the assistance of another person. Usually, I need special support on my torso (e.g., waist) and/or my head. I can walk at home for a while but only with the assistance of another person (n=1). 5. In all cases and in all places, I use a wheelchair. At best, I can use an electric wheelchair. I always need special support in my waist, torso, and head. I use many types of assistive devices for mobility impairments, but I still need the assistance of another person (n=2). The participants declared that they move sometimes alone and sometimes with the help of the equipment (n=1) or with the help of the equipment (n=3).

### 1.2.2. Instruments

The tools used for the present study are as follows: a) questionnaire for collecting demographic information of the participants, b) scenarios of activities for navigating accessible educational material, c) semi-structured interviews for evaluating the accessible educational material, and d) questionnaire on the usability of the accessible educational material.

The accessible educational material included the MS Word textbook, which was a book without (complex) images and tables. The same book was also examined in two other formats (DAISY-Textbook and Epub-Textbook). In order to compare the three formats, participants performed the same tasks in each format (word, DAISY, ePub). In the execution of all scenarios (MS Word, DAISY and ePub textbook), 4 out of the 5 participants participated.

### 1.2.3. Procedure

The same process was followed, as with individuals with visual impairments. In particular, the process of the experiment consists of a set of structured steps for collecting data and evaluating accessible educational material. The use of multiple tools such as the semi-structured interview and the usability questionnaire can provide further information on how users interact with the accessible educational material and how useful they consider it to be. The steps were as follows:

- Step 1. Participants answered the demographic questionnaire.

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- Step 2. The scenario was implemented for each accessible educational material.
- Step 3. Participants independently explored the accessible educational material, thinking aloud and commenting on its accessibility.
- Step 4. The semi-structured interview was conducted.
- Step 5. The usability questionnaire was completed.

#### 1.2.4. Analysis

During the assessment of accessible educational material, the following variables were used to measure the effectiveness of the educational material in achieving the desired learning outcomes.

- Success/Unsuccess: This variable indicates whether the participant was successful or unsuccessful in completing the scenario.
- With/without help: This variable indicates whether the participant completed the scenario with or without assistance.
- Time: This variable measures the time taken by the participant to complete the scenario.
- Interruption for solution by himself, by help: This variable measures the number of times the participant was interrupted and needed help to find a solution to complete the scenario.
- Times of interruption: This variable measures the total number of interruptions experienced by the participant during the completion of the scenario.

By collecting and analyzing these variables, researchers and educators can identify areas where participants may be struggling or where the educational material needs improvement to better support learning outcomes.

#### MS Word – Textbook

##### Scenarios

Tables 112-115 present the results of an assessment of four participants' completion of a task involving a Word textbook.

The Table 112 shows that all four participants were successful in completing the task "Find chapter 2 'Institutional Framework of Education and Disability'". Four of the participants completed the task without any help, while one participant needed help once. The time taken to complete the task varied from 5 seconds to 65 seconds, with a mean time of 33.5 seconds. Participant who needed help had to interrupt himself or ask for help once during the task. In contrast, participants who completed the task without help did not need to interrupt themselves or ask for help.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	65	No	0
P2	success	Without help	5	No	0
P3	success	With help	48	Yes (by help)	1
P4	success	Without help	16	No	0

Table 116. First task from MS Word - Textbook

The Table 113 displays that all four participants were successful in completing the task “Go to page 15”. The time taken to complete the task varied from 16 seconds to 182 seconds, with an average completion time of 85.7 seconds. Two participants had one interruption while solving the task.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	With help	120	Yes (by help)	1
P2	success	With help	182	Yes (by help)	1
P3	success	Without help	25	No	0
P4	success	Without help	16	No	0

Table 117. Second task from MS Word Textbook

Table 114 shows the results of the third task “Go to sub-chapter 5.1 “Assistive Technology: Definition” from the MS Word Textbook assessment. All participants were successful in completing the task without any help or interruption. The time it took to complete the task varied from 18 to 24 seconds, with an average completion time of 21 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	23	No	0
P2	success	Without help	24	No	0
P3	success	Without help	18	No	0
P4	success	Without help	19	No	0

Table 118. Third task from MS Word Textbook

Table 115 shows the results of the fourth task "Go to page 28 and open the link 'Ministry of Education and Religions'" from the MS Word Textbook assessment. All participants were successful in completing the task. Two participants interrupted their solution once by help, while the other participants did not interrupt their solution at all, neither by themselves nor with help. The time it took to complete the task varied from 84 to 160 seconds, with an average completion time of 106.2 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	160	No	0
P2	success	Without help	96	No	0
P3	success	With help	85	Yes (by	1

				help)	
P4	success	With help	84	Yes (by help)	1

Table 119. Fourth task from MS Word Textbook

### Independent exploration

From the statements given during the independent exploration, the following themes can be identified for the participants' opinions on the accessible educational material (MS Word – Textbook):

- **Navigation**
- Participants find the description of links helpful, especially when the website is no longer accessible.
- Page numbering at the top left is convenient, although some participants are accustomed to seeing it at the bottom center.
- Document navigation features like headings, table of contents, and shortcuts (Ctrl + F) for searching headers are considered helpful.
- **Content Presentation**
- Participants suggest having more spacing in the text as it can be dense.
- Some participants find the titles too close to the accompanying text.
- The presence of references within the text is appreciated as it saves time.
- Footnotes at the end of each page and a glossary are found to be useful for understanding and further exploration.
- **Useful Features**
- The existing file itself is considered very helpful.
- Participants find the references that connect to the bibliography to be valuable.

### Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All five participants evaluate the material positively. For example. One participant specifically mentions that she was not aware that it could be made easier, but she find it organized with headings.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

According to the participants' feedback on what to keep and what to change about the material:

- Keep:
- Headers: Participants appreciate the headers for document navigation.
- Description of Links: Participants find the description of links helpful.
- Page Numbering: Participants prefer keeping the page numbering at the top left as it is easier to locate.
- Change/Modify:

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- **Navigation Bar:** Participants suggest improving the navigation bar by increasing the font size and allowing simultaneous visibility of the page for each header.
- **Alignment:** Participants mention a preference for total alignment, while acknowledging that left alignment may facilitate reading.
- **Spacing and Indentation:** Participants suggest adding more space between titles and text, creating smaller paragraphs, and adding indentation for improved user-friendliness.
- **Hyperlinks and Table of Contents:** Participants suggest changing the hyperlink functionality and table of contents to require only one click for opening links.
- **No Changes:**
- One participant expresses satisfaction with the material and wouldn't make any changes, particularly highlighting the document structure using headers.

4. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Preference for Word Format:** Participants express a preference for Word compared to other formats without specifying alternatives.
- **PDF Format:** Participants mention the limitations of PDF in terms of difficulty in extracting sections but highlight the ability to highlight certain elements. Participants find PDF more enjoyable for reading and would exclusively use it in such cases.
- **Audio-Visual Format:** One participant suggests obtaining the information/knowledge through an audio-visual format, indicating a preference for multimedia content.

5. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Exams
- Lectures
- Studying

Based on the answers given by the participants, it seems that the material provided would be useful for various tasks and activities during their university studies.

6. What are the advantages and disadvantages of this form of material?

- **Advantages**
- **User-friendly:** Participants highlight that the material is easy to use and navigate. It provides features such as paragraph and subheading organization, page numbering, and zooming capabilities, making it convenient for reading and accessing information.
- **Accessibility:** Participants emphasize the importance of the material for individuals with upper limb mobility impairments. The ability to easily change pages, zoom in, and take notes contributes to its advantages.
- **Editability:** Participants mention the advantage of being able to edit the text, which allows for writing and customization.
- **Disadvantages**
- **No disadvantages mentioned:** Participants did not mention any specific disadvantages or drawbacks of the material.

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It is important to note that the participants' responses varied, with some focusing on the advantages of the material and others not mentioning any disadvantages. This indicates a generally positive perception of the material and its features.

### Usability Questionnaire

The questionnaire contained the following questions, for which the participants' answers are reported, and their interpretation is given.

1. How accessible is the material? - The average response is 9.0 out of 10, indicating that the participants found the material to be highly accessible.
2. How difficult was it for you to use it? - The average response is 4.6 out of 10, suggesting that the participants did not find the material overly difficult to use.
3. To what extent is training required to be able to use it? - The average response is 4.0 out of 10, indicating that the participants believed that some training might be beneficial to use the material effectively.
4. Would you use it if it was available to you? - The average response is 9.6 out of 10, indicating a strong inclination among participants to use the material if it were available to them.
5. Would you recommend others to use it? - The average response is 9.8 out of 10, suggesting a high likelihood of participants recommending the material to others.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7.8 out of 10, indicating that participants perceived the material to be in some extent effective in filling knowledge gaps.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 7.0 out of 10, suggesting that while participants saw the material as a valuable source of information, they believed there could be alternative ways to acquire the same knowledge.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 8.6 out of 10, indicating that participants viewed the material as largely fulfilling its intended purpose.
9. How useful would this material be for your university studies? - The average response is 9.4 out of 10, indicating that participants perceived the material as highly useful for their university studies.
10. How tedious is the material? - The average response is 4.8 out of 10, suggesting that participants did not find the material excessively tedious.
11. How complex and complicated is the material? - The average response is 4.2 out of 10, indicating that participants did not perceive the material to be highly complex or complicated.
12. How much load (memory and attention) does the material's use require? - The average response is 5.2 out of 10, suggesting that participants perceived the material to require moderate levels of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 8.8 out of 10, indicating a high level of satisfaction with the use of the material among participants.

## Scenarios

Tables 116-119 represent the results of an assessment of four participants' completion of tasks involving a DAISY textbook.

The Table 116 shows that all four participants were successful in completing the task "Find chapter 2 'Institutional Framework of Education and Disability'", without requiring any help. There were no interruptions reported by any of the participants while attempting to solve the task. The time taken to complete the task varied from 1 second to 15 seconds, with an average completion time of 6 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	3	No	0
P2	success	Without help	1	No	0
P3	success	Without help	5	No	0
P4	success	Without help	15	No	0

Table 120. First task from DAISY- Textbook

The Table 117 displays that all participants were successful in completing the task "Go to page 15" without help. The time to complete the task varied from 14 seconds to 37 seconds and an average completion time of 21.2 seconds. Most participants were able to complete the task without interruptions or assistance, except for one participant who had an interruption while attempting to solve the task.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	16	No	0
P2	success	With help	37	Yes (by help)	1
P3	success	Without help	14	No	0
P4	success	Without help	18	No	0

Table 121. Second task from DAISY Textbook

Table 118 shows the results of the third task "Go to sub-chapter 5.1 "Assistive Technology: Definition" from the DAISY Textbook assessment. All participants were able to successfully complete the task without any help. The amount of time it took the participants to complete the task varied from 7 seconds to 25 seconds and an average completion time of 14 seconds. No interruptions or assistance were reported by any of the participants, indicating a smooth and uninterrupted task completion process.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	14	No	0
P2	success	Without help	25	No	0
P3	success	Without help	10	No	0
P4	success	Without help	7	No	0

Table 122. Third task from DAISY Textbook

Table 119 shows the results of the fourth task "Go to page 28 and open the link 'Ministry of Education and Religions'" from the DAISY Textbook assessment. All participants were successful in completing the task. None of the participants reported any interruptions while attempting to solve the task. They were able to complete the task without any interruptions or the need for assistance. The time it took to complete the task varied from 30 to 54 seconds, with an average completion time of 38.25 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	30	No	0
P2	success	Without help	37	No	0
P3	success	Without help	32	No	0
P4	success	Without help	54	No	0

Table 123. Fourth task from DAISY Textbook

### Independent exploration

From the statements given during the independent exploration, the following themes can be identified for the participants' opinions on the accessible ePub material:

- **Navigation:**
- The navigation bar is easier to use compared to Word.
- The level of indentation in bullet points is confusing, and it would be preferred to have clearer visual distinctions between levels.
- Clicking on hyperlinks is convenient, eliminating the need to press multiple keys like in Word.
- It would be ideal to have a feature that allows returning to the previous "location", especially when there are multiple footnotes, links, and references.
- It would be beneficial to have page references within the document for easier navigation.
- **Placement of Footnotes:** Placing footnotes at the end of the page usually requires reducing the font size of the main text, and therefore, having footnotes at the end of the book is preferred.
- **Page numbering:** Participants mentioned issues with the lack of visible page numbers within the text of the DAISY file, suggesting that it be made more distinguishable.
- **Comparison with Word:**

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- Footnotes are considered better in Word.
- The advantage of the DAISY textbook is the ability to access hyperlinks with a single click and having an integrated screen reader.
- **Positive Feedback:**
- One participant was not aware of the application before but finds it very appealing.
- The larger font size in the navigation bar containing the book sections is appreciated.

### Semi-structured interview

The semi-structured interview consisted of 5 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- All participants had a positive evaluation of the material. One participant specifically mentioned that she liked the material even more than Word, indicating a strong positive sentiment.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

According to the participants' feedback on what to keep and what to change about the material:

- Keep:
- Large font size.
- Content navigation bar (with colors and larger font size).
- Ability to locate pages using the bottom right bar.
- Integrated screen reader.
- Single click for opening hyperlinks.
- Change/Modify:
- Change the color of the highlighting to blue.
- Modify the highlighting to underline only the word being read instead of the entire sentence.
- Add a visual indicator for page transitions, such as a separating line.
- Include a "back" option or button for returning to a previous position.
- Include page numbering within the document.
- Adjust spacing between titles and paragraphs, as well as indentation for paragraphs.
- Move footnotes to the end of each page instead of the end of the book.
- Change the language and preferences settings to include Greek language and integrated voice.

4. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

- **Preference for DAISY:** DAISY is preferred as an alternative format for obtaining the information or knowledge provided by the material. For example, one participant stated that he prefers DAISY because it would cover his needs as it combines both visual and audio elements.

5. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

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- Academic tasks
- Lectures
- Studying
- Exams

The common theme among the answers is that the material would be helpful in different areas of university studies. It would assist the participants in tasks such as studying, completing assignments, and preparing for exams. Additionally, some participants mention its usefulness in lectures and personal learning, indicating a broader application of the material in their academic pursuits.

#### 6. What are the advantages and disadvantages of this form of material?

Based on the responses of the participants, the advantages and disadvantages of this form of material are as follows:

- Advantages:
- Content navigation bar
- Open links with single-click.
- Larger and more readable font size.
- Integrated screen reader (with highlighting), improved readability, practicality.
- Different colors for sections in the navigation/content bar.
- Larger font size in navigation/content bar.
- Page locator bar.
- Progress bar indicating the percentage of the book read.
- Disadvantages:
- Difficulty in changing pages within the document.
- Absence of pages within the document.
- The lack of possibility of zooming in on the text when the mouse is on the navigation bar area.
- Annotations located at the end of the book.
- Settings not available in the Greek language.
- Loss of free embedded voice within the program.

#### Usability Questionnaire

The questionnaire contained the following questions, for which the participants' answers are reported, and their interpretation is given.

1. How accessible is the material? - The average response is 9.0 out of 10, indicating that the participants found the material to be highly accessible.
2. How difficult was it for you to use it? - The average response is 2.4 out of 10, indicating that the participants did not find the material difficult to use.
3. To what extent is training required to be able to use it? - The average response is 2.0 out of 10, indicating that the participants believed that little to no training is required to use the material effectively.
4. Would you use it if it was available to you? - The average response is 9.6 out of 10, indicating that the participants would highly likely use the material if it was available to them.
5. Would you recommend others to use it? - The average response is 9.8 out of 10, indicating that the participants would highly recommend others to use the material.

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6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 7.8 out of 10, indicating that the participants believe the material can effectively fill gaps in their knowledge.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 4.2 out of 10, indicating that the participants believe it may be challenging to obtain the same information through other means.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 9.0 out of 10, indicating that the participants believe the material successfully meets its intended purpose.
9. How useful would this material be for your university studies? - The average response is 9.2 out of 10, indicating that the participants find the material highly useful for their university studies.
10. How tedious is the material? - The average response is 3.0 out of 10, indicating that the participants did not find the material tedious.
11. How complex and complicated is the material? - The average response is 3.0 out of 10, indicating that the participants did not find the material highly complex.
12. How much load (memory and attention) does the material's use require? - The average response is 5.0 out of 10, indicating that the participants believe the material requires a moderate level of memory and attention.
13. How satisfied are you with the use of this material? - The average response is 9.0 out of 10, indicating that the participants were highly satisfied with the use of the material.

#### *ePub – Textbook*

#### **Scenarios**

The results of an evaluation of four participants' performance on a task involving an ePub textbook are presented in Tables 120-123.

The Table 120 shows that all participants were successful in completing the task "Find chapter 2 'Institutional Framework of Education and Disability'". One participant reported an interruption while attempting to solve the task and required help. This interruption occurred once and was resolved with the assistance provided. The remaining participants were able to complete the task without any interruptions or the need for assistance. The time it took to complete the task varied from 19 seconds to 65 seconds, with an average completion time of 34.7 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	With help	65	Yes (by help)	1
P2	success	Without help	19	No	0
P3	success	Without help	19	No	0
P4	success	Without help	36	No	0

Table 124. First task from ePub - Textbook

The Table 121 displays that all participants were successful in completing the task "Go to page 15". None of the participants reported any interruptions while attempting to solve the task. All participants were able to complete the task without any interruptions or the need for assistance. The

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time it took to complete the task varied widely, with completion times ranging from 12 seconds to 77 seconds, and an average completion time of 30 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	18	No	0
P2	success	Without help	12	No	0
P3	success	Without help	13	No	0
P4	success	Without help	77	No	0

Table 125: Second task from ePub Textbook

Table 122 shows the results of the third task "Go to sub-chapter 5.1 "Assistive Technology: Definition" from the ePub Textbook assessment. All participants were successful in completing the task without help, and the time it took to complete the task varied from 11 seconds to 35 seconds, with an average completion time of 24 seconds. No participants interrupted themselves or required help during the task, resulting in a total of zero interruptions.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	28	No	0
P2	success	Without help	22	No	0
P3	success	Without help	11	No	0
P4	success	Without help	35	No	0

Table 126. Third task from ePub Textbook

Table 123 shows the results of the fourth task "Go to page 28 and open the link 'Ministry of Education and Religions'" from the ePub Textbook assessment. All participants were successful in completing the task. no participants reported any interruptions or required assistance while completing the task. The time it took to complete the task varied from 9 to 86 seconds, with an average completion time of 38 seconds.

Participants	Success/Unsuccess	With/Without help	Time (sec)	Interruption for solution by himself, by help	Times of interruption
P1	success	Without help	86	No	0
P2	success	Without help	9	No	0
P3	success	Without help	17	No	0
P4	success	Without help	40	No	0

Table 127. Fourth task from ePub Textbook

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## Independent exploration

The participants commented the advantages of ePub in terms of visual appeal and the combination of features from both DAISY and Word. One participant emphasizes the positive user experience in terms of annotations.

## Semi-structured interview

The semi-structured interview consisted of 6 questions, which are listed below along with the participants' answers.

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

- The majority of participants expressed a positive evaluation of the material, with two participants specifically stating their positive opinion. One participant had a negative evaluation of the material, while another participant had a mixed evaluation, expressing some dissatisfaction.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change? Can you suggest some changes and improvements?

According to the participants' feedback on what to keep and what to change about the material:

- Keep:
- The font, which is more eye-friendly and easier to read.
- The references.
- Spacing between titles and paragraphs, and the readability of the annotations.
- The distances between titles and paragraphs.
- The highlighting and color scheme of the series during reading.
- The embedded screen reader.
- The bar indicating the percentage of the book read.
- Change/Modify:
- Change the color of the highlighting to blue.
- Add a page finding bar at the bottom right of the document, similar to the DAISY format.
- Add paragraph indentations
- Add page numbering within the document.
- Changes to various aspects, such as the way pages are changed.
- The table of contents accessibility. Modify the navigation bar to eliminate the need for opening a tab.
- Change the language in the settings to include Greek as an option.
- Alter the appearance of annotations as they are displayed in the ePub format.

From the participants' responses, it can be observed that there are certain aspects of the material that they would like to keep, such as font readability, references, and specific features. On the other hand, participants also expressed a desire for changes in navigation, format, and usability. One participant had a negative preference and indicated that they would change everything about the material.

3. Could you obtain the information/ knowledge provided by this material in another way? e.g., using some or a combination of some other alternative forms of educational material? What are they? (Should be listed individually or in combination).

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- **Preference for DAISY:** Participants believe that the information or knowledge provided by the material could be obtained in the DAISY format or other formats such as Word or PDF. There is a specific preference for the DAISY format, which suggests that participants consider it as an alternative way to access the same information or knowledge.

4. Where do you think this material would be helpful for you during your university studies (in which tasks / activities)?

- Academic tasks
- Studying
- Exams

The participants perceive the material as being helpful primarily for exam preparation and studying purposes during their university studies. However, one participant expresses the view that the material would not be helpful in any context.

5. What are the advantages and disadvantages of this form of material?

Based on the responses of the participants, the advantages and disadvantages of the form of material are as follows:

- Advantages:
- Useful references.
- ePub looks like a book.
- Integrated screen reader.
- Highlighting and color-coding of text during reading.
- Progress bar indicating the percentage of the book read.
- Disadvantages:
- Absence of page numbering within the document.
- Lack of a free embedded Greek voice.
- The table of contents accessibility.
- The existing annotations do not facilitate the reading experience.
- Finding a specific page is challenging due to the need to open a separate tab and navigate to the page search bar.

6. What are the advantages and disadvantages of each alternative form/ format of material?

Word

- Advantages:
- Familiar format.
- The ability to format text.
- Navigation bar.
- The ability to find specific pages.
- Disadvantages:
- Not designed for reading.
- Smaller font size in the navigation/table of contents.

DAISY

- Advantages:
- The integrated screen reader
- The navigation bar.

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- The page locator bar.
- Disadvantages:
- References do not work compared to the other formats
- Changing pages is not easily distinguishable.

#### ePub

- Advantages:
- The visual presentation resembling a book compared to the other formats.
- Disadvantages:
- Difficulties in finding specific pages and navigating through the contents.

From the responses, it can be interpreted that the participants perceive advantages in terms of the visual presentation and book-like appearance of ePub, the integrated screen reader and navigation features of DAISY, and the formatting and navigation capabilities of Word. However, there are also identified disadvantages, including difficulties with page navigation and content referencing in ePub and DAISY, as well as smaller font size in the navigation/table of contents in Word.

#### Usability Questionnaire

The questionnaire contained the following questions, for which the participants' answers are reported, and their interpretation is given.

1. How accessible is the material? - The average response is 6.8 out of 10, indicating that the participants found the material to be moderately accessible.
2. How difficult was it for you to use it? - The average response is 4.8 out of 10, suggesting that the participants found the material to have a moderate level of difficulty in terms of usability.
3. To what extent is training required to be able to use it? - The average response is 4.4 out of 10, indicating that the participants believed that some training may be necessary to use the material effectively.
4. Would you use it if it was available to you? - The average response is 6.0 out of 10, indicating a moderate level of willingness to use the material if it were available.
5. Would you recommend others to use it? - The average response is 5.8 out of 10, suggesting a moderate inclination to recommend the material to others.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The average response is 4.8 out of 10, indicating a moderate belief that the material will help address existing knowledge gaps.
7. Could you obtain the information/knowledge provided by this material in another way? - The average response is 9.0 out of 10, suggesting that the participants perceived it to be highly likely to obtain the same information or knowledge through alternative means.
8. Do you think that the material successfully meets the purpose for which it was built? - The average response is 6.6 out of 10, indicating a moderately positive perception of the material meeting its intended purpose.
9. How useful would this material be for your university studies? - The average response is 6.0 out of 10, suggesting a moderate usefulness of the material for university studies.
10. How tedious is the material? - The average response is 5.6 out of 10, indicating a moderate level of tedium associated with the material.
11. How complex and complicated is the material? - The average response is 5.0 out of 10, suggesting a moderate perception of the material's complexity and level of complication.

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12. How much load (memory and attention) does the material's use require? - The average response is 5.0 out of 10, indicating a moderate level of load in terms of memory and attention required to use the material.
13. How satisfied are you with the use of this material? - The average response is 5.0 out of 10, suggesting a moderate level of satisfaction with the use of the material.

### 1.3. Pilot Study of Individuals with Hearing Impairments

#### 1.3.1. Participants

The 5 participants of the study [Participant 1 (P1) - Participant 5 (P5)] were 3 men and 2 women with a mean age of 33 years (26 to 43). All have severe, bilateral hearing loss (71-90 dB). 3 were born with the disability, one participant had the impairment onset at 3,5 years and another at 7 years old. All 5 are lip readers, they understand the Greek written language and speak The Greek sign language and at least one more sign language. 4 of them use hearing aid devices.

#### 1.3.2. Instruments

The tools used for the present study are as follows: a) questionnaire for collecting demographic information of the participants, b) scenarios of activities for navigating accessible educational material, c) semi-structured interviews for evaluating the accessible educational material, and d) questionnaire on the usability of the accessible educational material. Additionally, there were comprehension questions on specific material.

#### 1.3.3. Procedure

The process of the experiment consists of a set of structured steps for collecting data and evaluating accessible educational material. The steps were as follows:

- Step 1. Participants answered the demographic questionnaire.
- Step 2. The scenario was implemented for each accessible educational material and comprehension questions were answered.
- Step 3. Participants independently explored the accessible educational material and commenting on its accessibility.
- Step 4. The semi-structured interview was conducted.
- Step 5. The usability questionnaire was completed.

#### 1.3.4. Analysis

During the assessment, the three accessible educational materials were evaluated by the number of correct answers given by the participants in 3 comprehension questions: 1. What is the functionality of the antenna implanted in the man's skull? 2. What color represents silence? 3. What challenge did the man undertake?

The success rate of the materials along with the results from the semi-structured interviews and the questionnaire, will provide further information on how users interact with the material and how useful they consider it to be.

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### 1.3.5. Results

#### Comprehension questions

The summarized results are presented in Table 124. The total correct answers were 9 for the first material, 10 for the second and 9 for the third. There were 3 incorrect answers for the first question by two participants, 5 incorrect answers for the second question by 3 participants and 9 incorrect answers for the third question by 4 participants. Participant 1 (P1) answered 3 times correctly, P2 8 times, P3 4 times, P4 answered correctly in all three questions with every material (9 times) and P5 was correct in 4 of his/her answers.

	Material 1				Material 2				Material 3		
Participant	Q1*	Q2	Q3		Q1	Q2	Q3		Q1	Q2	Q3
P1	NO*	NO	NO		NO	YES	NO		YES	YES	NO
P2	YES	YES	YES		YES	YES	NO		YES	YES	YES
P3	YES	NO	NO		YES	YES	YES		NO	NO	NO
P4	YES	YES	YES		YES	YES	YES		YES	YES	YES
P5	YES	YES	NO		YES	NO	NO		YES	NO	NO
The "YES" indicates a correct answer and the "NO" an incorrect answer.											
Q1 to Q3: Comprehension Questions 1 to 3											

Table 128: Summarized results in comprehension questions

#### Semi-structured interview

The interview consisted of 7 questions:

1. We would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

The first material has been generally evaluated as “positive” by all 5 participants. 1 commented that he/she liked the colors and 2 that the subtitles and the translation were helpful.

4 participants evaluated the second material as “positive”. One of them commented that he/she found negative the fact that the subtitles changed position from top to bottom. 1 participant evaluated the material as negative.

The third was evaluated by 3 participants as “negative” and by 2 as “positive” one of whom commented that he/she found the translator helpful.

2. What would you keep and what would you change about it? How (in which way) would you change each item you suggest for a change?

For the first material, 3 participants answered that they would keep the white fonts. 2 of them would also keep the black background and 1 the subtitles. Totally 3 participants answered that they would change the black background because it hides information.

For the second material, 2 participants would keep the functions and 2 the subtitles. 2 would keep the position of the subtitles fixed, 1 would change the background of the subtitles and one would add description of the surrounding sounds.

4 participants would keep the translator in the third material. 1 would keep the position of the translator with the note that he/she could not understand the signs that appeared over the translator's head. 2 participants would change the translator's position. 1 mention that he/she would like another translator and that the translator's window should be smaller. Finally, 1 participant mentioned that he/she could not watch the translator and the video at the same time.

### 3. How would you change each element. Would you recommend any improvements?

About the first material, 2 participants would make the subtitles background more transparent and lower their speed. Another mentioned that the subtitles should be kept simple, depending on the used educational level. 1 participant would add more details about the surrounding sounds.

Regarding the second material, 2 participants would lower the subtitles' speed. 1 participant prefers a fixed subtitles position and another prefers the subtitles on the bottom. The same participant as above, would add more details about the surrounding sounds.

In the third material there were 4 participants who would zoom in the translator window so she would be clearer from the waist up. 3 participants prefer the translator window on the right bottom side, 2 of them would also reduce the size of the window. 1 participant need more expression from the translator and another the hair pulled back and her nails without color.

### 4. The information provided by the material would you get them any other way. E.g., using one or a combination of other forms of educational material. Which are those?

4 participants answered that the information provided by the first material could be acquired by sign language only. 1 of them supported that depending on the goal, a combination of sign language and subtitles could be used. 1 participant answered the way of receiving information depend upon personal preferences.

4 participants supported that the second material could be replaced by simple sign language to receive the same information. 1 of them specifically referred to "good sign language and not simple translation". Another participant mentioned the use of speech-to-text application.

For the third material, 3 participants answered that they could receive the information from subtitles, 1 participant repeated the answer for "good sign language" and another answered that he could use both sign language and subtitles.

### 5. Where would the material be useful in your university studies (duties/actions)?

According to 4 participants, the first material could be used in lectures. 2 of them also mentioned homework and 1 in theoretical classes.

3 participants could use the second material in lectures and in theoretical classes. 1 of them also mentioned homework. Another participant could use it for notes.

4 participants mentioned lectures. 2 of them could also use it in theoretical classes and 1 in exams. Another participant said that it could be used where the sound is necessary.

### 6. What are the advantages and disadvantages (pros and cons) of the specific material?

For the first material:

#### Advantages

- Clear subtitles thanks to good color contrast
- Accessible information
- Understandable content

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### Disadvantages

- High speed
- Greek language only
- Black background hiding parts of the video
- No information on the surrounding sounds

For the second material

### Advantages

- Clear subtitles thanks to good color contrast
- Accessible information

### Disadvantages

- High speed
- Greek language only
- When image becomes white cannot distinguish the subtitles
- Black background
- Changing subtitles position

For the third material

### Advantages

- Sign language
- Accessible information
- Quickly understandable information

### Disadvantages

- Strict translation
- Translator's whole body was visible
- Translator's black clothes
- Light background color

## 7. Advantages and disadvantages (pros and cons) of each material (compare each material)

For the first material:

### Advantages

- Clearer subtitles
- Slower subtitle speed

### Disadvantages

- Less visible video because of black background

For the second material

### Advantages

- Subtitle functions

### Disadvantages

- White subtitle letters (less visible)

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- Faster subtitles

For the third material

#### Advantages

- Sign language
- Correct video position

#### Disadvantages

- Different sign gestures in different cities

#### **Questionnaire**

The questionnaire contained the following questions, for which the participants' answers are reported, and their interpretation is given.

#### For the first material:

1. How accessible is the material? - The respondents rated the accessibility of the material with an average score of 9.2. This suggests that the material is easy to access.
2. How difficult was it for you to use it? The respondents rated the accessibility of the material with an average score of 2.4. This indicates that the material is easy to use.
3. To what extent is training required to be able to use it? - The scores have an average of 6, indicating mixed opinions.
4. Would you use it if it was available to you? The respondents indicated that they would certainly use the material if it was available to them, with an average score of 9.6.
5. Would you recommend others to use it? - The respondents indicated that they would certainly recommend others to use the material, with an average score of 9.6.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The respondents indicated that the material would fill the gaps in knowledge to a significant extent, with an average score of 8.6.
7. Could you obtain the information/ knowledge provided by this material in another way? - The respondents were divided in their responses to this question, with some indicating that they could certainly obtain the information through other means, while others indicated that the material provided unique information. The average score was 7.
8. Do you think that the material successfully meets the purpose for which it was built? - Respondents generally believed that the material meets the purpose some in higher and others in lesser degree, with an average score of 7.2.
9. How useful would this material be for your university studies? - The respondents rated the usefulness of the material for their university studies between 9 to 10, with an average score of 9.6. This suggests that the material would be very useful for their studies.
10. How tedious is the material? The respondents rated the material as not very tedious, with an average score of 3.8.
11. How complex and complicated is the material? - The respondents rated the complexity and complication of the material between 1 to 6, with an average score of 4.4. This suggests that the material is not significantly complex.

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12. How much load (memory and attention) does the material's use require? - The scores for the amount of memory and attention required to use the material varied, had an average of 4. This suggests that the material requires some level of attention and memory.
13. How satisfied are you with the use of this material? - The respondents were clearly satisfied, with an average score of 9.6.

For the second material:

1. How accessible is the material? - The respondents rated the accessibility of the material with an average score of 8.4. This suggests that the material is generally easy to access.
2. How difficult was it for you to use it? The respondents rated the accessibility of the material with an average score of 5. This indicates that the participants had mixed opinions.
3. To what extent is training required to be able to use it? - The scores have an average of 5.6, indicating mixed opinions.
4. Would you use it if it was available to you? The respondents indicated that they would use the material if it was available to them, with an average score of 7.8.
5. Would you recommend others to use it? - The respondents indicated that they might recommend others to use the material, with an average score of 7.2.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The respondents indicated that the material would fill the gaps in knowledge, with an average score of 7.6.
7. Could you obtain the information/ knowledge provided by this material in another way? - The respondents were divided in their responses to this question, with some indicating that they could certainly obtain the information through other means, while others indicated that the material provided unique information. The average score was 7.4.
8. Do you think that the material successfully meets the purpose for which it was built? - Respondents generally believed that the material meets the purpose some in higher and others in lesser degree, with an average score of 6.8.
9. How useful would this material be for your university studies? - The respondents rated the usefulness of the material for their university with an average score of 8. This suggests that the material could be very useful for their studies.
10. How tedious is the material? The respondents rated the material with mixed scores, with an average score of 5.8.
11. How complex and complicated is the material? - The respondents rated the complexity an average score of 5.2. This suggests that they had again mixed opinions.
12. How much load (memory and attention) does the material's use require? - The scores for the amount of memory and attention required to use the material varied, had an average of 4.6. This suggests that the material requires some level of attention and memory.
13. How satisfied are you with the use of this material? - The respondents were satisfied, with an average score of 8.8.

For the second material:

1. How accessible is the material? - The respondents rated the accessibility of the material with an average score of 7.8. This suggests that the material was not difficult to access.

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2. How difficult was it for you to use it? The respondents rated the accessibility of the material with an average score of 5.2. This indicates that the participants had mixed opinions.
3. To what extent is training required to be able to use it? - The scores have an average of 5.75, indicating mixed opinions.
4. Would you use it if it was available to you? The respondents indicated that they would use the material if it was available to them, with an average score of 7.6.
5. Would you recommend others to use it? - The respondents indicated that they probably recommend others to use the material, with an average score of 8.
6. To what extent do you believe it will fill gaps of your existent knowledge? - The respondents indicated that the material would fill the gaps in knowledge, with an average score of 7.4.
7. Could you obtain the information/ knowledge provided by this material in another way? - The respondents were divided in their responses to this question, indicating that they could certainly obtain the information through other means. The average score was 9.4.
8. Do you think that the material successfully meets the purpose for which it was built? - Respondents generally believed that the material meets the purpose some in higher and others in lesser degree, with an average score of 7.8.
9. How useful would this material be for your university studies? - The respondents rated the usefulness of the material for their university with an average score of 7.4. This suggests that the material could be useful for their studies.
10. How tedious is the material? The respondents rated the material with an average score of 4.4 indicating that they have not found the material very tedious.
11. How complex and complicated is the material? - The respondents rated the complexity an average score of 4.4 having mixed opinions about its complexity.
12. How much load (memory and attention) does the material's use require? - The scores for the amount of memory and attention required to use the material varied, had an average of 4.8. This suggests that the material requires some level of attention and memory.
13. How satisfied are you with the use of this material? - The respondents were mixed in opinion, with an average score of 6.2.

## 1.4. Conclusions

### 1.4.1. Individuals with Visual Impairments

#### **MS Word Textbook**

Participants appreciated the helpful document navigation features, including shortcuts (Ctrl + F), headings, and the table of contents, as well as the clarity of content with clear descriptions of links and references and the use of bold for headings. The glossary for unfamiliar terms and organizations was also valued. However, changes were suggested, such as relocating and enlarging the page numbering in the left corner and addressing usability issues related to the heaviness and slowness of the accessibility program (Supernova + NVDA) and difficulty with bullet point symbols on mobile devices. Suggestions for improvements included maintaining the helpful navigation features, considering placing the glossary at the end of the book, slightly increasing the font size of titles, using

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numbered lists instead of bullet points for better mobile readability, ensuring consistent and clear page numbering. Additionally, participants mentioned the robotic voice from the screen reader (NVDA) as a disadvantage.

### **DAISY Textbook**

Participants expressed various opinions on the accessibility of the DAISY format. Some appreciated its organization and convenience, finding it well-organized and allowing for quick movement. However, others found it more difficult to navigate compared to MS Word and had issues with page numbering. On the other hand, many participants appreciated the navigation bar and yellow text highlighting during screen reading. Suggestions for improvements included announcing page numbers during screen reading, placing annotations at the end of each page, and adding space or a horizontal line for page changes. Disadvantages mentioned included the inability to open links, difficulties in taking notes by copy-pasting, loss of page numbering within the text, and confusion regarding page changes. It is important to note that participants listed both shared and unique advantages and disadvantages, highlighting the format's suitability based on individual preferences and needs.

### **ePub Textbook**

Participants shared their feedback on various aspects of the ePub document. They discussed navigation, suggesting improvements like better positioning of the table of contents. Appearance was another point of discussion, with participants recommending maintaining a book-like appearance while enhancing navigation methods. The addition of page numbers within the document was suggested for easier navigation. Changes to the placement of footnotes to avoid confusion were also proposed. Advantages highlighted included proper chapter distribution, an integrated reader, appealing appearance, and ease of page finding. Disadvantages mentioned encompassed the inability to copy-paste, difficulties with menu navigation, slower speed compared to Word, lack of specified page numbers within the text, single-page view, and font issues.

### **MS Word Sample book**

The participants emphasized the importance of using headings, graphs, links, and alternative text for accessibility purposes. They preferred working with Word due to its accessibility features and found asterisks helpful in indicating important sentences. Verbal descriptions for images and graphs were considered crucial, with participants suggesting the use of boundaries to distinguish images from text and placing images at the end of chapters to maintain the flow of text. Tables were found to be more useful than verbal descriptions for presenting data, while bullet points were preferred over table structures. The convenience of defining the beginning and end of an image was highlighted. Suggestions for improvements included adjusting the layout to place images after each chapter and moving the asterisk to the beginning of important sentences. Overall, participants expressed satisfaction with the book's design and content, appreciating its ease of use and accessibility features.

### **DAISY Sample book**

During the exploration of the DAISY Samplebook, participants focused on the quality of graphs and images in the digital format, particularly in comparison to the DAISY textbook format. They noted that the digital format's graphs were comparable to those in Word and that images had clear boundaries. Participants suggested that this digital format may be superior to the DAISY textbook due to its easier navigation without the need to find specific pages. However, they acknowledged the disadvantage of navigating pages in the DAISY format. The respondents also commented on the

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distinctness, size, and vividness of the graphs, as well as the quality of the letters. They observed a positive trend in the popularity of DAISY books. Suggestions for improvement included image placement at the end of each chapter, maintaining image boundaries but relocating them, and adding page numbering within the text. Participants appreciated features such as voice options, easy navigation with arrow keys and Ctrl + I, underlining in the integrated screen reader, and the availability of the contents bar. Advantages of the DAISY format included ease of navigation, clear images and fonts, underlining and the navigation bar, and compatibility with mobile phones, while disadvantages included the inability to make text changes, lack of page numbering, and the inability to add pages.

### **ePub Sample book**

The participants have highlighted that the ePub Thorium reader, an application for reading ePub books, consistently uses the term "caption" when referring to captions, which is appreciated and seen as appropriate by the participants. This suggests that the use of clear and accurate terminology in instructional materials holds importance for them. In terms of navigation, participants expressed a desire to change the navigation to the contents, finding it difficult to use, and also suggested altering the page numbering. They emphasized the importance of having an asterisk at the beginning of important sentences. Regarding visual elements, participants favored keeping bullets and the mention of "caption" from the screen reader when reading image captions. They recommended moving images to the end of each chapter and expressed dissatisfaction with the font used in the material. In terms of the general structure, participants wished to modify page numbering, address color loss in important sentences, and improve the appearance of bold writing. Advantages of the ePub Thorium reader included its easy use on mobile devices, the small file format suitable for portable devices, the use of the term "caption" for image captions, and its modern and visually appealing appearance. Disadvantages mentioned were the inability to edit text, the difficulty and complexity of navigation, the separation of the beginning of an image from the rest of the content, and the absence of pages.

### **Power Point**

Participants expressed surprise and praised the accessibility of the Power Point presentation (ppt), particularly its ability to describe images. They found the ppt to be very helpful and fulfilling its purpose effectively. The overall evaluation of the ppt was positive, with participants stating that they really liked it and considering it to be of high quality. Feedback included suggestions to keep the material as it is, make minor changes like adjusting the background color to gray, or improving certain aspects such as making tables more recognizable like in Word. The advantages of the ppt mentioned by participants included clear images and font, the ability to create lists and include audio, text, and video, as well as the flexibility to make it accessible in terms of images. Bullets, numbering, and lists were also appreciated for facilitating understanding. The main disadvantage mentioned was the inability to make changes to the text. Overall, the participants highlighted more advantages than disadvantages of this form of material, with one participant noting a lack of familiarity with some features like alternative text for images.

### **Verbal descriptions**

The participants provided a positive evaluation of the material, describing it as helpful and satisfying. While most participants expressed a desire to keep the material mostly unchanged, some minor changes were suggested, such as making the text shorter or reducing the amount of information presented. Overall, the material was praised for its detailed information and descriptions, which were found to be very helpful in understanding the content. It was also appreciated for being

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understandable and concise, providing a comprehensive picture of the subject matter and delivering information quickly. However, some participants felt that there was too much information, with lengthy and detailed descriptions that could be overwhelming. Complex graphs were also mentioned as a potential challenge in understanding the material. Additionally, a few participants felt that certain information provided was unnecessary or not useful. In summary, while the detailed nature of the material was generally appreciated, there were varying opinions on its length, complexity, and relevance to the overall content.

### **Video**

All participants expressed a positive evaluation of the material, acknowledging its usefulness. Some participants recommended minor changes, such as adding an audio description to the video instead of a separate Word file to avoid fatigue or/and distracting when listening to both files (video file and word file). They also suggested modifying the reader screen description in the Word document's table for better clarity (the screen reader table description using terms like "row 1, row 2" considered confusing or tiresome by some participants). The material was praised for providing detailed information and descriptions that aided understanding, especially for aspects that may have been missed in the video alone. Overall, the material was regarded positively, with suggestions for improvements to enhance integration and usability.

### **Tactile microcapsule**

All participants assessed the tactile material positively. Information in more specialized subjects can become accessible. The different textures in various surface areas were very helpful for some of them. One participant mentioned that small details were more understandable in microcapsule paper. They mentioned they could understand the shapes easily and would keep the graphs and textures. However, some changes and improvements were suggested. One participant mentioned that the Braille language was too close to the signs and the small signs were not very clear to him. They recommended the division of the material in smaller parts, zoomed in with more details and the addition of legends describing each region. Most of the participants mentioned that they would use the tactile material in combination with another type of accessible material like verbal description or audio-tactile material.

### **Tactile Tiger prints**

Participants provided positive feedback on the Tiger tactile material. They mentioned the positive impact of the surface textures of the Tiger prints. Separate details were clearer and more intense. The lines were bold and the various surface areas were understood better. However, in some cases they could not understand the details accurately. In various surface areas overwhelmed with information they had difficulties distinguishing each element. Again, the division of material in smaller parts zoomed in with more details was recommended. The combination of the Tiger prints with an audio element seems to be preferable. Lastly San participants mentioned that familiarization is needed to use tiger tactile prints.

### **Audio-tactile**

All the participants expressed a positive evaluation of the material. Many mentioned this was their favorite type of material because of how easy it was to get the information and perceive each area. While most of the participants mentioned they would find it helpful to have a verbal description in the beginning, one participant preferred to receive the tactile material initially and then proceed to the audio-tactile one. Lastly it was mentioned that some individuals might find it difficult to use the material on their own because of the devices that are needed and, in some cases, the tactile

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touchpad may be unaffordable.

### **Math**

The feedback for mathematical content was mainly positive but some had neutral feelings. Most of the participants expressed positive opinion about the mathematical equations being accessible and the fact that they do not need printed content in Braille or Nemeth. However, they also mentioned that the screen readers need to be updated. Some letters were not spelled correctly and the participants could not understand the content.

### **Chem**

Most of the opinions were neutral but also there were positive ones. The participants struggled to understand the chemical equations. They mentioned that signs were read as letters and confused them. However, on the positive side this material is easy to distribute to more students and there is no need for printing

### **Visual image (for low vision)**

The participants mentioned that this type of material was almost ideal and all of them gave a positive review. The colors were good and the information was easy to get visually. Some recommendations were made. While this type of material is good when there is not a lot of information, when there are more elements, changes are needed. Verbal descriptions in the beginning of the exploration would be helpful. The shapes and the structures should be minimal. Generally, all participants mentioned that an audio element would be helpful in combination with this material.

### **Visual audio-tactile image (for low vision)**

Most of the feedback was positive however there were negative opinions also regarding this material. Generally, the participants found the material useful and commented that they could get the information easily and could read shapes that would be difficult in other occasions. Having the remaining vision some participants mentioned that the tactile feature was unnecessary for them. However, some others said that it could help. One participant mentioned that she would keep two types of sensory feedback, not three - either tactile and audio or visual and audio.

## **1.4.2. Individuals with Mobility Impairments**

### **MS Word Textbook**

Participants expressed their preferences regarding the material and suggested changes to enhance its usability. They appreciate the headers for document navigation, find the description of links helpful, and prefer keeping the page numbering at the top left. However, they recommend improving the navigation bar by increasing the font size and allowing simultaneous visibility of the page for each header. Participants also suggest total alignment, more spacing and indentation for improved readability, and changing the hyperlink functionality (single-click instead of double-click for opening links) and table of contents for easier access. One participant expressed satisfaction with the material's structure and wouldn't make any changes. They highlight the user-friendly nature of the material, its accessibility for individuals with mobility impairments, and the advantage of being able to edit the text. No specific disadvantages were mentioned. Overall, the participants provide valuable feedback on the material and its usability.

### **DAISY Textbook**

Participants provided feedback on the navigation and features of the DAISY textbook, as well as comparisons with Word. They found the navigation bar easier to use compared to Word and

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suggested clearer visual distinctions between levels of indentation in bullet points. Clicking on hyperlinks was convenient, and they desired a feature to easily return to previous locations. Page references within the document for easier navigation and footnotes placed at the end of the page were also suggested. Participants mentioned that footnotes are better in Word, but appreciated the single-click access to hyperlinks and the integrated screen reader in the DAISY textbook. One participant found the application appealing and liked the larger font size in the navigation bar. They recommended keeping the large font size, content navigation bar, page locator bar, and single-click link opening. Changes suggested included adjusting the highlighting color and style, adding a visual indicator for page transitions, including a "back" option, incorporating page numbering, adjusting spacing and indentation, moving footnotes to the end of each page, and adding Greek language support. The advantages of the DAISY textbook mentioned by participants included the content navigation bar, single-click link opening, larger font size, integrated screen reader, and color-coded sections. Disadvantages mentioned included difficulty in changing pages within the document, absence of page numbers, limited zooming options, footnotes located at the end of the book, lack of Greek language settings, and the loss of the free embedded voice. Overall, participants provided valuable feedback to enhance the usability and features of the DAISY textbook.

### **ePub Textbook**

Participants provided feedback on what elements to keep and what changes to make for the ePub format. They suggested keeping the eye-friendly and easy-to-read font, references, spacing between titles and paragraphs, readability of annotations, distances between titles and paragraphs, highlighting and color scheme during reading, embedded screen reader, and the progress bar indicating the percentage of the book read. Changes and modifications suggested included changing the color of the highlighting to blue, adding a page finding bar at the bottom right of the document similar to the DAISY format, adding paragraph indentations and page numbering within the document, making changes to the way pages are navigated, modifying the navigation bar to improve the accessibility of the table of contents, changing the language settings to include Greek, and altering the appearance of annotations in the ePub format. The advantages of the ePub format mentioned by participants included useful references, the book-like appearance, integrated screen reader, highlighting and color-coding during reading, and the progress bar. Disadvantages mentioned included the absence of page numbering within the document, lack of a free embedded Greek voice, challenges with table of contents accessibility, annotations that don't facilitate the reading experience, and difficulty in finding specific pages due to the need to open a separate tab and navigate to the page search bar. The participants' feedback provides insights into improving the ePub format for better readability and user experience.

#### **1.4.3. Individuals with Hearing Impairments**

##### **Open captions**

All the participants reviewed the open captions material positively. The context was well understood and they liked the color of the captions. The black background of the captions received mixed reviews. Some participants liked the contrast with the white captions and could read them clearly, while others mentioned that it hides information from the video. A proposition that was made was to turn the black background transparent. The speed of the captions was considered a little high and some individuals might find it difficult to catch up. Lastly, one participant mentioned that he would like to get more information from the captions, not only the dialogs and voices.

##### **Closed captions**

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The closed captions in this case received mixed evaluation. Some reviewed it positively, while others negatively. The functions provided by the closed captions received the most positive feedback. Most of the participants liked the fact that they could control the captions properties, like color, size, speed, appearance. What bothered almost all of the participants was the position of the captions. It would change positions in different dialogs. Most preferred the caption position on the bottom of the screen. The speed of the captions while it was fine for most of the participants, some found it high.

### **Sign language**

All the participants commented positively on the presence of sign language. The information is understood faster with sign language. However, many did not like the translation made by the translator and recommendations were made. Firstly, the translator, being from another city, signed words that were difficult to understand by some participants. Some mentioned they felt the signing was a direct translation of the dialogs and would not give more information on the context of the video. Recommendations were made on the size and position of the translation video. Many participants preferred a smaller window located on the bottom right part of the image and not hiding information from the video. Regarding the translator, he or she should be visible from the waist and above, with the background having a good contrast with the translator, wearing dark or black clothes, with hair pulled back.

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## 2. A.2.2.7 “Implementation of the research on user requirements”

The adapted and the alternative forms of educational materials was consequently addressed to 118 persons with impairments. Specifically, 63 individuals with visual impairments - 33 with blindness and 30 with residual vision, 19 individuals with hearing impairments and 35 individuals with mobility impairments were asked to declare their requirements as end-users of the material under examination, and express their satisfaction arisen from the use of the material at hand.

### 2.1. Procedures

Each individual was participating in the research alone in a quiet environment, either at the University or at his own place. Initially, the participant answered a number of questions aiming at collecting the demographic data. After that, there was a short period of time where the participant had a familiarization session with the material to be evaluated each time. During the familiarization phase he/she could ask questions to the researcher that were related to the use of the material.

Next, the phase of material study and examination started. In the beginning, the participant explored autonomously the educational material without a time limit, while the process was completed when stated so by the participant. The whole procedure was audio recorded, and the researcher was observing and taking notes. In case the participant did not explore all the aspects of the material, the researcher was motivating him/ her to do so. Each type of educational material was examined separately. Each time a participant completed the examination of a type, he/she proceeded to: 1) a semi-structured interview, and 2) a questionnaire completion.

### 2.2. Instruments

Three instruments were used for collecting quantitative and qualitative data. The first tool (see Appendix I) included a series of questions focusing on the demographic data and the data related to the participants' previous knowledge or their familiarization with the material (different questions for each type of the material), as well as the devices and the software that they would use during the tests.

The second tool was a questionnaire of ten items (see below) evaluating the participants' aspects on a) the effectiveness and b) the working load/requirements that the use of the accessible educational material entailed, as well as their satisfaction over it. The participants declared to what extent (Likert scale 1-10: 1= not at all and 10= absolutely) they agreed with the statements that the ten items of the questionnaire presented. The items were divided into two groups of questions. The first group of questions (questions 1, 3, 4, 5, 6, and 10) included questions describing positive aspects, while the second group of questions (questions 2, 7, 8, and 9), included questions referring to the work load and the requirements that the use of the material could entail for the end-users.

The material the participants studied to answer the questions was consisted of: a) an accessible e-book in docx format consisted of text in French language, b) an accessible sample (e-)book in docx format consisted of text, tables and pictures in French language, c) an accessible e-book in ePub format consisted of text in French language, d) an accessible sample (e-)book in ePub format consisted of text, tables and pictures in French language, e) an accessible e-book in DAISY format

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consisted of text in French language, f) an accessible sample (e-)book in DAISY format consisted of text, tables and pictures in French language, g) two accessible Power Point presentations including text, tables and pictures – one in French and one in Arabic language, h) verbal descriptions (in docx format) of 6 pictures of different kind (such as a statue, a concept map, a cartographic map) in French and Arabic language, i) three pictures (of different kind) in microcapsule paper, and j) three pictures created with a Tiger embosser, k) a video accompanied with a verbal description in a docx file, l) a video in which the video of a person interpreting using the French sign language was embedded, m) a video with closed captions and n) a video with open captions.

From all the above-described material, individuals with blindness studied the items a-k, individuals with residual vision as well as participants with mobility impairments studied the items a-g, while participants with hearing impairments studied the videos l-n.

### Questionnaire

- Q1.** How accessible is the material? (To what extent 1-10)  
**Q2.** To what extent is training required to be able to use it? (1-10)  
**Q3.** Would you use it if it was available to you? (To what extent 1-10)  
**Q4.** Would you recommend others to use it? (To what extent 1-10)  
**Q5.** To what extent do you believe it will fill gaps of your existent knowledge? (To what extent 1-10)  
**Q6.** How useful would this material be for your university studies? (to what extent 1-10)  
**Q7.** How tedious is the material? (to what extent 1-10)  
**Q8.** How complex and complicated is the material? (to what extent 1-10)  
**Q9.** How much load (memory and attention) does the material's use require? (to what extent 1-10).  
**Q10.** How satisfied are you with the use of this material? (to what extent 1-10)

Following the completion of the questionnaire, the participants took part in a semi-structured interview (see below) which aimed to give prominence to additional information regarding the adequacy and the effectiveness of the various types of accessible educational material. Furthermore, topics concerning the usefulness of the material in the context of Higher Education studies, possible changes in and complete substitution of types of the material, were broached during the interview.

### Interview

- INT1.** I would like you to make a general comment on the material. How do you evaluate it (positive / negative)?  
**INT2.** What would you keep and what would you change about it? Can you suggest some changes and improvements?  
**INT3.** Where do you think this material would be helpful for you during your university studies (in which courses/ tasks / activities)?  
**INT4.** Would you replace it with something else (another form of material)?

## 2.3. Participants

In the present research, a total number of a hundred and eighteen (118) individuals with impairments participated. Specifically, the sample of the research consisted of sixty-three (63)

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individuals with visual impairments, thirty-five (35) individuals with mobility impairments, and nineteen (19) individuals with hearing impairments, coming from two countries of Africa, Algeria and Tunisia. The following tables (1-49) present the demographic data of the sample in detail per impairment.

### 2.3.1. Visual Impairments

	Mean	SD	Minimum	Maximum
<b>Age</b>	24.77	5.10	15	39
<b>Age at onset of visual impairment</b>	3.75	6.18	0	21

Table 129. Mean of chronological age and age at onset of impairment of participants with visual impairments.

Gender	Counts	% of Total
Male	34	54.0 %
Female	29	46.0 %

Table 130. Number of male and female participants with visual impairments.

Place of residence	Counts	% of Total
Blida	2	3.2 %
Oran	15	23.8 %
Sfax	11	17.5 %
Sousse	11	17.5 %
Tizi Ouzou	23	36.5 %
Tlemcen	1	1.6 %

Table 131. Place of residence of participants with visual impairments.

University you attend	Counts
Association	3
Blida 2 university	2
Sousse	11
High School of Oran	1
Sfax	11
Tizi Ouzou	23
Tlemcen University	1
University of Mostaganem	1
University of Oran	10

Table 132. University the participants with visual impairments attend.

Type of disability	Counts
Cataracts	3
Diabetic retinopathy	1
Glaucoma	12
Macular degeneration	2

Torn retina	3
Retinopathy left, Right eye prosthesis	1
Congenital glaucoma	1
Genetic	4
Blood pressure	1
Don't know	5
Retinopathy	2
Inherited Glaucoma	2
Retinopathy, glaucoma	1

Table 133. Type of disability of participants with visual impairments.

Age at onset of visual impairments	Counts	% of Total
0	40	63.5 %
1	2	3.2 %
2	3	4.8 %
5	1	1.6 %
6	1	1.6 %
7	1	1.6 %
9	1	1.6 %
10	2	3.2 %
12	4	6.3 %
13	2	3.2 %
15	1	1.6 %
16	1	1.6 %
17	1	1.6 %
19	2	3.2 %
21	1	1.6 %

Table 134. Age at onset of impairment (in years) of participants with visual impairments.

Educational level	Counts	% of Total
Undergraduate student	16	25.4 %
Graduate of higher education	16	25.4 %
Master or PhD student	29	46.0 %
Master or PhD graduate	2	3.2 %

Table 135. Educational level of participants with visual impairments.

Severity of visual impairments	Counts	% of Total
Blindness	33	52.4 %



Severe visual impairments	16	25.4 %
Moderate visual impairments	12	19.0 %
Low vision	2	3.2 %

Table 136. Severity of visual impairment.

Means of reading	Counts	% of Total
Braille or screen reader	47	75.8 %
Both	7	11.3 %
Large prints or magnifiers	8	12.9 %

Table 137. Means participant with visual impairments use to access information.

Move alone	Counts	% of Total
Alone	14	22.2 %
Sometimes alone and sometimes with help of an attendant	30	47.6 %
With help of an attendant	19	30.2 %

Table 138. Movement – independent or with help – of participants with visual impairments.

How often move alone	Counts	% of Total
Never	10	15.9 %
Few times	22	34.9 %
Some times	2	3.2 %
Most of the time	18	28.6 %
Always	11	17.5 %

Table 139. Frequency of independent movement.

Use assistive technology	Counts	% of Total
Yes	59	93.7 %
No	4	6.3 %

Table 140. Use of assistive technology.

Which assistive technology	Counts
Telephone (Zoom)	4
Telephone (talkback)	20
Applications installed in smartphone	1
Braille	9
Braille Magnification	1
Screen reader	34

Insta reader (android), onvision (android), lookout	1
Word PDF audio from classmate	1
PDF converter with a classmate	1
Narrator on mobile phone	8
SmartVoice	2
White cane	1

Table 141. Assistive technology means the participants with visual impairments use.

Educational material suitable	Counts
Text	5
Text & Audio	20
Text, Audio, & Audio-visual	2
Text & Audio-visual	4
Audio	22
Audio & Audio-visual	3
Audio-visual	6

Table 142. Kind of educational material the participants with visual impairments find suitable.

Use accessible material	Counts	% of Total
Yes	44	69.8 %
No	19	30.2 %

Table 143. The use of accessible material.

### 2.3.2. Mobility impairments

	Mean	SD	Minimum	Maximum
<b>Age</b>	26.79	8.08	19	57
<b>Age at onset</b>	2.43	4.08	0	20

Table 144. Mean of chronological age and age at onset of impairment of participants with mobility impairments.

Gender	Counts	% of Total
Males	21	60.0 %
Females	14	40.0 %

Table 145. Number of male and female participants with mobility impairments.

Place of residence	Counts	% of Total
Blida	2	5.7 %

Oran	15	42.9 %
Sfax	2	5.7 %
Sousse	3	8.6 %
Tizi Ouzou	7	20.0 %
Tlemcen	6	17.1 %

Table 146. Place of residence of participants with mobility impairments.

University you attend	Counts
Abou Bekr Belkaid University	6
Blida 2 university	2
Sfax	2
Sousse	3
Tizi Ouzou	7
Univesrity of Oran	15

Table 147. University the participants with mobility impairments attend.

Type of disability	Counts
Accident	1
Hereditary progressive	1
Chain myopathy	1
Charcot-marie-tooth	1
Hemiplegia	4
Hemiplegia, Accident	1
Myopathy	4
Organic	1
Paralysis disease	9
Spina Bifida	2
Writer's cramp	1

Table 148. Type of disability of participants with mobility impairments.

Educational level	Counts	% of Total
Undergraduate student	11	31.4 %
Graduate of higher education	12	34.3 %
Master or PhD student	10	28.6 %
Master or PhD graduate	2	5.7 %

Table 149. Educational level of participants with mobility impairments.

Disability occurs	Counts	% of Total
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In lower extremities	14	41.2 %
In upper extremities	5	14.7 %
In lower and upper extremities	13	38.2 %
On one side of body	1	2.9 %
Only in one of extremities	1	2.9 %

Table 150. Body levels (parts) impacted from impairment.

Hands functionality	Counts
I handle all objects easily and successfully. I may have some difficulties in activities that require great speed or/and accuracy. However, these difficulties do not restrict my independence in my daily activities at all.	11
I handle all objects with somewhat reduced quality (accuracy) or/and speed. Certain activities need to be done in alternative ways. Usually, these difficulties do not restrict my independence in my daily activities.	3
I handle objects with difficulty, I need help to prepare or modify the activities. My performance is slow and can be achieved with limited success as regards the quantity and quality of activity. I can be independent, only if the activities have been adapted for me.	8
I can only handle selected (very specific) objects that are easy and only in adapted activities. Usually, I only perform parts of an entire activity with a lot of effort and with limited success. I need continuous support, assistance and/or adapted equipment.	1
Basically, I cannot handle objects as I have severely limited ability to perform even simple actions. I need total assistance.	2

Table 151. Description of hands functionality.

Move alone	Counts	% of Total
Alone	13	37.1 %
Sometimes alone and sometimes with help of an attendant	11	22.9 %
With help of an attendant	11	22.9 %

Table 152. Movement – independent or with help – of participants with mobility impairments.

How often move alone	Counts	% of Total
Never	7	20.0 %
Few times	1	2.9 %
Some times	5	14.3 %
Most of the time	11	31.4 %
Always	11	31.4 %

Table 153. Frequency of independent movement.

Describe your commute	Counts	% of Total
I walk on any place without restrictions and assistance. I may have	5	14.3 %

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balance, speed or motor-coordination difficulties.		
In most places, I walk without any assistance. However, outside my home, I may use either walking aids – walkers, crutch, cane – for walking or climbing up the stairs or a wheelchair for long distances.	4	11.4 %
Most of the time, I need walking aids to be able to walk anywhere. Usually, I need the assistance of another person or I need specialized equipment to get up from the floor, from the bed, or from the chair. When climbing stairs, I usually need assistance or at least supervision from someone else. I need a wheelchair for outdoor environments.	4	11.4 %
Almost everywhere, I use a wheelchair on my own (either electric or manual wheelchair). However, almost always, I need the assistance of another person. Usually, I need special support on my torso (e.g., waist) and/or my head. I can walk at home for a while but only with the assistance of another person.	9	25.7 %
In all cases and in all places, I use a wheelchair. At best, I can use an electric wheelchair. I always need special support in my waist, torso and head. I use many types of assistive devices for mobility impairments, but I still need the assistance of another person.	13	37.1 %

Table 154. Ways and means of commuting.

Use assistive devices	Counts	% of Total
Yes	18	51.4 %
No	17	48.6 %

Table 155. Use of assistive technology.

Which assistive devices	Counts
Crutches	2
Wheelchair	9
Electric wheelchair	6
Voice synthesizer	1
Deambulator	1

Table 156. Assistive technology means the participants with mobility impairments use.

Educational material suitable	Counts
Text, Visual & Audio	1
Text, Visual, Audio & Audio-visual	19
Text, Visual & Audio-visual	6
Text & Audio	1
Text & Audio-visual	1
Visual	2

Visual, Audio & Audio-visual	1
Audio-visual	2

Table 157. Kind of educational material the participants with mobility impairments find suitable.

Use accessible material	Counts	% of Total
Yes	5	14.3 %
No	30	85.7 %

Table 158. The use of accessible material.

What accessible material	Counts
Accessible texts with screen reader	2

Table 159. Kind of accessible material the participants with mobility impairments use.

### 2.3.3. Hearing Impairments

	Mean	SD	Minimum	Maximum
Age	22.33	1.97	20	27
Age at onset	0.789	2.07	0	8

Table 160. Mean of chronological age and age at onset of impairment of participants with hearing impairments.

Gender	Counts	% of Total
Males	11	57.9 %
Females	8	42.1 %

Table 161. Number of male and female participants with hearing impairments.

Place of residence	Counts	% of Total
Oran	15	78.9 %
Sousse	2	10.5 %
Tizi Ouzou	2	10.5 %

Table 162. Place of residence of participants with hearing impairments.

University you attend	Counts	% of Total
Tizi Ouzou	2	10.5 %
University of Oran	15	79 %
Association de Sousse	2	10.5 %

Table 163. University the participants with hearing impairments attend.

Age at onset of hearing impairments	Counts	% of Total
0	16	84.2 %
3	1	5.3 %

4	1	5.3 %
8	1	5.3 %

Table 164. Age at onset of impairment (in years) of participants with hearing impairments.

Educational level	Counts	% of Total
Undergraduate student	4	21.1 %
Graduate of higher education	11	57.9 %
Master or PhD student	4	21.1 %

Table 165. Educational level of participants with hearing impairments.

Bilateral loss	Counts	% of Total
Yes	15	78.9 %
No	4	21.1 %

Table 166. Bilateral loss of hearing.

Parents with deafness	Counts	% of Total
Yes	2	10.5 %
No	17	89.5 %

Table 167. Existence of parents with deafness.

Lip-reader	Counts	% of Total
Yes	9	47.4 %
No	10	52.6 %

Table 168. Number of lip-readers.

Difficulty - oral language	Counts	% of Total
Easy	11	57.9 %
Difficult	5	26.3 %
Very difficult	3	15.8 %

Table 169. Difficulty of understanding the oral language (through lip-reading).

Written French/Arabic language	Counts	% of Total
Yes	18	94.7 %
No	1	5.3 %

Table 170. Understanding of French/Arabic language.

Difficulty - written language	Counts	% of Total
Very easy	9	47.4 %
Easy	9	47.4 %

Very difficult	1	5.3 %
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Table 171. Difficulty of understanding the written language.

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Sign language	Counts	% of Total
Yes	17	89.5 %
No	2	10.5 %

Table 172. Knowledge of sign language.

Use assistive devices	Counts	% of Total
Yes	13	68.4 %
No	6	31.6 %

Table 173. Use of assistive technology.

Which assistive devices	Counts
Hearing aid	12
Auditory speaker	1

Table 174. Assistive technology means the participants with hearing impairments use.

Educational material suitable	Counts
Text & Visual	2
Visual	1
Audio-visual	16

Table 175. Kind of educational material the participants with hearing impairments find suitable.

Use accessible material	Counts
Yes	15
No	4

Table 176. The use of accessible material.

What accessible material	Counts
Video with captions or sign language	15

Table 177. Kind of accessible material the participants with hearing impairments use.

## 2.4. Results

### 2.4.1. Visual impairments

The following tables present the results of the descriptive statistical analysis on the visually impaired participants' answers to the items of the questionnaire. The participants declared to what extent (Likert scale 1-10: 1 = not at all and 10 = absolutely) they agree with the statements presented through the ten items of the questionnaire. On each table there are two lines with total mean scores. The first line refers to the total mean score of the questions 1, 3, 4, 5, 6, and 10. This is a group of items representing the positive aspects of the participants. The second line refers to the total mean score of the questions 2, 7, 8, and 9, which constitute a group of items referring to the work load and the requirements that the type of the material examined entails.

1. e-books: Accessible book (docx)	Mean	SD	Min	Max
How accessible is the material?	5.77	1.63	2	9
To what extent is training required to be able to use it?	6.31	2.76	1	10
Would you use it if it was available to you?	8.73	1.16	5	10
Would you recommend others to use it?	7.98	2.20	5	10
To what extent do you believe it will fill gaps of your existent knowledge?	6.42	2.04	1	9
How useful would this material be for your university studies?	8.87	1.83	1	10
How tedious is the material?	2.58	1.97	0	7
How complex and complicated is the material?	4.33	1.53	1	7
How much load (memory and attention) does the material's use require?	4.12	1.90	1	10
How satisfied are you with the use of this material?	6.75	3.23	2	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.34</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>7.42</b>			

Table 178. Assessment of accessible book in docx format in participants with visual impairments.

2. e-books: Accessible book (ePub)	Mean	SD	Min	Max
How accessible is the material?	5.86	1.484	2	9
To what extent is training required to be able to use it?	6.27	2.822	1	10
Would you use it if it was available to you?	8.78	1.419	2	10
Would you recommend others to use it?	8.06	2.158	5	10
To what extent do you believe it will fill gaps of your existent knowledge?	6.67	2.132	1	10
How useful would this material be for your university studies?	8.88	1.829	1	10
How tedious is the material?	2.55	1.826	0	6

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How complex and complicated is the material?	4.27	1.358	1	6
How much load (memory and attention) does the material's use require?	3.86	1.919	1	10
How satisfied are you with the use of this material?	6.82	3.204	2	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.24</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>7.51</b>			

Table 179. Assessment of accessible book in ePub format in participants with visual impairments.

<b>3. e-books: Accessible book (DAISY)</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
How accessible is the material?	6.06	1.583	2	9
To what extent is training required to be able to use it?	6.92	2.927	1	10
Would you use it if it was available to you?	7.69	1.606	2	10
Would you recommend others to use it?	7.82	2.389	2	10
To what extent do you believe it will fill gaps of your existent knowledge?	6.53	2.603	1	10
How useful would this material be for your university studies?	8.06	2.258	1	10
How tedious is the material?	2.43	1.700	0	8
How complex and complicated is the material?	4.55	1.942	1	9
How much load (memory and attention) does the material's use require?	3.84	2.469	1	10
How satisfied are you with the use of this material?	7.29	3.113	2	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.4</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>7.24</b>			

Tbale 180. Assessment of accessible book in DAISY format in participants with visual impairments.

<b>4. Accessible Power point</b>	<b>Mean</b>	<b>SD</b>	<b>Minimum</b>	<b>Maximum</b>
How accessible is the material?	6.18	1.911	1	9
To what extent is training required to be able to use it?	6.08	2.253	1	10
Would you use it if it was available to you?	6.98	1.846	2	10
Would you recommend others to use it?	6.58	1.715	1	10
To what extent do you believe it will fill gaps of your existent knowledge?	5.72	2.313	1	10
How useful would this material be for your university studies?	8.18	1.004	5	10
How tedious is the material?	4.68	1.755	1	8
How complex and complicated is the material?	3.68	1.659	1	10
How much load (memory and attention)	5.10	2.261	1	9

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does the material's use require?				
How satisfied are you with the use of this material?	7.10	3.202	1	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.89</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>6.79</b>			

Table 181. Assessment of accessible Power Point presentation in participants with visual impairments.

5. Verbal description of pictures	Mean	SD	Minimum	Maximum
How accessible is the material?	5.46	2.474	1	9
To what extent is training required to be able to use it?	3.30	2.068	1	8
Would you use it if it was available to you?	7.62	1.645	3	10
Would you recommend others to use it?	7.38	1.951	3	10
To what extent do you believe it will fill gaps of your existent knowledge?	7.13	2.262	2	10
How useful would this material be for your university studies?	8.05	2.513	2	10
How tedious is the material?	4.57	1.756	1	7
How complex and complicated is the material?	5.25	1.850	1	7
How much load (memory and attention) does the material's use require?	6.03	2.213	2	9
How satisfied are you with the use of this material?	7.38	3.067	2	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.79</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>7.17</b>			

Table 182. Assessment of verbal descriptions of pictures in participants with visual impairments.

6. Pictures on microcapsule paper	Mean	SD	Minimum	Maximum
How accessible is the material?	5.10	1.907	1	9
To what extent is training required to be able to use it?	7.90	1.403	6	10
Would you use it if it was available to you?	6.76	1.199	5	10
Would you recommend others to use it?	6.12	1.269	5	10
To what extent do you believe it will fill gaps of your existent knowledge?	8.39	1.730	5	10

How useful would this material be for your university studies?	8.00	2.121	3	10
How tedious is the material?	7.65	1.052	5	9
How complex and complicated is the material?	7.43	1.061	3	8
How much load (memory and attention) does the material's use require?	8.88	1.550	5	10
How satisfied are you with the use of this material?	8.04	2.354	3	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>7.97</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>7.07</b>			

Table 183. Assessment of pictures on microcapsule paper in participants with visual impairments.

<b>7. Pictures created with Tiger</b>	<b>Mean</b>	<b>SD</b>	<b>Minimum</b>	<b>Maximum</b>
How accessible is the material?	5.06	1.625	1	9
To what extent is training required to be able to use it?	7.47	1.781	3	10
Would you use it if it was available to you?	6.53	1.709	1	9
Would you recommend others to use it?	5.88	1.394	3	10
To what extent do you believe it will fill gaps of your existent knowledge?	8.18	2.108	2	10
How useful would this material be for your university studies?	8.04	2.121	3	10
How tedious is the material?	7.10	2.044	1	9
How complex and complicated is the material?	6.69	1.636	2	10
How much load (memory and attention) does the material's use require?	7.55	1.990	1	10
How satisfied are you with the use of this material?	7.92	2.317	3	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>7.20</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>6.94</b>			

Table 184. Assessment of tactile pictures created with a Tiger embosser in participants with visual impairments.

<b>8. Tactile pictures for commenting</b>	<b>Mean</b>	<b>SD</b>	<b>Minimum</b>	<b>Maximum</b>
How accessible is the material?	5.79	1.277	4	8
To what extent is training required to be able to use it?	6.45	0.760	5	7
Would you use it if it was available to you?	5.68	0.471	5	6
Would you recommend others to use it?	5.16	0.370	5	6
To what extent do you believe it will fill gaps of	9.42	0.793	8	10

your existent knowledge?				
How useful would this material be for your university studies?	9.55	0.602	8	10
How tedious is the material?	5.82	2.759	2	8
How complex and complicated is the material?	4.92	2.634	1	7
How much load (memory and attention) does the material's use require?	6.68	1.710	4	8
How satisfied are you with the use of this material?	9.55	0.602	8	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>5.97</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>7.53</b>			

Table 185. Assessment of tactile pictures created for commenting by participants with visual impairments.

9. Video (with table)	Mean	SD	Minimum	Maximum
How accessible is the material?	6.93	1.033	5.00	8.00
To what extent is training required to be able to use it?	8.07	1.100	6.00	10.00
Would you use it if it was available to you?	6.20	1.014	4.00	7.00
Would you recommend others to use it?	5.80	0.561	5.00	7.00
To what extent do you believe it will fill gaps of your existent knowledge?	5.40	0.632	5.00	7.00
How useful would this material be for your university studies?	5.20	0.862	4.00	7.00
How tedious is the material?	4.80	0.676	4.00	6.00
How complex and complicated is the material?	5.33	1.047	4.00	7.00
How much load (memory and attention) does the material's use require?	5.73	0.594	5.00	7.00
How satisfied are you with the use of this material?	5.80	1.082	4.00	7.00
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>5.98</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>5.89</b>			

Table 186. Assessment of video given with verbal description in participants with visual impairments

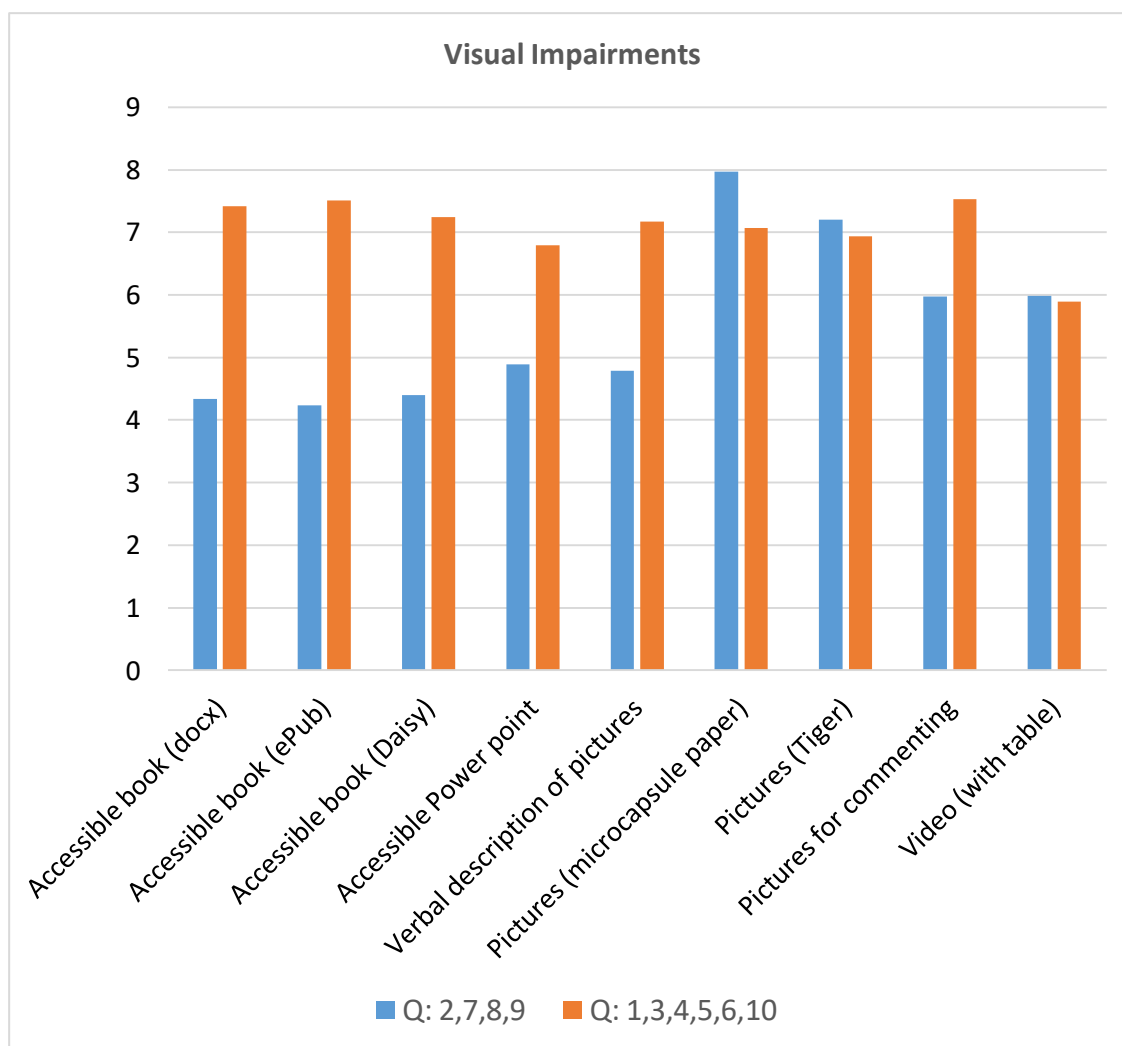


Figure 1. The diagram presents the mean scores of the participants with visual impairments in the two groups of questions (1, 3, 4, 5, 6, and 10 = positive aspects, 2, 7, 8, and 9 = work load and requirements)

The tables below present the results of the analysis of the visually impaired participants' answers in the semi-structured interview:

**INT1.** I would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

**INT2.** What would you keep and what would you change about it? Can you suggest some changes and improvements?

**INT3.** Where do you think this material would be helpful for you during your university studies (in which courses/ tasks / activities)?

**INT4.** Would you replace it with something else (another form of material)?

Accessible book (docx)_INT1	Counts
Positive	16
Very useful	24

Table 187. Visually impaired participants' answers in the first question of the interview (general comment) with reference to accessible book in docx format.

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Accessible book (docx)_INT2	Counts
Add automatic accessibility corrector	15

Table 188. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to accessible book in docx format.

Accessible book (docx)_INT3	Counts
Reading books	23
All courses and tasks	16
To prepare dissertation and read books and documents related to the studied Module	1

Table 189. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to accessible book in docx format.

Accessible book (docx)_INT4	Counts
No	17

Table 190. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to accessible book in docx format.

Accessible book (ePub)_INT1	Counts
Positive	16
Very useful	23

Table 191. Visually impaired participants' answers in the first question of the interview (general comment) with reference to accessible book in ePub format.

Accessible book (ePub)_INT2	Counts
Add automatic accessibility corrector	11
Add automatic accessibility corrector and accessibility features	4

Table 192. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to accessible book in ePub format.

Accessible book (ePub)_INT3	Counts
Reading books	23
All courses and tasks	16

Table 193. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to accessible book in ePub format.

Accessible book (ePub)_INT4	Counts
No	16

Table 194. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to accessible book in ePub format.



Accessible book (DAISY)_INT1	Counts
Very useful	23

Table 195. Visually impaired participants' answers in the first question of the interview (general comment) with reference to accessible book in DAISY format.

Accessible book (DAISY)_INT2	Counts
Nothing	14

Table 196. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to accessible book in DAISY format.

Accessible book (DAISY)_INT3	Counts
Reading books	23

Table 197. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to accessible book in DAISY format.

Accessible book (DAISY)_INT4	Counts
No	19

Table 198. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to accessible book in DAISY format.

Accessible Power point _INT1	Counts
Courses	23
It is not accessible for screen readers thus it is not usefull	1
Positive	16

Table 199. Visually impaired participants' answers in the first question of the interview (general comment) with reference to accessible Power Point presentation.

Accessible Power point _INT2	Counts
Self accessibility corrector	15
I would like there to be a software that can effectively read the power point	1

Table 200. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to accessible Power Point presentation.

Accessible Power point _INT3	Counts
Activities, courses, tasks	3
Courses	33
Tasks, courses	3
To read the courses provided by teachers and to prepare presentations	1

Table 201. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to accessible Power Point presentation.

Accessible Power point _INT4	Counts
No	16
Yes with word docs	1

Table 202. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to accessible Power Point presentation.

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Verbal description of pictures_INT1	Counts
It is good to receive some information	23
Positive	26
It is very usefull	1

Table 203. Visually impaired participants' answers in the first question of the interview (general comment) with reference to verbal description of pictures.

Verbal description of pictures_INT2	Counts
Never used during their studies	11
Not available	15
Nothing	1

Table 204. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to verbal description of pictures.

Verbal description of pictures_INT3	Counts
Never used	11
Some activities and presentations	23
All courses and tasks	15
To read materials given by teachers and to read more about each module	1

Table 205. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to verbal description of pictures.

Verbal description of pictures_INT4	Counts
Never used	11
No	16

Table 206. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to verbal description of pictures.

Pictures on microcapsule paper_INT1	Counts
It is the first time I use these pictures	23
Positive	15

Table 207. Visually impaired participants' answers in the first question of the interview (general comment) with reference to pictures on microcapsule paper.

Pictures on microcapsule paper_INT2	Counts
Use High-quality paper	1
Not available	11
Use Soft paper	3

Table 208. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to pictures on microcapsule paper.

Pictures on microcapsule paper_INT3	Counts
Courses and tasks	8
Courses, tasks and activities	7

Table 209. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to pictures on microcapsule paper.

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Pictures on microcapsule paper_INT4	Counts
No	15

Table 210. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to pictures on microcapsule paper.

Pictures created with Tiger_INT1	Counts
It is the first time I use these pictures	23
Positive	15

Table 211. Visually impaired participants' answers in the first question of the interview (general comment) with reference to pictures created with a Tiger embosser.

Pictures created with Tiger_INT2	Counts
Audio description	2
Braille captions	2
High contrast	5
Not available	3
Tactile Features	3

Table 212. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to pictures created with a Tiger embosser.

Pictures created with Tiger_INT3	Counts
All courses	15

Table 213. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to pictures created with a Tiger embosser.

Pictures created with Tiger_INT4	Counts
3D Models	2
Braille	5
Not available	8

Table 214. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to pictures created with a Tiger embosser.

Tactile pictures for commenting_INT1	Counts
It is the first time I use these pictures	23
Positive	15

Table 215. Visually impaired participants' answers in the first question of the interview (general comment) with reference to pictures created for commenting.

Tactile pictures for commenting_INT2	Counts
Not available	14
Use soft paper	1

Table 216. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to pictures created for commenting.

Tactile pictures for commenting_INT3	Counts
In all courses	15

Table 217. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to pictures created for commenting.

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<b>Tactile pictures for commenting_INT4</b>	<b>Counts</b>
3D Printing	3
Haptic technology	1
Not available	4
Verbal description	6
Virtual Reality	1

Table 218. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to pictures created for commenting.

<b>Video (with table)_INT1</b>	<b>Counts</b>
Negative	5
Positive	10

Table 219. Visually impaired participants' answers in the first question of the interview (general comment) with reference to the video with a verbal description.

<b>Video (with table)_INT2</b>	<b>Counts</b>
Clear voice description of table	1
Describing the content of the table is better	1
I prefer a clear description	1
It needs voice description	1
Not available	5
Should not be simple table	1
Should not be so complex	5

Table 220. Visually impaired participants' answers in the second question of the interview (keep-change) with reference to the video with a verbal description.

<b>Video (with table)_INT3</b>	<b>Counts</b>
Breaking down complex processes	3
Classify the data	7
Comparing data	3
Summarizing information	2

Table 221. Visually impaired participants' answers in the third question of the interview (helpful during studies) with reference to the video with a verbal description.

<b>Video (with table)_INT4</b>	<b>Counts</b>
Audio descriptions	6
Captions	4
Transcripts	5

Table 222. Visually impaired participants' answers in the fourth question of the interview (replace the material) with reference to the video with a verbal description.

## 2.4.2. Mobility impairments

The following tables present the results of the descriptive statistical analysis on the mobility impaired participants' answers to the items of the questionnaire. The participants declared to what extent (Likert scale 1-10: 1 = not at all and 10 = absolutely) they agree with the statements presented through the ten items of the questionnaire. On each table there are two lines with total mean scores. The first line refers to the total mean score of the questions 1, 3, 4, 5, 6, and 10. This is a group of items representing the positive aspects of the participants. The second line refers to the total mean score of the questions 2, 7, 8, and 9, which constitute a group of items referring to the work load and the requirements that the type of the material examined entails.

1. e-books: Accessible book (docx)	Mean	SD	Minimum	Maximum
How accessible is the material?	6.94	2.82	1	10
To what extent is training required to be able to use it?	4.70	3.17	0	10
Would you use it if it was available to you?	7.30	3.12	2	10
Would you recommend others to use it?	7.52	1.94	5	10
To what extent do you believe it will fill gaps of your existent knowledge?	5.36	3.01	0	10
How useful would this material be for your university studies?	6.30	3.57	0	10
How tedious is the material?	3.36	2.12	0	5
How complex and complicated is the material?	4.00	2.83	0	9
How much load (memory and attention) does the material's use require?	4.91	2.40	1	9
How satisfied are you with the use of this material?	6.91	2.54	3	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.25</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>6.72</b>			

Table 223. Assessment of accessible book in docx format in participants with mobility impairments.

2. e-books: Accessible book (ePub)	Mean	SD	Minimum	Maximum
How accessible is the material?	5.79	2.96	1	10
To what extent is training required to be able to use it?	5.27	3.61	0	10
Would you use it if it was available to you?	7.36	2.90	2	10
Would you recommend others to use it?	7.03	2.21	3	10
To what extent do you believe it will fill gaps of your existent knowledge?	5.21	2.92	0	10
How useful would this material be for your university studies?	5.88	3.90	0	10
How tedious is the material?	3.67	2.35	0	7
How complex and complicated is the material?	4.06	2.89	0	9
How much load (memory and attention) does the material's use require?	5.55	2.20	2	9
How satisfied are you with the use of this material?	6.15	2.56	2	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.64</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>6.24</b>			

Table 224. Assessment of accessible book in ePub format in participants with mobility impairments.

3. e-books: Accessible book (DAISY)	Mean	SD	Minimum	Maximum
How accessible is the material?	6.70	3.24	1	10
To what extent is training required to be able to use it?	5.88	3.66	0	10
Would you use it if it was available to you?	5.85	2.58	2	9
Would you recommend others to use it?	6.55	2.54	2	10
To what extent do you believe it will fill gaps of your existent knowledge?	4.79	2.96	0	9
How useful would this material be for your university studies?	4.45	3.15	0	9
How tedious is the material?	3.39	2.62	0	8
How complex and complicated is the material?	4.58	3.36	0	9
How much load (memory and attention) does the material's use require?	5.85	2.56	2	9
How satisfied are you with the use of this material?	6.85	2.44	2	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.93</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>5.87</b>			

Table 225. Assessment of accessible book in DAISY format in participants with mobility impairments.

4. Accessible Power Point	Mean	SD	Minimum	Maximum
How accessible is the material?	6.52	3.04	1	10
To what extent is training required to be able to use it?	7.38	1.82	5	10
Would you use it if it was available to you?	8.83	1.67	1	10
Would you recommend others to use it?	8.31	2.02	3	10
To what extent do you believe it will fill gaps of your existent knowledge?	6.90	1.40	5	10
How useful would this material be for your university studies?	6.55	3.86	0	10
How tedious is the material?	3.45	2.38	0	7
How complex and complicated is the material?	6.10	1.59	1	9
How much load (memory and attention) does the material's use require?	7.21	1.45	1	9
How satisfied are you with the use of this material?	7.83	1.87	2	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>6.04</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>7.49</b>			

Table 226. Assessment of accessible Power Point presentation in participants with visual impairments

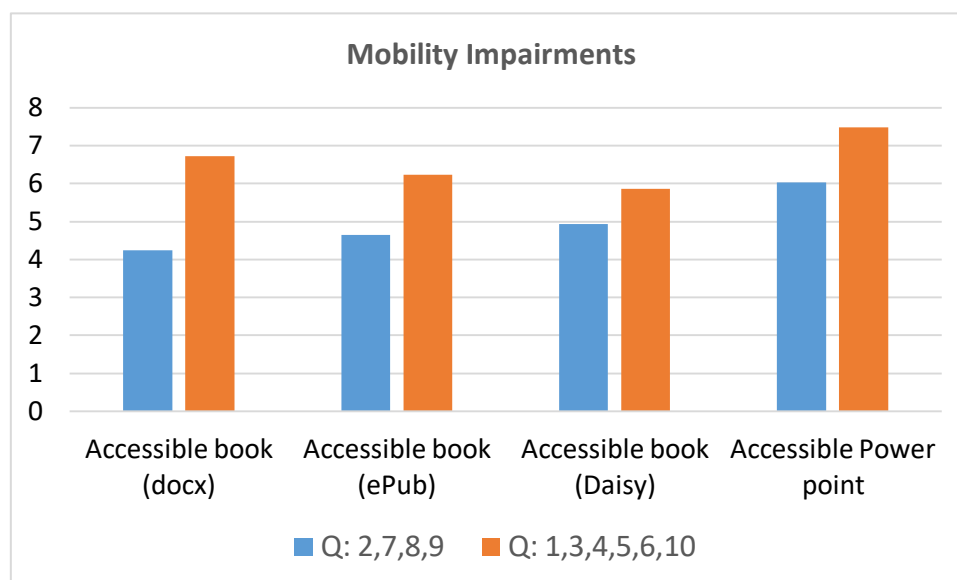


Figure 2. The diagram presents the mean scores of the participants with mobility impairments in the two groups of questions (1, 3, 4, 5, 6, and 10 = positive aspects, 2, 7, 8, and 9 = work load and requirements)

The tables below present the results of the analysis of the mobility impaired participants' answers in the semi-structured interview:

**INT1.** I would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

**INT2.** What would you keep and what would you change about it? Can you suggest some changes and improvements?

**INT3.** Where do you think this material would be helpful for you during your university studies (in which courses/ tasks / activities)?

**INT4.** Would you replace it with something else (another form of material)?

Accessible book (docx)_INT1	Counts
Positive	25

Table 227. Mobility impaired participants' answers in the first question of the interview (general comment) with reference to accessible book in docx format.

Accessible book (docx)_INT2	Counts
I do not need it for my studies but it is good	7
Add eye and head detector movement	6
Add more accessibility features	9

Table 228. Mobility impaired participants' answers in the second question of the interview (keep-change) with reference to accessible book in docx format.

Accessible book (docx)_INT3	Counts
No	7
All courses	18

Table 229. Mobility impaired participants' answers in the third question of the interview (helpful during studies) with reference to accessible book in docx format.

Accessible book (docx)_INT4	Counts
No	25

Table 230. Mobility impaired participants' answers in the fourth question of the interview (replace the material) with reference to accessible book in docx format.

Accessible book (ePub)_INT1	Counts
Positive	25

Table 231. Mobility impaired participants' answers in the first question of the interview (general comment) with reference to accessible book in ePub format.

Accessible book (ePub)_INT2	Counts
Add more accessibility features	14
I do not need it for my studies but it is good	7
Add automatic accessibility corrector and accessibility features	1

Table 232. Mobility impaired participants' answers in the second question of the interview (keep-change) with reference to accessible book in ePub format.

Accessible book (ePub)_INT3	Counts
No	7
All courses	18

Table 233. Mobility impaired participants' answers in the third question of the interview (helpful during studies) with reference to accessible book in ePub format

Accessible book (ePub)_INT4	Counts
No	25

Table 234. Mobility impaired participants' answers in the fourth question of the interview (replace the material) with reference to accessible book in ePub format.

Accessible book (DAISY)_INT1	Counts
Positive	25

Table 235. Mobility impaired participants' answers in the first question of the interview (general comment) with reference to accessible book in DAISY format.

Accessible book (DAISY)_INT2	Counts
I do not need it for my studies but it is good	7
No thing to add	15

Table 236. Mobility impaired participants' answers in the second question of the interview (keep-change) with reference to accessible book in DAISY format.

Accessible book (DAISY)_INT3	Counts
All courses	18

Table 237. Mobility impaired participants' answers in the third question of the interview (helpful during studies) with reference to accessible book in DAISY format.

Accessible book (DAISY)_INT4	Counts
Audio books	7
Braille	3
No	7
Pdf	4
ePub	1



Table 238. Mobility impaired participants' answers in the fourth question of the interview (replace the material) with reference to accessible book in DAISY format.

Accessible Power point_INT1	Counts
I do not need it for my studies but it is good	7
Positive	18

Table 239. Mobility impaired participants' answers in the first question of the interview (general comment) with reference to accessible Power Point presentation.

Accessible Power point_INT2	Counts
No	7
Self-accessibility corrector	15

Table 240. Mobility impaired participants' answers in the second question of the interview (keep-change) with reference to accessible Power Point presentation.

Accessible Power point_INT3	Counts
All courses	25

Table 241. Mobility impaired participants' answers in the third question of the interview (helpful during studies) with reference to accessible Power Point presentation.

Accessible Power point_INT3	Counts
All courses	25

Table 242. Mobility impaired participants' answers in the fourth question of the interview (replace the material) with reference to accessible Power Point presentation.

### 2.4.3. Hearing impairments

The following tables present the results of the descriptive statistical analysis on the hearing-impaired participants' answers to the items of the questionnaire. The participants declared to what extent (Likert scale 1-10: 1 = not at all and 10 = absolutely) they agree with the statements presented through the ten items of the questionnaire. On each table there are two lines with total mean scores. The first line refers to the total mean score of the questions 1, 3, 4, 5, 6, and 10. This is a group of items representing the positive aspects of the participants. The second line refers to the total mean score of the questions 2, 7, 8, and 9, which constitute a group of items referring to the work load and the requirements that the type of the material examined entails.

10. Video with sign language	Mean	SD	Minimum	Maximum
How accessible is the material?	8.84	2.316	2	10
To what extent is training required to be able to use it?	7.16	2.754	1	10
Would you use it if it was available to you?	9.24	1.251	7	10
Would you recommend others to use it?	9.89	0.315	9	10
To what extent do you believe it will fill gaps of your existent knowledge?	8.58	1.677	5	10
How useful would this material be for your university studies?	10.00	0.000	10	10
How tedious is the material?	1.35	0.493	1	2
How complex and complicated is the material?	2.00	2.223	1	8

How much load (memory and attention) does the material's use require?	8.42	2.735	1	10
How satisfied are you with the use of this material?	9.56	0.629	8	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>4.73</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>9.35</b>			

Table 243. Assessment of a video with sign language in participants with hearing impairments.

<b>11. Video with captions (closed)</b>	<b>Mean</b>	<b>SD</b>	<b>Minimum</b>	<b>Maximum</b>
How accessible is the material?	9.00	1.491	4	10
To what extent is training required to be able to use it?	5.53	2.389	1	10
Would you use it if it was available to you?	8.84	2.455	2	10
Would you recommend others to use it?	8.95	2.505	2	10
To what extent do you believe it will fill gaps of your existent knowledge?	8.53	2.632	1	10
How useful would this material be for your university studies?	8.53	2.796	2	10
How tedious is the material?	1.63	1.012	0	4
How complex and complicated is the material?	1.47	1.020	0	4
How much load (memory and attention) does the material's use require?	4.95	2.068	2	8
How satisfied are you with the use of this material?	8.72	2.845	1	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>3.40</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>8.76</b>			

Table 244. Assessment of a video with closed captions in participants with hearing impairments.

<b>12. Video with captions (open)</b>	<b>Mean</b>	<b>SD</b>	<b>Minimum</b>	<b>Maximum</b>
How accessible is the material?	6.84	1.537	4	10
To what extent is training required to be able to use it?	7.68	2.187	1	10
Would you use it if it was available to you?	8.26	2.330	2	10
Would you recommend others to use it?	8.42	2.364	2	10
To what extent do you believe it will fill gaps of your existent knowledge?	8.11	2.536	1	10
How useful would this material be for your university studies?	7.32	2.382	2	10
How tedious is the material?	3.37	1.950	0	7
How complex and complicated is the material?	4.47	2.435	0	7
How much load (memory and attention) does the material's use require?	5.89	1.696	2	8
How satisfied are you with the use of this material?	7.89	2.601	1	10
<b>Total (q2, 7, 8 &amp; 9)</b>	<b>5.35</b>			
<b>Total (q1, 3, 4, 5, 6 &amp; 10)</b>	<b>7.42</b>			

Table 245. Assessment of a video with open captions in participants with hearing impairments.

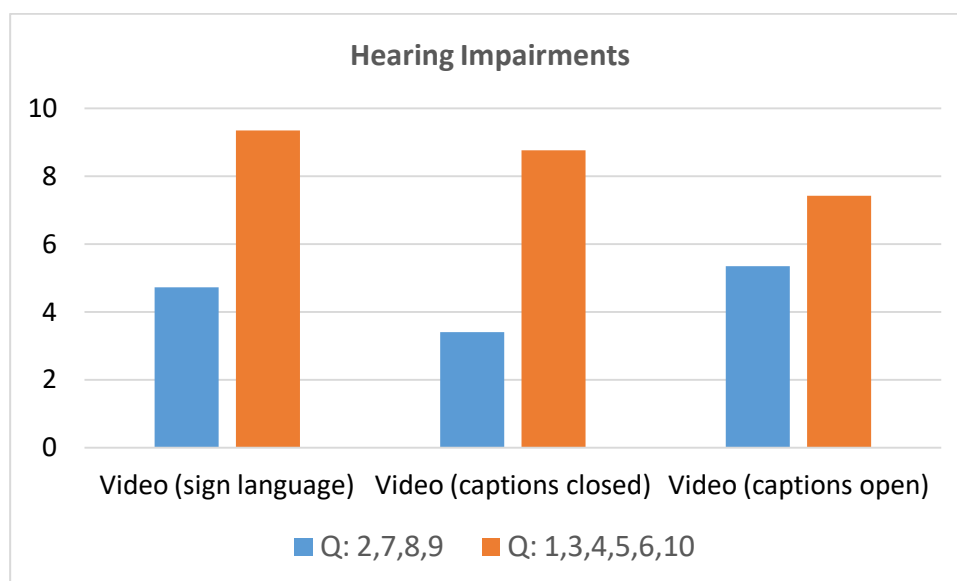


Figure 3. The diagram presents the mean scores of the participants with hearing impairments in the two groups of questions (1, 3, 4, 5, 6, and 10 = positive aspects, 2, 7, 8, and 9 = work load and requirements)

The tables below present the results of the analysis of the hearing-impaired participants' answers in the semi-structured interview:

**INT1.** I would like you to make a general comment on the material. How do you evaluate it (positive / negative)?

**INT2.** What would you keep and what would you change about it? Can you suggest some changes and improvements?

**INT3.** Where do you think this material would be helpful for you during your university studies (in which courses/ tasks / activities)?

**INT4.** Would you replace it with something else (another form of material)?

Video with sign language_INT1	Counts
I didn't have a training with sign language	2
Positive	17

Table 246. Hearing impaired participants' answers in the first question of the interview (general comment) with reference to the video with sign language.

Video with sign language_INT2	Counts
A little more material is insufficient	1
Have this equipment at home to work	2
Time to practice	11
Time to practice with other students like us	1

Table 247. Hearing impaired participants' answers in the second question of the interview (keep-change) with reference to the video with sign language.

Video with sign language_INT3	Counts
I can't answer	2
Activities	1
Courses	5
Courses and activities	8
Courses and tasks	3

Table 248. Hearing impaired participants' answers in the third question of the interview (helpful during studies) with reference to the video with sign language.

Video with sign language_INT4	Counts
No, it is enough	15
Yes, with laptop	1

Table 249. Hearing impaired participants' answers in the fourth question of the interview (replace the material) with reference to the video with sign language.

Video with captions (closed)_INT1	Counts
Very useful and I need it for my courses and TV	2
Negative	2
Positive	15

Table 250. Hearing impaired participants' answers in the first question of the interview (general comment) with reference to the video with closed captions.

Video with captions (closed)_INT2	Counts
A little more material is insufficient	1
Have this equipment at home to work	6
More time to practice	7
Time to practice with other students like us	1

Table 251. Hearing impaired participants' answers in the second question of the interview (keep-change) with reference to the video with closed captions.

Video with captions (closed)_INT3	Counts
Activities	1
Courses	9
Courses and activities	6
Tasks	2

Table 252. Hearing impaired participants' answers in the third question of the interview (helpful during studies) with reference to the video with closed captions.

Video with captions (closed)_INT4	Counts
No, it is enough	14
Yes	2
Yes, with laptop	1

Table 253. Hearing impaired participants' answers in the fourth question of the interview (replace the material) with reference to the video with closed captions.

Video with captions (open)_INT1	Counts
Positive	15
Very useful and I need it for some courses and TV	2
Negative	2

Table 254. Hearing impaired participants' answers in the first question of the interview (general comment) with reference to the video with open captions.

Video with captions (open)_INT2	Counts
Time to practice	15

Table 255. Hearing impaired participants' answers in the second question of the interview (keep-change) with reference to the video with open captions.

Video with captions (open)_INT3	Counts
Courses	6
Courses and activities	10
Courses, tasks and activities	3
Tasks	2

Table 256. Hearing impaired participants' answers in the third question of the interview (helpful during studies) with reference to the video with open captions.

Video with captions (open)_INT4	Counts
Closed captions with many languages	2
No	15
Yes	2

Table 257. Hearing impaired participants' answers in the fourth question of the interview (replace the material) with reference to the video with open captions.

## 2.5. Conclusions

Studying the results from the users with visual impairments' requirements research and with reference to the accessible e-books, a general satisfaction with the accessible book in docx format appears. Though they do not find it very accessible they would definitely use it if it was available and they would recommend its use to others, since they find it very useful for their university studies. The same conclusions resulted for both the ePub and the DAISY e-books. Comparing the three different kinds of accessible e-books though the DAISY appears to be considered more accessible, regarding the overall satisfaction of the participants, the ePub appears to surpass. In any case, for all the different kinds of accessible e-books, the participants consider the previous training necessary before someone makes use of them. In addition, based on the participants' answers in the interview, a tool for correcting automatically accessibility issues would raise their satisfaction over docx and ePub documents.

Regarding the accessible power point, though the participants were satisfied with the material and found it very useful for their university studies, they declared that improvements could be implemented to increase its accessibility, including the use of a tool for autocorrection of accessibility issues.

With reference to the verbal descriptions of pictures, participants would use the material if it was available, they would recommend its use to other and they found it very useful for their university studies. Their satisfaction over the material was enough but they assess its accessibility to be on a medium level.

As far as the tactile pictures are concerned, we could say that they caused a polarization effect in the participants answers. Participants found the tactile pictures a very useful tool that could fill any gap in their existent knowledge, but they also found them tedious, complex and complicated, especially when these were used in the context of a specific task (instead of just commenting). Overall, their satisfaction was enough from the use of tactile pictures and the material itself, while previous training would make them even more useful. Comparing the two different kind of tactile pictures – those developed with microcapsule paper and those with a Tiger embosser – the formers seem to be a bit more satisfying and appealing to individuals with blindness.

Finally, the videos that were given in combination with a verbal description in a docx file appeared to be of medium satisfaction and to require a lot of training before someone uses it. Based on the participants' answers in the interview they would replace this form of the description with audio description embedded in the original video or with a video with captions or transcripts.

The participants with mobility impairments found less satisfying the three different kinds of accessible e-books than the participants with visual impairments, though the former do consider those e-books useful for their studies, and they indeed would make use of them if they were available or would recommend their use to others. From all the three kinds of accessible e-books, the e-books in docx format gained more acceptance, while the e-books in DAISY format were the less appealing. More attractive appeared to be the power point presentation which participants with mobility impairments found satisfying enough. Though its use seems to require much memory and attention, they would definitely use it and recommend its use to others. Based on the participants' answers on the interview, adding more accessibility features would raise the participants' satisfaction. In any case, their feedback was positive and they wouldn't replace any kind of the studied material with anything else.

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The comparison of the three different kinds of video in individuals with hearing impairments showed that the video with the embedded sign language was by far the most satisfying and useful, followed by the video with closed captions.

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## 3. Appendix I

### 3.1. Visual impairments

**1. Gender**

- a. Boy
- b. Girl

**2. The place of residence (and the University you attend).**

**3. The type of your disability and the cause of it** (official clinical diagnosis).

**4. The age at onset of visual impairments.**

**5. The date of birth.**

**6. Educational level** e.g., lower secondary school, tertiary level of education, master degree).

**7. Severity of disability**

- a. Blindness
- b. Severe visual impairments
- c. Moderate visual impairments
- d. Low vision

**8. What means do you use to read?**

- a. Braille or screen reader
- b. Large prints or magnifiers

**9. Visual acuity of the left eye**

- a. Total blindness, loss of light perception
- b. Only light perception
- c. Less than 1/20
- d. Better than 1/20 and worse than 1/10
- e. Better than 1/10

**10. Visual acuity of the right eye**

- a. Total blindness, loss of light perception
- b. Only light perception
- c. Less than 1/20
- d. Better than 1/20 and worse than 1/10
- e. Better than 1/10

**11. Visual field**

- a. Full visual field
- b. Central vision loss
- c. Peripheral vision loss

**12. You move alone or with the help of an attendant?**

- a. Alone
- b. Sometimes alone and sometimes with help of an attendant

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c. With help of an attendant

**13. How often do you move alone?**

- a. Never
- b. Few times
- c. Some times
- d. Most of the time
- e. Always

**13. Do you use assistive technology?**

- a. Yes
- b. No

**14. If yes, which assistive technology?**

.....(describe shortly).....

**15. What kind of educational material is more suitable for you? (you can choose more than one answers)**

- a. Text
- b. Visual
- c. Audio
- d. Audio-visual (e.g., video)

**16. Do you use any kind of accessible educational material?**

- a. Yes
- b. No

**17. If yes, what kind of it?**

.....(describe shortly).....

### 3.2. Mobility impairments

**1. Gender**

- c. Boy
- d. Girl

**2. The place of residence (and the University you attend).**

**3. The type of your disability and the cause of it** (official clinical diagnosis).

**4. The age at onset of mobility impairments.**

**5. The date of birth.**

**6. Educational level** (e.g., lower secondary school, tertiary level of education, master degree).

**7. Your disability occurs**

- a. In your lower extremities
- b. In your upper extremities
- c. In your lower and upper extremities
- d. On one side of your body
- e. Only in one of your extremities
- f. Other: \_\_\_\_\_

**8. How would you most accurately describe the functionality of your hands?**

(Select only one of the following answers)

- a. I handle all objects easily and successfully. I may have some difficulties in activities that require great speed or/and accuracy. However, these difficulties do not restrict my independence in my daily activities at all.
- b. I handle all objects with somewhat reduced quality (accuracy) or/and speed. Certain activities need to be done in alternative ways. Usually, these difficulties do not restrict my independence in my daily activities.
- c. I handle objects with difficulty, I need help to prepare or modify the activities. My performance is slow and can be achieved with limited success as regards the quantity and quality of activity. I can be independent, only if the activities have been adapted for me.
- d. I can only handle selected (very specific) objects that are easy and only in adapted activities. Usually, I only perform parts of an entire activity with a lot of effort and with limited success. I need continuous support, assistance and/or adapted equipment.
- e. Basically, I cannot handle objects as I have severely limited ability to perform even simple actions. I need total assistance.

**9. You move alone or with the help of an attendant?**

- a. Alone
- b. Sometimes alone and sometime with help of an attendant
- c. With help of an attendant

**10. How often do you move alone?**

- a. Never
- b. Few times
- c. Some times

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- d. Most of the times
- e. Always

**11. How would you describe your commute?**

(Select only one of the following answers)

- a. I walk on any place without restrictions and assistance. I may have balance, speed or motor-coordination difficulties.
- b. In most places, I walk without any assistance. However, outside my home, I may use either walking aids – walkers, crutch, cane – for walking or climbing up the stairs or a wheelchair for long distances.
- c. Most of the time, I need walking aids to be able to walk anywhere. Usually, I need the assistance of another person or I need specialized equipment to get up from the floor, from the bed, or from the chair. When climbing stairs, I usually need assistance or at least supervision from someone else. I need a wheelchair for outdoor environments.
- d. Almost everywhere, I use a wheelchair on my own (either electric or manual wheelchair). However, almost always, I need the assistance of another person. Usually, I need special support on my torso (e.g., waist) and/or my head. I can walk at home for a while but only with the assistance of another person.
- e. In all cases and in all places, I use a wheelchair. At best, I can use an electric wheelchair. I always need special support in my waist, torso and head. I use many types of assistive devices for mobility impairments, but I still need the assistance of another person.

**12. Do you use assistive devices?**

- c. Yes
- d. No

**13. If yes, which assistive devices?**

.....(describe shortly).....

**14. What kind of educational material is more suitable for you? (you can choose more than one answers)**

- a. Text
- b. Visual
- c. Audio
- d. Audio-visual (e.g., video)

**15. Do you use any kind of accessible educational material?**

- c. Yes
- d. No

**16. If yes, what kind of it?**

.....(describe shortly).....

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### 3.3. Hearing impairments

**1. Gender**

- e. Boy
- f. Girl

**2. The place of residence (and the University you attend).**

**3. The type of your hearing loss and the cause of it (official clinical diagnosis).**

**4. The age at onset of hearing loss.**

**5. The date of birth.**

**6. Educational level (e.g., lower secondary school, tertiary level of education, master degree).**

**7. Do you have bilateral hearing loss?**

- a. Yes
- b. No

**8. Do you have deaf/hard of hearing parents?**

- a. Yes
- b. No

**9. Degrees of hearing loss in left ear**

- a. Slight hearing loss (25-40 dB)
- b. Mild hearing loss (41-55 dB)
- c. Moderate hearing loss (56-70 dB)
- d. Severe hearing loss (71-90 dB)
- e. Profound hearing loss (91+ dB)

**10. Degrees of hearing loss in right ear**

- a. Slight hearing loss (25-40 dB)
- b. Mild hearing loss (41-55 dB)
- c. Moderate hearing loss (56-70 dB)
- d. Severe hearing loss (71-90 dB)
- e. Profound hearing loss (91+ dB)

**11. Are you a lip-reader?**

- a. Yes
- b. No

**12. Level of difficulty in understanding the oral language (through lip reading)**

- a. Very easy
- b. Easy
- c. Neutral
- d. Difficult
- e. Very difficult

**13. Do you understand the written form of French/Arabic language?**

- a. Yes

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b. No

**14. Level of difficulty in understanding the written language**

a. Very easy

b. Easy

c. Neutral

d. Difficult

e. Very difficult

**15. Do you know sign language?**

a. Yes

b. No

**16. Do you use assistive listening devices?**

e. Yes

f. No

**17. If yes, which assistive listening devices?**

.....(describe shortly).....

**18. What kind of educational material is more suitable for you? (*you can choose more than one answers*)**

a. Text

b. Visual

c. Audio

d. Audio-visual (e.g., video)

**19. Do you use any kind of accessible educational material?**

e. Yes

f. No

**20. If yes, what kind of it?**

.....(describe shortly).....