

REPORT ABOUT THE VALIDATION PROCESS

Aspaym Castilla y León Foundation



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i-Express myself: Report about the validation process

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1. Introduction

Multi Disabled Visually Impaired (MDVI) persons are facing major challenges in expressing themselves, in communication and learning. MDVI means a person with at least two disabilities, one of which manifests itself as a visual impairment, which impact significantly on the person's learning potential to such a degree to require a customized educational provision. Experience and knowledge in how assistive devices could help this target group is starting to grow slowly. Only a small number of institutes in Europe are trying to gather their knowledge and experience to create a practice based methodology. The MDVI target group is relatively small (although 70% of all persons with a mental disability have a visual impairment too) but complex. To get a good perspective and create a qualitative good curriculum from different perspectives, international exchange of existing experience has great benefit. With this project, we wanted teachers, trainers and professionals raised more awareness, competences and knowledge for ICT possibilities in working with MDVI. Then, the main objectives of this project were:

1. Exchange of existing curriculum in Europe for training MDVI with assistive devices.
- 2. Design and validate a screening instrument for training MDVI persons with ICT.**
3. Exchange of knowledge and expertise in learning strategies of MDVI and assistive devices.

In the following pages, it is described in detail how the second objective of the project was carried out, as well as the results obtained during the validation process.

2. Design of the screening instrument (SI)

The first step was to design a screening instrument that allow professionals (i.e. teachers, occupational therapists, health professional) to know the degree in which Information and Communications Technologies (ICT) are mastered by children with MDVI, and then evaluate if ICT could be used at school to teach and train new skills to this population.

During the second meeting of the project, in Valladolid (Spain), the four partners were working on this instrument. Previously, in the Netherlands, Royal Dutch Visio developed a curriculum about assistive devices (i.e. pc, laptop, tablets). In this curriculum, all stages of learning with MDVI were described. Taking this curriculum as reference document, after a “multi-country” brainstorming and after several hours of working, two original versions of the SI were created. The first one pretended to be used with **low vision students** and included the following sections:

- 1) Headline
- 2) Aim
- 3) Equipment needed
- 4) Application protocol
- 5) Time needed to complete the SI and maximum possible score
- 6) Score sheet
- 7) 16 items grouped in 5 dimensions:
 - a. Focusing Attention (2 items)
 - b. Following (5 items)
 - c. Pressing and releasing (3 items)
 - d. Action and reaction (2 items)
 - e. Operation (4 items)
- 8) For each dimension and/or item it was included:
 - a. *Instructions for the professional*. These were detailed information with some technical words that would allow to any professional evaluate the item with the highest objectivity.
 - b. *Respond*: This was the behaviour expected from the student.
 - c. *Instructions for the user*: This was the message that the evaluator should say to the student with “understandable words”. Then, any student would receive the same message.
 - d. *Score*: Four possible behaviours of the student in response to the instruction given. The four responses were in an ordinal scale and numbered from 0 to 3, so 0 was the worst score and 3 the best one.

The **SI for blind** contained the same sections but only 8 items were included. In order to do not create confusion between the original SI and the final SI, only the final are included in the appendixes.

3. Content validity

In social sciences, the first step after designing a questionnaire as our SI, is to check the content validity. That is the estimation of how much a measure represents every single element of a construct. For example, in respect to our designed SI, assessing the content validity means wondering if the SI takes into account all aspects of a learning context using ICT for students with MDVI.

The way of testing context validity is asking experts in the field if they agree with the information, items, and answers included. They are also asked to specify if there is anything else in respect to the field of study that is not contained within the SI and should be in it. Then, four experts, one provided for each partner of the project, completed a form (by google forms) to give us a feedback about each SI (low vision and blind versions). The [appendix I](#) of the present document contains the information provided by the 3 experts in respect to the SI for low vision students. The [appendix II](#) of the present document contains the information provided by the 4 experts in respect to the SI for blind students. Since in the School for Blind (Budapest, Hungary) there are no students with low vision, their expert only assessed the SI for blind students.

Experts strongly agreed with the information included at the beginning, score sheet, dimensions and with almost all the items. However, after reading carefully their suggestions, the following changes were done in the SI:

- Age was added in the score sheet.
- Original items 1, 2, 3 were modified according to experts suggestions in the Low vision version.
- Original items 3, 4, 5 and 6 were modified according to the expert's suggestions in the Blind version.
- Original item 7 was removed according to one expert suggestion in the Low vision version. Then, from item 8 to item 16 items were renumbered.
- Instructions for the user in the original items 8, 9 and 10 were modified according to expert suggestions in the Low vision version.

The final versions of the SI for low vision students and for blind students are included in the [appendixes III](#) and [IV](#) of the present document, respectively.

An expert from the Netherlands checked the English grammar and vocabulary of both SI.

4. Data collection, construct validity and reliability

4.1. Data collection

From May 2017 to October 2017 data were obtained from students of Royal Dutch Visio (The Netherlands), the Icelandic National Institute for the Blind and Budapest School for the Blind (Hungary).

In each country, two professionals separately with the corresponding SI evaluated every student. Between 2 and 4 weeks later, each student was evaluated again. We needed two professionals to test the **objectivity**; this means that the results obtained does not depends on the person who applied the SI. Likewise, the SI was applied to the same students in a second occasion to test **repeatability** or **test-retest reliability**; this evaluates the variation in the SI score when it is applied under the same conditions in a short period. A measurement may be said to be repeatable when this variation is smaller than a pre-determined acceptance criterion.

During the data collection, the room conditions of brightness were kept constant for each student. Then, both testers assessed students in the same conditions in both days. A sketch of how student, computer and tester were placed is shown in the following picture:

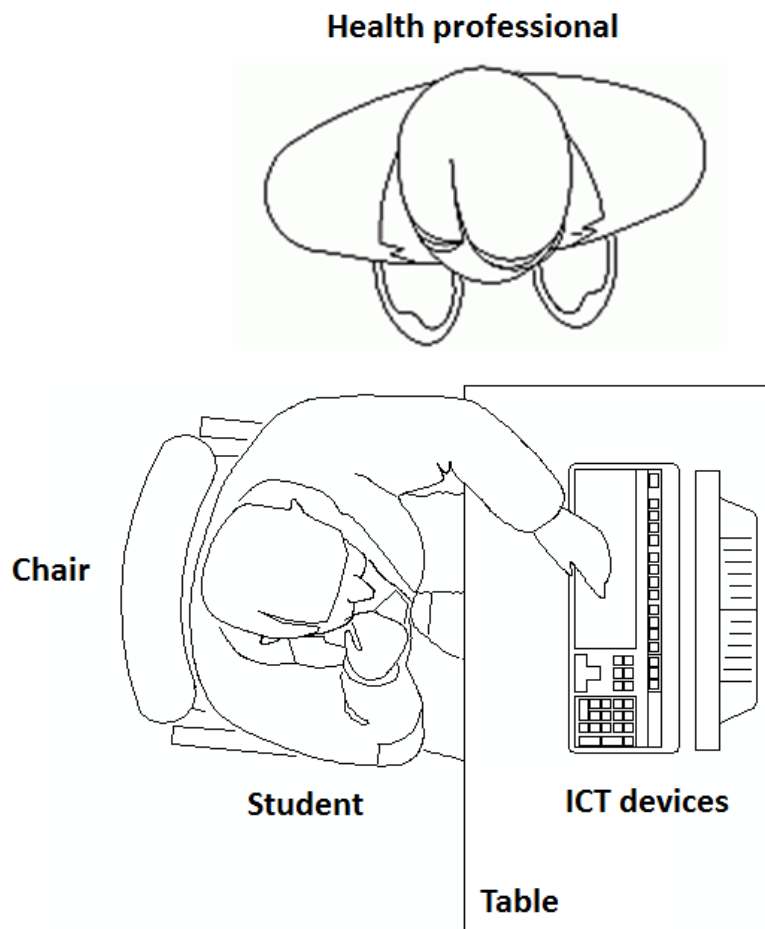


Figure 1. Sketch of how student and health professional were placed during the data collection process.

Table 1 shows the data obtained during the collection phase. In the columns, it is respectively showed the following information:

- *Country*: the country where the data was obtained.
- *Sample*: if the student was classified as low vision or blind.
- *Code*: numerical value assigned to each evaluated student.
- *Name*: name of the student, so that each country could easily identify their students and check if they agree with the score obtained.
- *Dev_age*: developmental age of the student. Each one could be classified as 0-2 yrs or 2-4 yrs.
- *Age*: biological age of the student in years.
- *D1T1, D1T2, D2T1 & D2T2*: score obtained after the application of the SI the day 1 or 2 (D1, D2) by the tester 1 or 2 (T1, T2).
- *D1T1', D1T2', D2T1' & D2T2'*: ordinal classification of the previous score as *not able*, *partially able* or *able* is included. It is important to indicate that this classification refers to the moment in which the student was evaluated and it can change over the time.
- *Agree*: In order to know if the cut points of the classification¹ proposed in the SI were adequate, it was important to know if the therapists or teachers that usually work with these students agreed with how each student was classified.

Finally, it is important to indicate that an assumption has been made within this project. To perform the statistical analysis, it has been assumed that there are two testers (tester number 1 and tester number 2). Then, these two testers have performed all the screening instruments in any country.

¹ For **Low vision**: 0-12 = not able; 13-26 = partially able; 27-45 = able. For **Blind**: 0-7 = not able; 8-14 = partially able; 15-24 = able.

i-Express myself: Report about the validation process

Table 1. Data obtained from the 29 students that participated in the project.

Country	Sample	Code	Name	Dev_age	Age	D1T1	D1T1'	D1T2	D1T2'	D2T1	D2T1'	D2T2	D2T2'	Agree
Iceland	LV	1	Sindri L	2-4 yrs	9	14	Partially able	16	Partially able	18	Partially able	18	Partially able	Yes
Iceland	LV	2	Kristín L	2-4 yrs	8	38	Able	38	Able	39	Able	39	Able	Yes
Iceland	LV	3	Dan L	2-4 yrs	8	38	Able	37	Able	41	Able	41	Able	Yes
Iceland	LV	4	Sturla L	2-4 yrs	15	40	Able	40	Able	45	Able	45	Able	Yes
Hungary	LV	5	Edit	2-4 yrs	7	35	Able	32	Able	35	Able	35	Able	Yes
Hungary	LV	6	Kalman	0-2 yrs	7	25	Partially able	26	Able	32	Able	30	Able	Yes
Netherlands	LV	9	Sebastiaan	2-4 yrs	11	38	Able	39	Able	38	Able	39	Able	Yes
Netherlands	LV	10	Wessel	2-4 yrs	9	39	Able	39	Able	45	Able	39	Able	Yes
Netherlands	LV	11	Hafsa	2-4 yrs	5	27	Able	30	Able	28	Able	26	Partially able	Yes
Netherlands	LV	12	Thijs S	2-4 yrs	8	42	Able	42	Able	37	Able	37	Able	Yes
Netherlands	LV	13	Nedim	2-4 yrs	5	33	Able	33	Able	35	Able	33	Able	Yes
Netherlands	LV	14	Maxim	0-2 yrs	13	7	Not able	7	Not able	7	Not able	7	Not able	No
Netherlands	LV	15	Eline	0-2 yrs	15	12	Not able	12	Not able	16	Partially able	11	Partially able	Yes
Netherlands	LV	16	Sadusan	2-4 yrs	14	15	Partially able	15	Partially able	16	Partially able	16	Partially able	Yes
Netherlands	LV	17	Tristan	2-4 yrs	9	44	Able	40	Able					Yes
Netherlands	LV	18	Tim	2-4 yrs	10	26	Able	27	Able	32	Able	33	Able	No
Netherlands	LV	19	Pieter	0-2 yrs	12	21	Partially able	27	Able	32	Able	30	Able	No
Hungary	B	7	Erika	0-2 yrs	7	14	Partially able	15	Able	13	Partially able	13	Partially able	Yes
Hungary	B	8	Nora	0-2 yrs	6	13	Partially able	13	Partially able	15	Able	16	Able	Yes
Netherlands	B	20	Hugo	0-2 yrs	9	6	Not able	10	Partially able	7	Not able	8	Partially able	Yes
Netherlands	B	21	Stijn	2-4 yrs	17	18	Able	17	Able	17	Able	17	Able	Yes
Netherlands	B	22	Mohammed	2-4 yrs	12	19	Able	20	Able	22	Able	22	Able	Yes
Netherlands	B	23	Macy	2-4 yrs	11	13	Partially able	17	Able	14	Partially able	15	Able	Yes
Netherlands	B	24	Donny	2-4 yrs	9	21	Able	21	Able	23	Able	23	Able	Yes
Netherlands	B	25	Mark	2-4 yrs	11	23	Able	23	Able	24	Able	24	Able	Yes
Netherlands	B	26	Rens	0-2 yrs	15	10	Partially able	11	Partially able	13	Partially able	11	Partially able	Yes
Netherlands	B	27	Stephen	2-4 yrs	7	17	Able	15	Able	17	Able	18	Able	No
Netherlands	B	28	Robin	2-4 yrs	14	15	Able	12	Partially able	10	Partially able	9	Partially able	Yes



i-Express myself: Report about the validation process

Netherlands	B	29	Sanne	0-2 yrs	6	7	Not able	8	Partially able	Yes



4.2. Reliability or internal consistency

Internal consistency is a reliability measurement in which items on a test are correlated in order to determine how well they measure the same construct or concept. Reliability shows how consistent a test or measurement is.

In research, the statistical test used to check the internal consistency of a questionnaire, like our SI, is the Cronbach's alpha. Tables 2 and 3 shows the values of this coefficient for the low vision and blind SI.

Table 2. Values of the Cronbach's alpha of the items 1 to 15 in the SI for low vision students.

LOW VISION	Iceland (n=2-3)	Hungary (n=2)	Netherlands (n=7-6)	All (n=11)
Day 1 – Tester 1	0.536	0.857	0.882	0.859
Day 1 – Tester 2	0.476	0.833	0.899	0.870
Day 2 – Tester 1	0.383	0.714	0.899	0.867
Day 2 – Tester 2	0.383	0.857	0.860	0.846

Table 3. Values of the Cronbach's alpha of the items 1 to 8 in the SI for blind students.

BLIND	Hungary (n=2)	Netherlands (n=9)	All (n=11)
Day 1 – Tester 1	-4.571	0.846	0.821
Day 1 – Tester 2	-1.143	0.782	0.747
Day 2 – Tester 1	-1.714	0.884	0.829
Day 2 – Tester 2	0.508	0.895	0.845

In order to interpret the Cronbach's alpha coefficient, the following classification is used in social sciences field:

$\alpha < 0.5$	Unacceptable reliability
$0.5 < \alpha < 0.6$	Poor reliability
$0.6 < \alpha < 0.7$	Questionable reliability
$0.7 < \alpha < 0.8$	Acceptable reliability
$0.8 < \alpha < 0.9$	Good reliability
$\alpha > 0.9$	Excellent reliability

In **conclusion**, the screening instrument had a good reliability. It was well designed since items correlates among themselves. However, Iceland (low vision instrument) and Hungary (blind instrument) should work in order to improve the reliability.

4.3. Repeatability

As previously mentioned, repeatability or test–retest reliability evaluates the variation in the SI score when it is applied under the same conditions in a short period of time. A measurement may be said to be repeatable when this variation is smaller than a pre-determined acceptance criterion.

The non parametric Wilcoxon test allows us to know if there were differences in the scores of both days. The “total value” obtained in the SI by each tester (tester 1 or 2) was compared in both days. Tables 4 and 5 shows the results of this statistical procedure.

Table 4. P values of the comparisons between day 1 and day 2 for each tester for the low vision SI.

LOW VISION	Iceland (n=4)	Hungary (n=2)	Netherlands (n=10)	All (n=16)
Tester 1	0.068	0.317	0.068	0.008
Tester 2	0.068	0.180	1.000	0.106

Table 5. P values of the comparisons between day 1 and day 2 for each tester for the blind SI.

BLIND	Hungary (n=2)	Netherlands (n=10)	All (n=12)
Tester 1	0.655	0.287	0.234
Tester 2	0.655	0.931	0.762

In research, the p value is interpreted as follows:

$p > 0.05$ *There are no differences between the scores of both testers, so the instrument is repeatable.*

$p < 0.05$ *There are differences between the scores of both testers, so the instrument is not repeatable.*

In **conclusion**, although the tester 1 showed different results between both days, in 3 out of 4 times the instrument showed repeatability.

4.4. Objectivity

An instrument is objective or has inter-tester reliability when the results obtained after analyzing are the same independently of who performs the analysis.

The non parametric Wilcoxon test allows us to know if there were differences between both testers each day. Then, the “total values” of both testers within the same day were compared. Tables 6 and 7 shows the results of this statistical procedure.

Table 6. P values of the comparisons between tester 1 and tester 2 within each day for the low vision SI.

LOW VISION	Iceland (n=4)	Hungary (n=2)	Netherlands (n=10)	All (n=16)
Day 1	0.655	0.655	0.066	0.201
Day 2	1.000	0.317	0.061	0.033

Table 7. P values of the comparisons between tester 1 and tester 2 within each day for the blind SI.

BLIND	Hungary (n=2)	Netherlands (n=10)	All (n=12)
Day 1	0.317	0.523	0.433
Day 2	0.317	1.000	0.739

As previously mentioned, in research, the p value is interpreted as follows:

$p > 0.05$ *There are no differences between the scores of both testers, so the instrument is objective.*

$p < 0.05$ *There are differences between the scores of both testers, so the instrument is not objective.*

In **conclusion**, although the in the second day there were differences in the scores obtained in the Low vision instrument by the tester, in 3 out of 4 times the instrument showed objectivity. This lack of agreement between testers could be due to the following:

- There could be a lack of familiarization with the instrument by the testers.
- Although we have assumed in the analysis that all screening instruments were carried out by two testers, based on the excel files at least 10 different tester applied the instrument; then, results concerning objectivity could be considered positive.

4.5. Construct validity

One of the questions we were interesting to answer with the construct validity process, was to know if there was a relationship between “developmental age” and SI’s score. The statistical procedure that allows knowing if there was this relationship among variables, is the Chi-square. From table 9 to table 11, data of the low vision SI is showed.

Table 8. Contingency table that relates developmental age and ordinal score obtained in the SI for low vision students the day 1 by tester 1.

LOW VISION		Day 1, tester 1			Total
		Not able	Partially able	Able	
Dev_age	0-2 yrs	2	2	0	4
	2-4 yrs	0	2	10	12
Total		2	4	10	16

Chi-square ($p=0.005$). If $p<0.05$, there was a relationship between both variables.

Table 9. Contingency table that relates developmental age and ordinal score obtained in the SI for low vision students the day 1 by tester 2.

LOW VISION		Day 1, tester 2			Total
		Not able	Partially able	Able	
Dev_age	0-2 yrs	2	0	2	4
	2-4 yrs	0	2	10	12
Total		2	2	12	16

Chi-square ($p=0.029$). If $p<0.05$, there was a relationship between both variables.

Table 10. Contingency table that relates developmental age and ordinal score obtained in the SI for low vision students the day 2 by tester 1.

LOW VISION		Day 2, tester 1			Total
		Not able	Partially able	Able	
Dev_age	0-2 yrs	1	1	2	4
	2-4 yrs	0	2	10	12
Total		1	3	12	16

Chi-square ($p=0.169$). If $p<0.05$, there was a relationship between both variables.

Table 11. Contingency table that relates developmental age and ordinal score obtained in the SI for low vision students the day 2 by tester 2.

LOW VISION		Day 2, tester 2			Total
		Not able	Partially able	Able	
Dev_age	0-2 yrs	1	1	2	4
	2-4 yrs	0	3	9	12
Total		1	4	11	16

Chi-square ($p=0.195$). If $p<0.05$, there was a relationship between both variables.

It is important to remember that the ordinal score of the Low Vision SI was interpreted as:

- 0-12 = ICT could not be used in the learning process of the student to train any skills at this moment.
- 13-26 = ICT could be partially used in the learning process of the student to train new skills.
- 27-45 = ICT could be used in the learning process of the student to train new skills.

In **conclusion**, students with a higher developmental age are more able to use ITC in their learning process.

From table 12 to table 15, data of the blind SI is showed.

Table 12. Contingency table that relates developmental age and ordinal score obtained in the SI for blind students the day 1 by tester 1.

BLIND		Score_D1T1			Total
		Not able	Partially able	Able	
Dev_age	0-2 yrs	2	3	0	5
	2-4 yrs	0	1	6	7
Total		2	4	6	12

Chi-square ($p=0.012$). If $p<0.05$, there was a relationship between both variables.

Table 13. Contingency table that relates developmental age and ordinal score obtained in the SI for blind students the day 1 by tester 2.

BLIND		Score_D1T2		Total
		Partially able	Able	
Dev_age	0-2 yrs	4	1	5
	2-4 yrs	1	6	7
Total		5	7	12

Chi-square ($p=0.023$). If $p<0.05$, there was a relationship between both variables.

Table 14. Contingency table that relates developmental age and ordinal score obtained in the SI for blind students the day 2 by tester 1.

BLIND		Score_D2T1			Total
		Not able	Partially able	Able	
Dev_age	0-2 yrs	1	2	1	4
	2-4 yrs	0	2	5	7
Total		1	4	6	11

Chi-square ($p=0.215$). If $p<0.05$, there was a relationship between both variables.

Table 15. Contingency table that relates developmental age and ordinal score obtained in the SI for blind students the day 2 by tester 2.

BLIND		Score_D2T2		Total
		Partially able	Able	
Dev_age	0-2 yrs	3	1	4
	2-4 yrs	1	6	7
Total		4	7	11

Chi-square ($p=0.044$). If $p<0.05$, there was a relationship between both variables.

It is important to remember that the ordinal score of the blind SI was interpreted as:

0-7 = ICT could not be used in the learning process of the student to train any skills at this moment.

8-14 = ICT could be partially used in the learning process of the student to train new skills.

15-24 = ICT could be used in the learning process of the student to train new skills.

In **conclusion**, students with a higher developmental age are more able to use ITC in their learning process.

5. Conclusions of the validation process

After carrying out the validation process, we establish the following general conclusions:

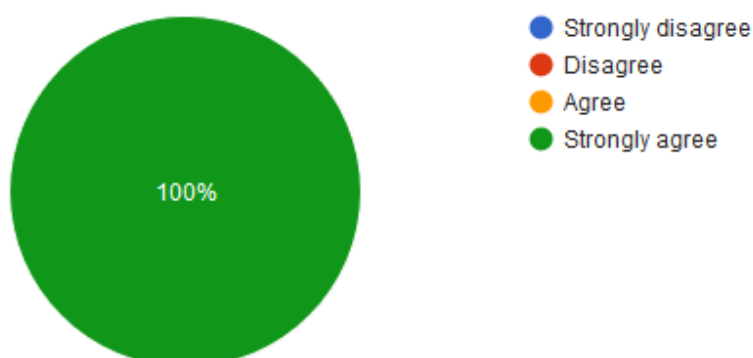
1. Two screening instrument have been designed by a teamwork of 4 institutions, that allow to know the degree in which Information and Communications Technologies can be used in the learning process of student with low vision or blind students.
2. Both screening instrument (low vision & blind) have been validated by a multi-country group of experts. All experts agreed with the final version of each screening instrument.
3. The health professionals that applied the screening instruments reported no problems during the collection of the data from the students. However, they pointed out that the professional should be familiarized with the instrument in order to be objective and reliable.
4. In 25 out of 29 students (86.2%) professionals agreed with how the screening instrument classified each student as not able, partially able or able. Then, the cut points suggested to classified students with each screening instruments seems to be adequate.
5. The screening instruments designed and proposed in this project showed a good reliability, repeatability and objectivity.
6. Students with a higher developmental age are more able to use ITC in their learning process.
7. The screening instruments designed and proposed in this project could be used to assess the evolution of students that uses ITC during their learning process.

Appendix I: Content validity

Screening instrument of ICT skills for students with MDVI (LOW VISION)

1. What is your opinion about the information included at the beginning of the screening instrument (aim, equipment needed, application protocol and completion)?

3 responses



2. Would you suggest any modification in the information included at the beginning of the screening instrument (aim, equipment needed, application protocol and completion)?

3 responses

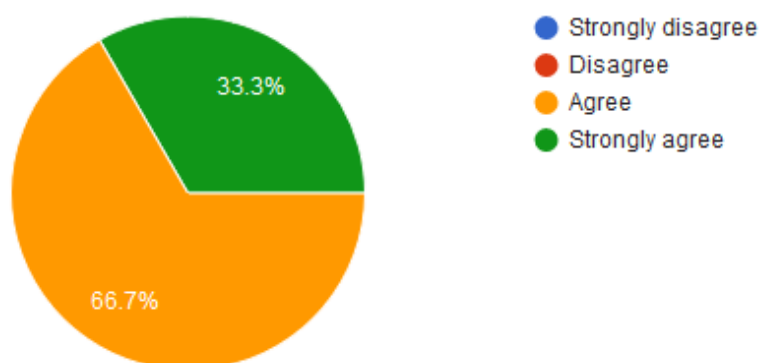
no

Do we always assume that students have full hearing?

No changes suggested

3. What is your opinion about the relevancy of the score sheet?

3 responses



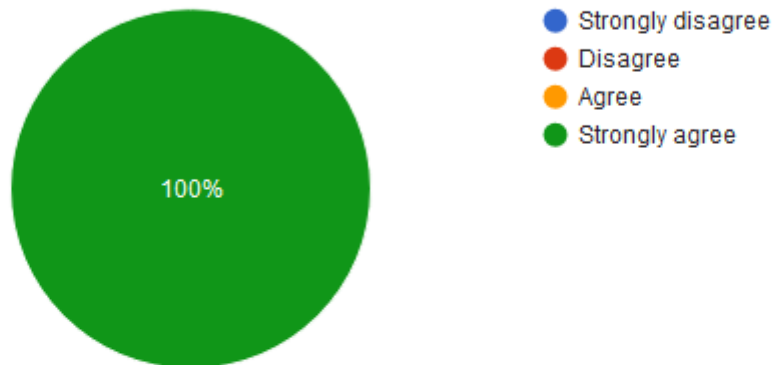
4. Would you suggest any modification in the score sheet?

3 responses

no
the score sheet looks good and no reason to change
No changes suggested

5. Please, assess the relevancy of the dimensions (focusing attention, following, pressing and releasing, action and reaction, and operation) in respect with the aim of the screening instrument.

3 responses



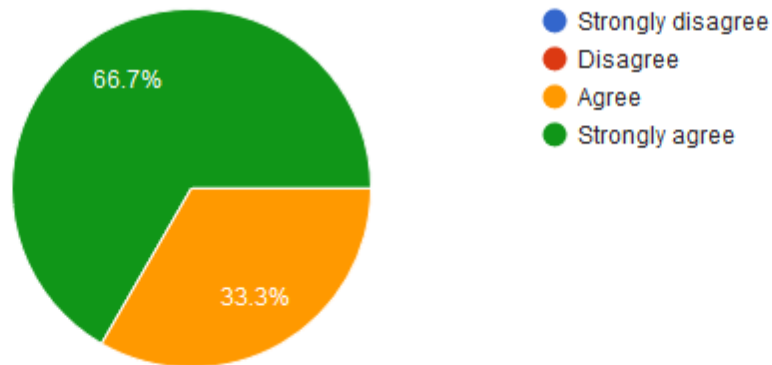
6. Would you add any other dimension or do you think that are enough for the proposed aim?

3 responses

no other dimension
would not add anything more
In my opinion, no more dimensions are needed

7. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 1 "Keeping attention on a visual stimulus"?

3 responses



8. Would you add or modify anything related with the instructions or answers of the item No.1?

3 responses

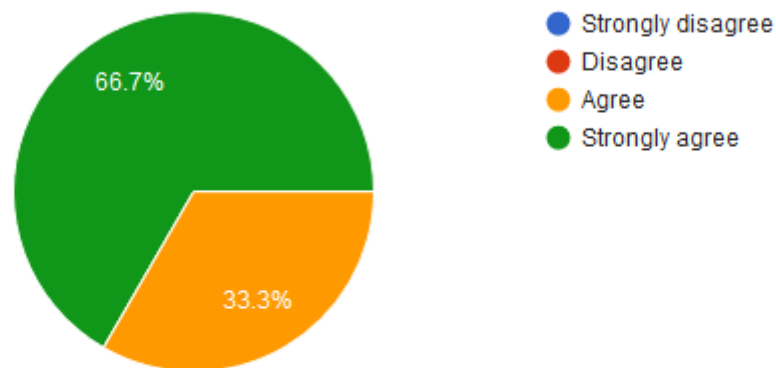
Since the student is (supposed to be) looking at a screen, it seems rather difficult to me how the professional can observe how the student "is really looking in the direction of the stimulus". Risk of bias in interpreting the observations is high here. You might consider using an eyetracker here?

It looks good and no reason to add.

No changes suggested

9. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 2 "Keeping attention on a visual and auditory stimulus"?

3 responses



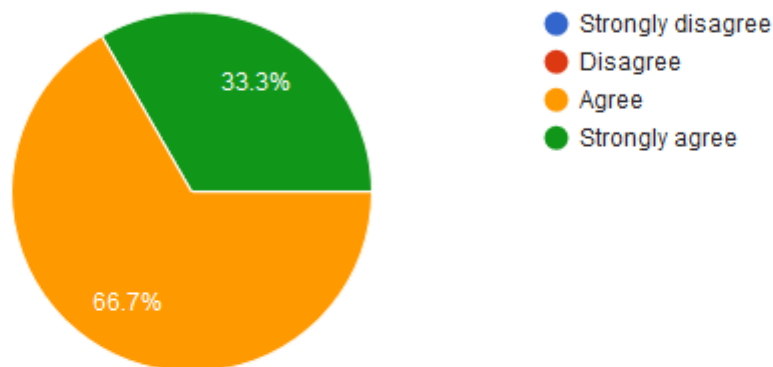
10. Would you add or modify anything related with the instructions or answers of the item No.2?

2 responses

no reason to add
No changes suggested

11. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 3 "Following an object visually when it is moved horizontally from the right part of the screen towards the left part of the screen"?

3 responses



12. Would you add or modify anything related with the instructions or answers of the item No.3?

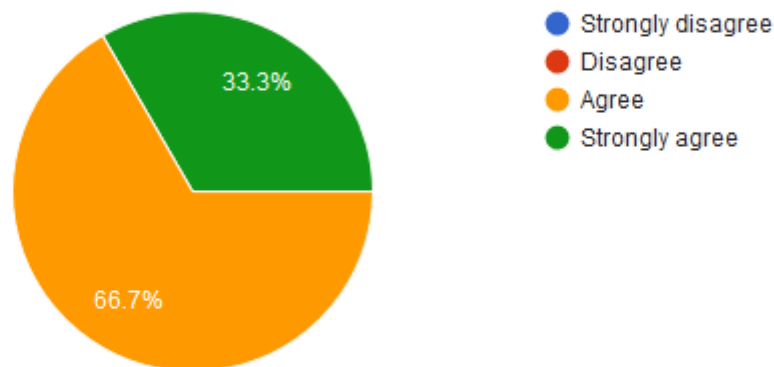
1 response

Which is the score if the patient follows the object during the entire trajectory just 1 of 2 times? It is not clear because it can't be neither 3 points nor 2 points.

Suggestion: 2 points if the patient follows the object during the entire trajectory less than 2 times. Instruction for the professional: In this case it is necessary to write down the cause for which the patient has not properly completed the task (i.e. patient cannot cross the centerline, patient properly completed the task just 1 of 2 times).

13. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 4 "Following an object visually when it is moved horizontally from the left part of the screen towards the right part of the screen"?

3 responses



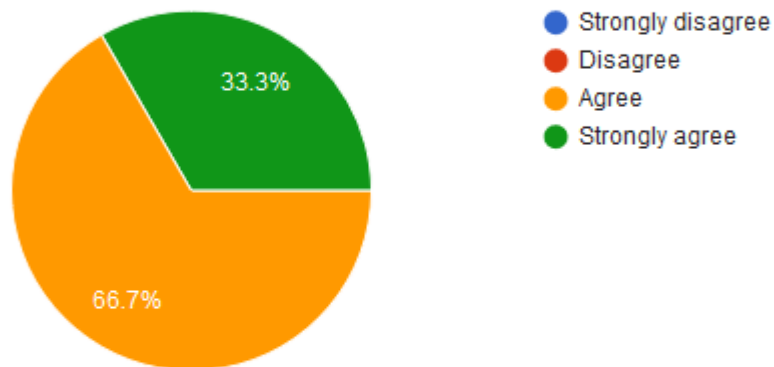
14. Would you add or modify anything related with the instructions or answers of the item No.4?

1 response

Same comment than in question 12

15. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 5 "Following an object visually when it is moved vertically from the upper part of the screen towards the lower side of the screen"?

3 responses



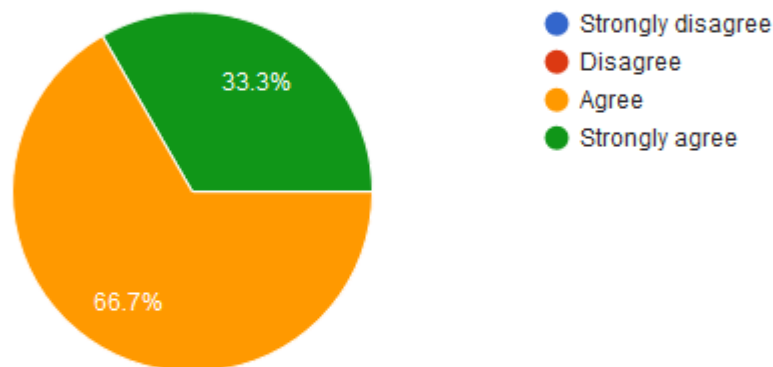
16. Would you add or modify anything related with the instructions or answers of the item No.5?

1 response

Same comment than in question 12

17. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 6 "Following an object visually when it is moved vertically from the lower part of the screen towards the upper side of the screen"?

3 responses



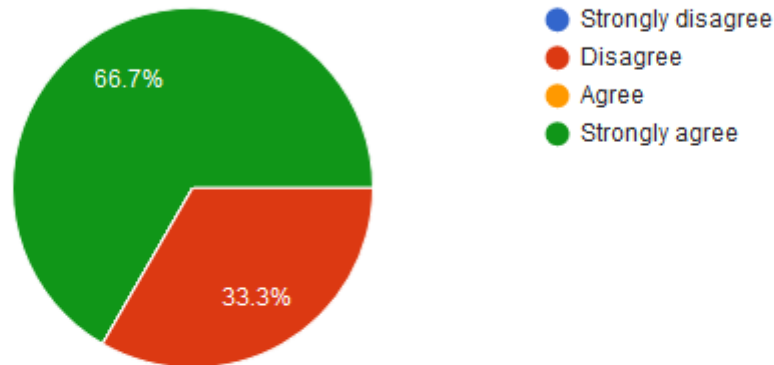
18. Would you add or modify anything related with the instructions or answers of the item No.6?

1 response

Same comment than in question 12

19. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 7 "Following an object visually in a circle movement passing the centerline"?

3 responses



20. Would you add or modify anything related with the instructions or answers of the item No.7?

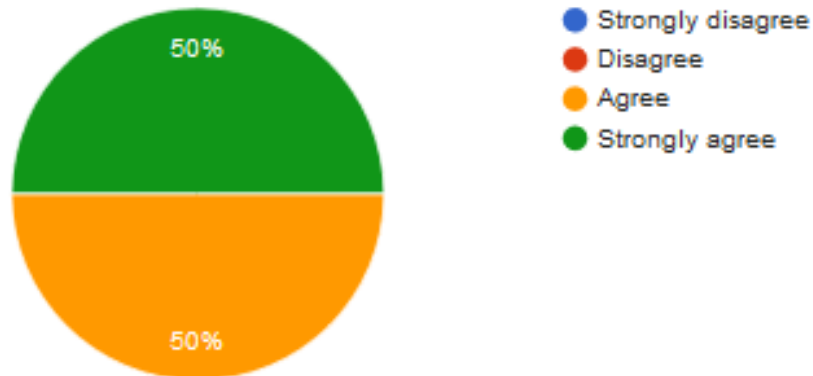
2 responses

I don't see the added value of testing circular pursuit movements compared to horizontal and vertical pursuit movements.

No changes suggested

21. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 8 "Pressing a switch or hitting the touchscreen"?

2 responses



22. Would you add or modify anything related with the instructions or answers of the item No.8?

2 responses

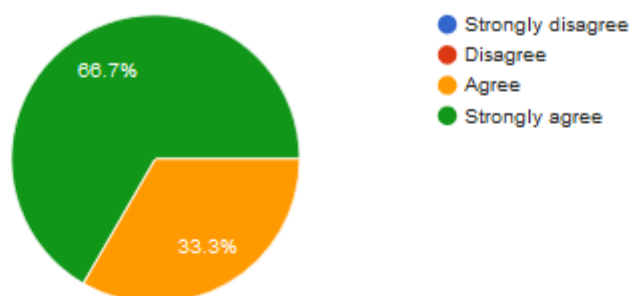
Good to be able to show the student how to. Looks good and clear

In my opinion the instruction for the user is not completely clear because, as it is formulated, patients could understand that it is possible to touch in any place on the screen.

Suggestion: Change "If you see something at the screen, try to press the button/touch the screen" by "If you see something at the screen, try to press the stimulus that has appear on the screen".

23. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 9 "Pressing a switch or hit the touchscreen and hold it"?

3 responses



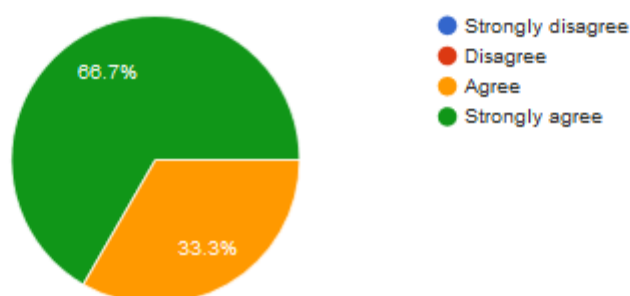
24. Would you add or modify anything related with the instructions or answers of the item No.9?

1 response

Same comment than in question 22. If patients have to press on the stimulus it is necessary to make it clear.

25. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 10 "Pressing a switch or hit the touchscreen and releases it"?

3 responses



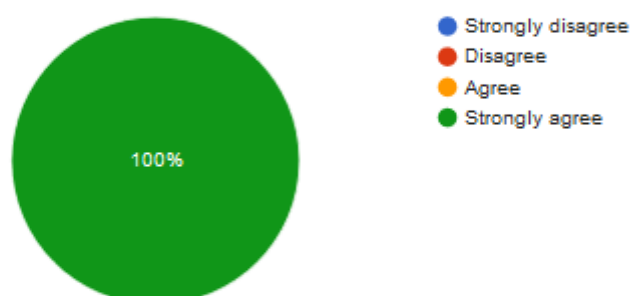
26. Would you add or modify anything related with the instructions or answers of the item No.10?

1 response

Same comment than in question 22

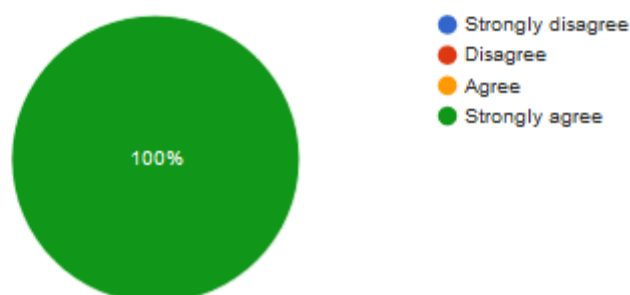
27. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 11 "Responding to a visual instruction and knows when to proceed"?

3 responses



28. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 12 "Responding to a visual and auditory instruction together and knows when to proceed"?

3 responses



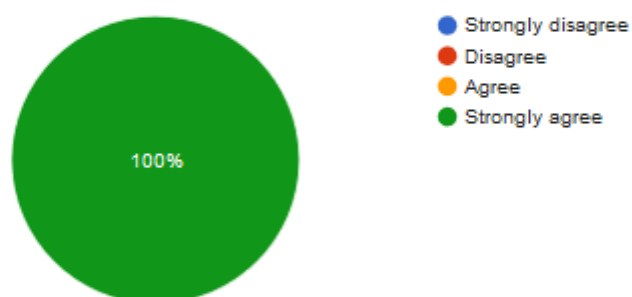
29. Would you add or modify anything related with the instructions or answers of the items No.11 & 12?

1 response

No changes suggested

30. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 13 "Grabbing a mouse or switch"?

3 responses



31. Would you add or modify anything related with the instructions or answers of the item No.13?

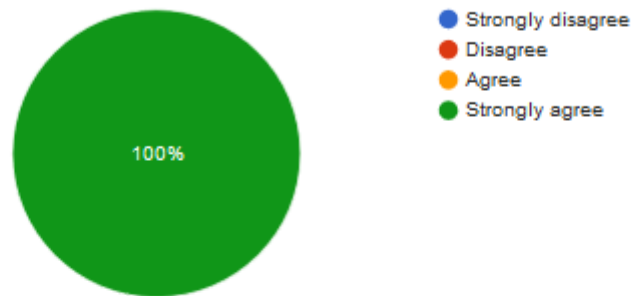
2 responses

Very good instructions

No changes suggested

32. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 14 "Making targeted movements with a mouse or switches and moves the cursor across an object on the screen"?

3 responses



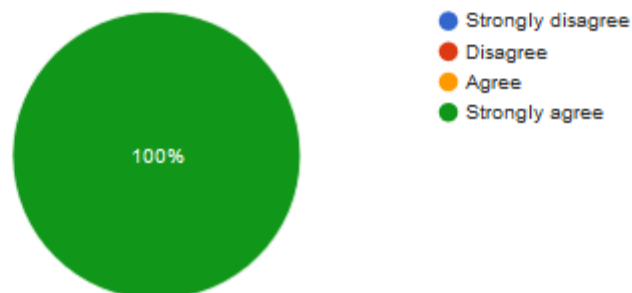
33. Would you add or modify anything related with the instructions or answers of the item No.14?

1 response

No changes suggested

34. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 15 "Completing a left-mouse-click action or activates an object on the touchscreen by a single tap"?

3 responses



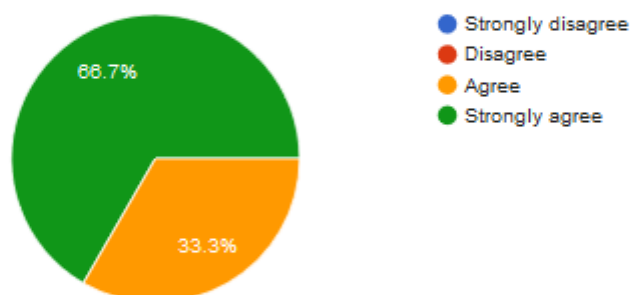
35. Would you add or modify anything related with the instructions or answers of the item No.15?

1 response

The evaluators have to have clear the difference between "press and release" and "activate with a touch" when ptients are working with a touchpad or touchscreen.

36. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 16 "Dragging and dropping with a mouse, switches or with the touchscreen"?

3 responses



37. Would you add or modify anything related with the instructions or answers of the item No.16?

2 responses

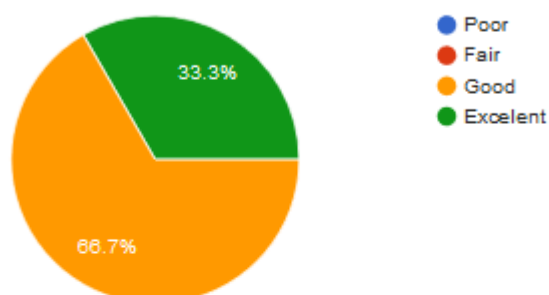
very good instruction

Which is the score if the patient select function correctly and drags the object over the screen to the target and drops the object at the right place but less than 4 times?

Suggestion: 2 points if patient complete the task properly but less than 4 times. Instruction for the professional: In this case it is necessary to write down the cause for which the patient has not properly completed the task (i.e. patient cannot drop the object, patient patient drop the object in a wrong place, etc.).

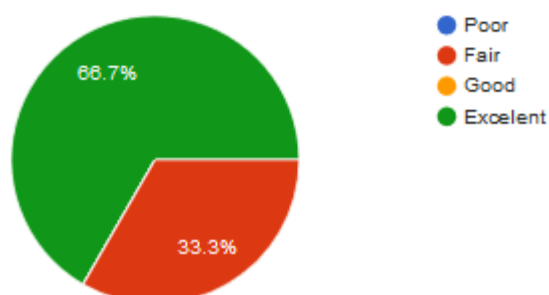
38. In general, how would you consider the understanding of the language used in the instructions and answers of the screening instrument?

3 responses



39. In general, how would you consider the content validity of the screening instrument?

3 responses

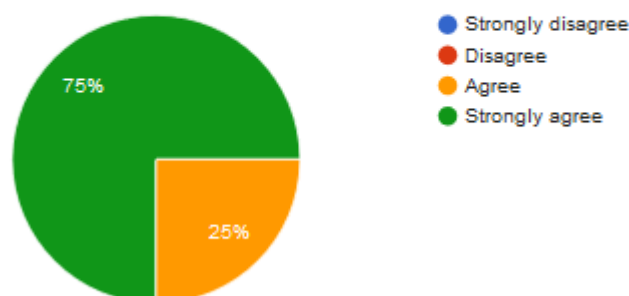


Appendix II: Content validity

Screening instrument of ICT skills for students with MDVI (BLIND)

1. What is your opinion about the information included at the beginning of the screening instrument (aim, equipment needed, application protocol and completion)?

4 responses



2. Would you suggest any modification in the information included at the beginning of the screening instrument (aim, equipment needed, application protocol and completion)?

4 responses

Apart from the document title, there is no indication that this instrument is specifically aiming at (totally?) blind students. What definition is used for "blind"? Could this instrument also be of use for students with "low vision" as well?

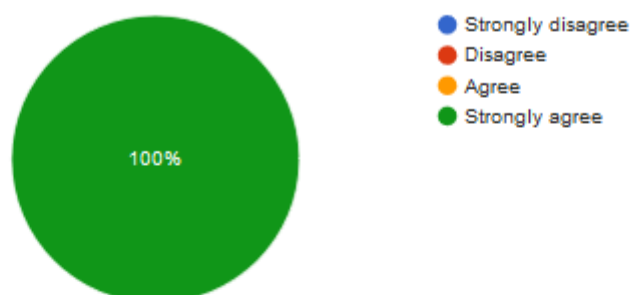
if the student does not respond to the test -when should it be ok to stop. Should we carry on all the way?

No changes suggested

Age range is missing. Check the spelling (full instrument).

3. What is your opinion about the relevancy of the score sheet?

4 responses



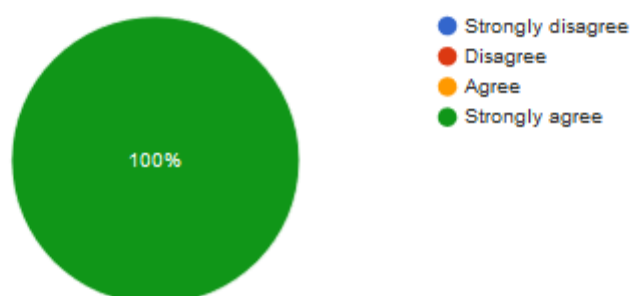
4. Would you suggest any modification in the score sheet?

3 responses

no
very good
No changes suggested

5. Please, assess the relevancy of the dimensions (focusing attention, following, pressing and releasing, action and reaction, and operation) in respect with the aim of the screening instrument.

4 responses



6. Would you add any other dimension or do you think that are enough for the proposed aim?

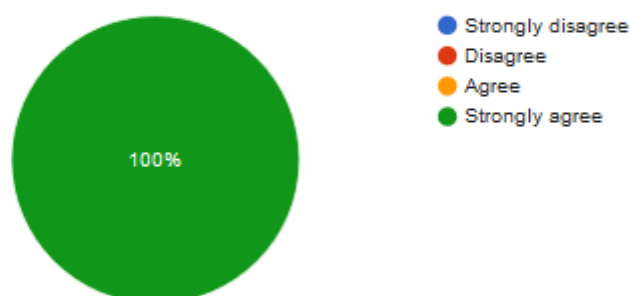
2 responses

enough for the proposed aim

No changes suggested

7. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 1 "Keeping attention on a visual stimulus"?

4 responses



8. Would you add or modify anything related with the instructions or answers of the item No.1?

4 responses

none (note that your question mentions "Keeping attention on a visual stimulus" where I assume you mean "Keeping attention on a AUDITORY stimulus")

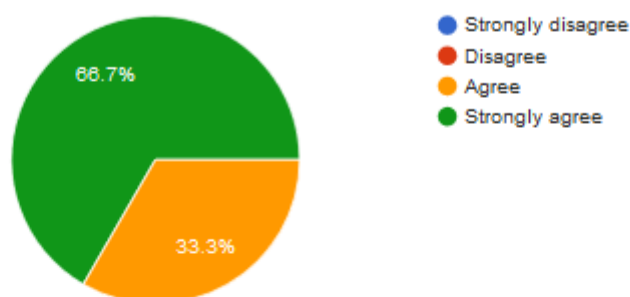
Please notice that no.1 is auditory stimulus not visual -otherwise we have nothing to add

No changes suggested

'Adviceto the student' phrase is not clear. 'If you hear something' instead of 'if you perceive any stimulus'

9. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 2 "Pressing a switch or hitting the touchscreen"?

3 responses



10. Would you add or modify anything related with the instructions or answers of the item No.2?

3 responses

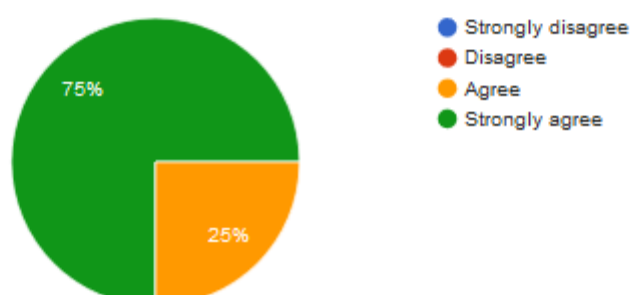
Could it be an idea to use another word for "hitting" like "touching". In the instruction part there are several language issues that could be fixed.

No changes suggested

'If you perceive something' is too general

11. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 3 "Pressing a switch or hit the touchscreen and hold it"?

4 responses



12. Would you add or modify anything related with the instructions or answers of the item No.3?

3 responses

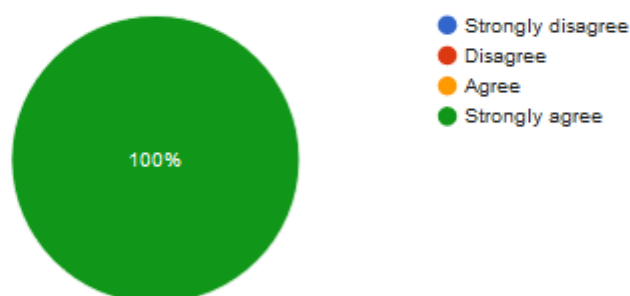
pressing a switch -we question the fact that no physical support is allowed as we can imagine that minimum support is needed for some students to activate their ability.

Which is the score if a patient responds more than 3 seconds but less than 4 times?
Suggestion: 2 points if the patient responds between 1-3 seconds at least 1 out of 4 times.

1 sec is too short to measure in a valid way (measurement error is usually longer using a stopper)

13. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 4 "Pressing a switch or hit the touchscreen and releases it"?

4 responses



14. Would you add or modify anything related with the instructions or answers of the item No.4?

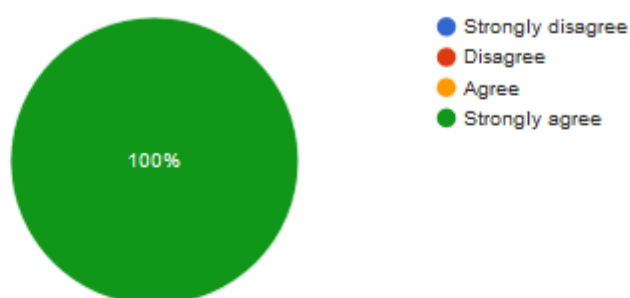
2 responses

instructions: would be better if the instructions by item 2 would be repeated instead of having to look back to another page

No changes suggested

15. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 5 "Responding to an auditory instruction and knows when to proceed"?

4 responses



16. Would you add or modify anything related with the instructions or answers of the item No.5?

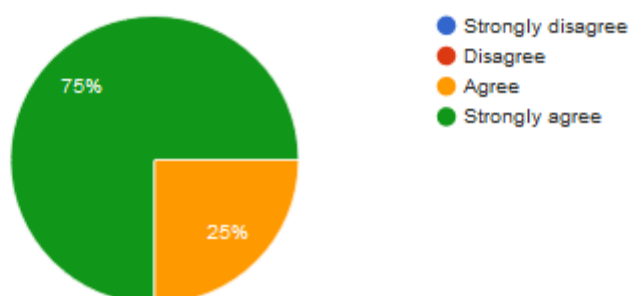
2 responses

question about the instructions in general... could it be option to give an idea of software that should be used in the beginning or throughout the test

No changes suggested

17. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 6 "Placing the hand correctly on the (adapted) keyboard or switches"?

4 responses



18. Would you add or modify anything related with the instructions or answers of the item No.6?

3 responses

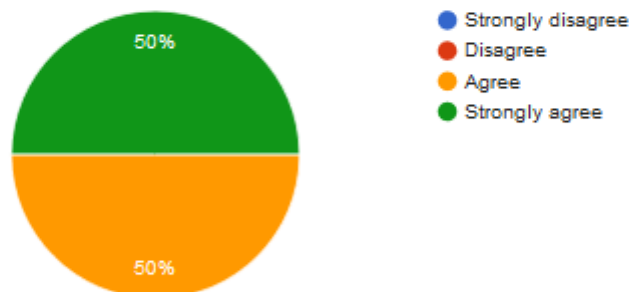
instructions should be repeated on each level (6, 7, 8) - it's easier for the teacher to read through the test even if it's repeated. Also thinking about visual instructions for the teacher -for example small photo/video of "how to" .

No changes suggested

Long and complicated instruction for the tester

19. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 7 "Making targeted movements left and right with the (adapted) keyboard / switches or swiping on the touchscreen to scroll over different choices with speech support"?

4 responses



20. Would you add or modify anything related with the instructions or answers of the item No.7?

3 responses

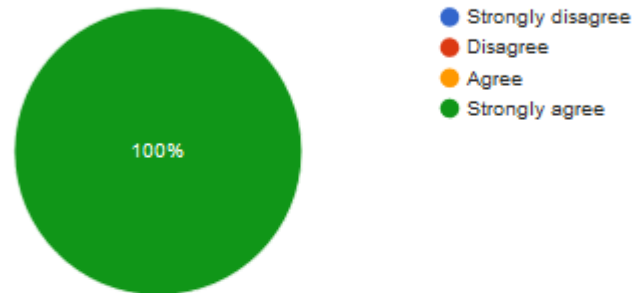
instructions: might sound a bit confusing too "try to bring the focus to an object" do you mean "attention"

No changes suggested

' Try to bring the focus' phrase is often not adequat language level for an MDVI child (comprehension is lower)

21. In respect with the aim of the screening instrument, could you please assess the relevancy of the item No. 8 "Activates an object with the (adapted) keyboard / switches or on the touchscreen by a double tap with speech support"?

4 responses



22. Would you add or modify anything related with the instructions or answers of the item No.8?

3 responses

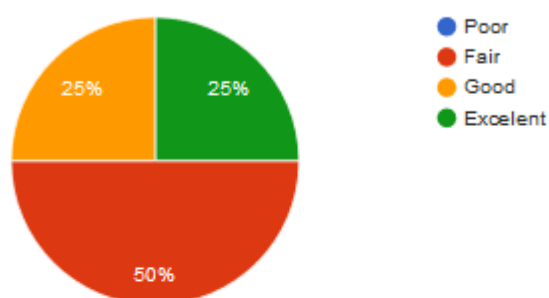
Maybe it would be better to have more options instead of 3 divided (6, 7, 8) or observe it with different aims and instructions for each question. Important to have clarity throughout the test

No changes suggested

With verbal support instead of speech support

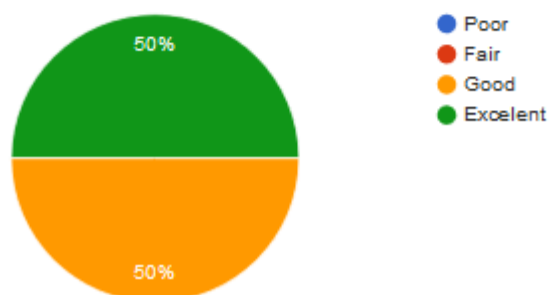
23. In general, how would you consider the understanding of the language used in the instructions and answers of the screening instrument?

4 responses



24. In general, how would you consider the content validity of the screening instrument?

4 responses



Appendix III: Screening instrument of ICT skills for students with MDVI (LOW VISION)

The **aim** of this screening instrument is to know what skills related with the use of Information and Communications Technologies (ICT) are mastered by children with multiple disability and visual impairment (MDVI). This screening instrument would allow the professional to know the degree in which ICT could be used at school to teach and train new skills to this population, and it would allow measuring the progress in ICT skills over time.

Equipment needed:

Chair (with armrests), table, personal computer with a screen of at least 22" (recommended 24" with touchscreen) or iPad, switch (i.e. Buddy Button), stopwatch, ruler of 30 cm, specific apps to test some items.

Application protocol

Carry out the test in a quiet room with no other students where you can blindfold the windows when necessary and adjust the brightness of the light. All the items should be analyzed with the student sitting down in front of the computer screen and looking forward. If a screen or an object is used, the distance between it and the eyes of the student should be between 10 and 40 cm. If an item cannot be evaluated in a student, the score of that item would be 0. In any item, if the respond to the stimulus is negative (i.e. screaming, turning away because the student does not want to see it, hitting to the screen out of frustration) the test may stop.

Completion:

Time: 15-20 min

Scoring: A four-point scale from 0 to 3. "0" indicates the lowest level of function and "3" the higher level of function. Maximum score = 48

Interpretation:

0-12 = ICT could not be used in the learning process of the student to train any skills.

13-26 = ICT could be partially used in the learning process of the student to train new skills.

27-45 = ICT could be used in the learning process of the student to train new skills.

Score Sheet

Name:					Age:		
Date:	Distance eyes-screen (if it's > 10 or >40 cm):						
	Item	Score (0-3)	Mark²	Item	Score (0-3)	Mark	
	1		<input type="checkbox"/>	9	S / T ²	<input type="checkbox"/>	
	2		<input type="checkbox"/>	10	S / T ²	<input type="checkbox"/>	
	3		<input type="checkbox"/>	11		<input type="checkbox"/>	
	4		<input type="checkbox"/>	12		<input type="checkbox"/>	
	5		<input type="checkbox"/>	13		<input type="checkbox"/>	
	6		<input type="checkbox"/>	14		<input type="checkbox"/>	
	7 ³		<input type="checkbox"/>	15		<input type="checkbox"/>	
	8	S / T ⁴	<input type="checkbox"/>	TOTAL			

² Mark here if you had to make sound by tapping on the screen to get the attention of the student.

³ If after this item the partial score is lower than 5 points, we should stop the evaluation.

⁴ Choose if the item is performed with a switch or touchscreen

			SCORE		
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A. Focusing Attention

1. Keeping attention on a visual stimulus.

Instructions for the professional: Turn off the sound of the computer. Advice to the student that you start the activity, then you can run the program. Observe what kind of reaction you see by the student during the time the stimulus appears on the screen. Measure how long the student is keeping his attention to the stimulus from the moment he is really looking in the direction of the stimulus. To make sure the reaction is no coincidence we offer this stimulus 4 times to the student. A positive respond could be: turning the head to the stimulus, starts smiling, try to touch the stimulus on the screen, getting closer with the face to the screen, etc.

When the student has problem sitting towards the screen or focusing, you may make sound by tapping on the screen to get their attention once as a practice to show what stimulus you are offering him. Then you should offer the stimulus again and from that moment they have to keep their attention by themselves. Make a mark icon in the score sheet when you do this.

Instructions for the user: If you see something on the screen, try to look at it as long as possible.

Score:

- () 0 Not able to keep attention on the stimulus or giving a negative respond.
- () 1 Able to keep attention on the stimulus less or equal than 5 seconds.
- () 2 Able to keep attention on the stimulus more than 5 seconds but only 1-3 out of 4 times.
- () 3 Able to keep attention on the stimulus more than 5 seconds in 4 out of 4 times.

2. Keeping attention on a visual and auditory stimulus.

Instructions for the professional: Do the same as in item 1, but with the sound turned on (average volume). Make sure the student doesn't have any hearing problems.

Respond:

The same looking reactions as in item 1 can be seen.

Listening reactions could be: turning their ear to the sound, getting closer with the ears to the speakers, start swinging at the music, giving a spoken response, etc.

It is ok if they only show the looking or listening respond or both at the same time.

Instructions for the user: If you hear or see something, try to look at the screen as long as possible.

Score:

- () 0 Not able to keep attention on the stimulus or giving a negative respond.
- () 1 Able to keep visual and/or auditory attention on the stimulus less or equal than 5 seconds.
- () 2 Able to keep visual and/or auditory attention on the stimulus more than 5 seconds but only 1-3 out of 4 times.
- () 3 Able to keep visual and/or auditory attention on the stimulus more than 5 seconds in 4 out of 4 times.

B. Following

Instructions for the professional: You are going to assess items 3 to 7 at once. Advice to the student that you start the activity, then you can run the program. In this program, objects will move one after each other from different directions. Observe the reaction of the student during the time the object

appears and moves on the screen. To make sure that the reaction is no coincidence we complete the whole program so different moving directions would be offered and could be observed.

When the student has problems sitting towards the screen or focusing, you may make sound by tapping on the screen to get their attention once as a practice to show what stimulus you are offering him. Then you should offer the stimulus again, and from that moment they have to keep their attention by themselves. Make a mark icon in the score sheet when you do this.

When the student gets too distracted by the sound and does not look at the object anymore, the sound of the program should be turned off. Make a note when you do this.

Respond:

The student must pay attention on the visual object in the screen when it appears. When the object on the screen is moving you must see that the eyes of the student or the whole head are moving with the object during the entire route. Maybe the student will follow the object by placing his finger or hand on the screen and move this with the object over the screen.

Instructions for the user: Keep yourself looking at the screen. If you see something, try to follow it as long as possible.

3. Following an object visually when it is moved horizontally from the right part of the screen towards the left part of the screen.

Score:

- ☐ 0 Not looking to the screen.
- ☐ 1 Looking to the screen, but not able to follow the object.
- ☐ 2 Performs eye movements in the direction of the object but cannot cross the centerline.
- ☐ 3 Performs eye movements in the direction of the object during the entire trajectory, at least, in 1 out of 2 times.

4. Following an object visually when it is moved horizontally from the left part of the screen towards the right part of the screen.

Score:

- ☐ 0 Not looking to the screen.
- ☐ 1 Looking to the screen, but not able to follow the object.
- ☐ 2 Performs eye movements in the direction of the object but cannot cross the centerline.
- ☐ 3 Performs eye movements in the direction of the object during the entire trajectory, at least, in 1 out of 2 times.

5. Following an object visually when it is moved vertically from the upper part of the screen towards the lower side of the screen.

Score:

- ☐ 0 Not looking to the screen.
- ☐ 1 Looking to the screen, but not able to follow the object.
- ☐ 2 Performs eye movements in the direction of the object but cannot cross the centerline.
- ☐ 3 Performs eye movements in the direction of the object during the entire trajectory, at least, in 1 out of 2 times.

6. Following an object visually when it is moved vertically from the lower part of the screen towards the upper side of the screen.

Score:

- ☐ 0 Not looking to the screen.
- ☐ 1 Looking to the screen, but not able to follow the object.
- ☐ 2 Performs eye movements in the direction of the object but cannot cross the centerline.

() 3 Performs eye movements in the direction of the object during the entire trajectory, at least, in 1 out of 2 times.

C. Pressing and Releasing

7. Pressing a switch or hitting the touchscreen.

Instructions for the professional: Make sure the student is sitting in front of the computer's screen and behind a table with the right ergonomic height to place the switch on. Ask the student to press at the switch. Give the student some time to react to the question. When using a touchscreen here, make sure that the touchscreen is placed in a way that the student can look at it with his head straight up, but also reach the touchscreen with his hand without lifting his arm or reaching his arm to far. Let the student repeat this 4 times.

When the student shows no respond on your question to press at the switch or hit the touchscreen, you may practice a few time. You can do it yourself once or twice so that the student can see and/or hear what is happening when you press at the switch or hit the touchscreen. You can ask for his hand and do it once or twice together, so he understand the movement. However, after that the student must do it by himself. Make a mark icon in the score sheet if you had to do this.

Respond:

The student must make a movement with his arm and hand towards the switch or touchscreen and touch it. Besides touching, he also has to press downwards to activate the switch and make a real pressing movement. In this item, it doesn't matter if the student is using another body part instead of his hand to touch and press. Nevertheless, make a note when the student uses his head, nose, arm or something else but manage to press or touch at the adequate place.

Instructions for the user: If you see something at the screen, try to press the stimulus that has appear on the screen.

Score:

- () 0 No movement reaction towards pressing and/or hitting at the stimulus.
- () 1 Reacts to the stimulus and starts a movement towards pressing or hitting without pressing the switch or hit the touchscreen.
- () 2 Makes a pressing or hitting movement but only get to the adequate place 1-3 out of 4 times.
- () 3 Makes a pressing or hitting movement and get to the adequate place 4 out of 4 times.

8. Pressing a switch or hit the touchscreen and hold it.

Instructions for the professional: Make sure the student is sitting in front of the computer screen and behind a table wit the right ergonomic height to place the switch on. Ask the student to press at the switch and hold it. Give the student some time to react to the question. When using a touchscreen here, make sure that the touchscreen is placed in a way that the student can look at it with his head straight up, but also reach the touchscreen with his hand without lifting his arm or reaching his arm to far. Let the student repeat this 4 times.

When the student does not understand why he has to hold the switch or touchscreen to let the activity goes on in the program, you can show him once or twice. However, after that the student must do it by himself. You may give verbal support at this point. By example by saying to hold the switch down or hold the hand at the touchscreen, but without physical support. Make a mark icon in the score sheet when you do this.



Respond:

The student must make a movement with his arm and hand towards the switch or touchscreen and touch it. Besides touching, he also has to press downwards to activate the switch and make a real pressing movement. Besides pressing and touching the student must hold the switch down or hold his hand on the touchscreen for a longer time so the activity goes on in the program. In this item, it doesn't matter if the student is using another body part instead of his hand to touch and press. Nevertheless, make a note when the student is using his head, nose, arm or something else but manage to press or touch at the adequate place.

Instructions for the user: If you see something at the screen, try to press the stimulus that has appear on the screen and hold it.

Score:

- () 0 Reacts to the stimulus and presses or hits very briefly for less than 1 second.
- () 1 Reacts to the stimulus and presses for 1 second.
- () 2 Reacts to the stimulus and presses for 1 - 3 seconds.
- () 3 Reacts to the stimulus and presses for more than 3 seconds in 4 out of 4 times.

9. Pressing a switch or hit the touchscreen and releases it.

Instructions for the professional: See instructions of item 9. You now ask to press the switch or hit the touchscreen. When the student does, you ask to release the switch or touchscreen. Only then, the activity starts in the program. Let the student repeat this 4 times.

When the student doesn't understand that he has to release and keeps his hand resting on the device you may practice this once or twice. Lift his hand together so he sees and/or hears that the program continues at the moment he loses contact with the switch.

Respond:

The student must make a movement with his arm and hand towards the switch or touchscreen and touch it. Besides touching he also has to press downwards to activate the switch and make a real pressing movement. To release the student must lift his hand from the switch or slide it away from the switch or touchscreen so that there is no contact anymore with the device. In this item it doesn't matter if the student is using another body part instead of his hand to touch and press. However, make a note when the student is using his head, nose, arm or something else but manage to press or touch at the adequate place.

Instructions for the user: If you see something at the screen, try to press the stimulus that has appear on the screen with your index finger and release it.

Score:

- () 0 Leaves the hand on the switch or does not press the switch or hit the touchscreen at all.
- () 1 Releases correctly 1 out of 4 times.
- () 2 Releases correctly 2-3 out of 4 times.
- () 3 Releases correctly 4 out of 4 times.

D. Action and Reaction

Instructions for the professional:

Computer: Make sure you turn the sound off during item 11 to test only the respond on a visual instruction and turn the sound on again in item 12 to test both the respond on a visual and auditory instruction. Make sure the cursor is at the position of the visual cue on the screen in order to make the switch work properly. The student only has to activate the switch and doesn't have to move the cursor to the right place. Say to the student that he has to wait with responding after the visual (and auditory, in item 12) cue is given. Run the program so the cue is given on the screen.

Tablet: Make sure you turn the sound off to test only the respond on a visual instruction. Say to the student that he has to wait with responding after the visual (and auditory, in item 12) cue is given. Run the program and watch the first pattern movie together and then the visual cue is given on the screen.

The student has to repeat this 4 times.

When the student doesn't understand that he has to wait you may practice it once or twice. You can use verbal language by saying "wait" till the cue disappear and then say press/hit now.

Respond:

The student should only press or hit after the cue is given by the program. There is no problem if the student is doing that once or twice quickly. However, it is not correct when he keeps pressing or hitting repeatedly while the next animation is already playing or let his hand resting on the switch or screen.

Instructions for the user: If you see something on the screen / hear something, try to press the switch or hit the screen.

10. Responding to a visual instruction and knows when to proceed.

Score:

- () 0 Not able to wait to the visual instruction or doesn't respond to the instruction at all.
- () 1 Respond to the visual instruction with an action in 1 out of 4 times.
- () 2 Respond to the visual instruction with an action in 2-3 out of 4 times.
- () 3 Respond to the visual instruction with an action in 4 out of 4 times.

11. Responding to a visual and auditory instruction together and knows when to proceed.

Score:

- () 0 Not able to wait to the visual instruction or doesn't respond to the instruction at all.
- () 1 Respond to the visual and auditory instruction with an action in 1 out of 4 times.
- () 2 Respond to the visual and auditory instruction with an action in 2-3 out of 4 times.
- () 3 Respond to the visual and auditory instruction with an action in 4 out of 4 times.

E. Operation

Instructions for the professional (Items 13 & 14): Both items are observed at once. Give a mouse, a (adapted) keyboard, or multiple direction switches to the student. Show the student the cursor on the screen by pointing. Ask if the student can move this cursor to the object on the screen with the device you hand over to him. During the testing process, it is possible to support him verbally but not physically.

These items have to be tested twice with a visual object on the screen of 5x5 cm. When the student succeed in reaching the object, you can change to the visual object on the screen of 2x2 cm and testing this twice. Otherwise, you stay with 5x5 cm and test this in 4 times total.

If the student has no experience with moving a cursor on the screen, you can show him once or twice. Choose the device the student is going to work with and show what is happening with the cursor if you use it (and show how you use it). You can ask for his hand to do it together for once or twice.

If you are not sure about which device the student can handle, start with the mouse. When that is physically too difficult, you can go to the use of switches. Make a note of which one is suiting the student and use this device for the remaining items.

12. Grabbing a mouse or switch.

Instructions for the professional:

Mouse: The student is able to move his arm in the direction of the mouse. He is placing an open hand over the mouse without pushing it away and let it rest on it. His hand palm must rest on the lower part / bottom of the mouse so that his fingers are laying over the mouse buttons. His fingertips can reach the table. The score will look as follow for the mouse placement:

- 1- Able to grab the mouse, but is pinching in the device with high muscle tense instead of a relax position of the hand with relaxing muscle tense.
- 2- Able to grab the mouse, but the hand is too high and the whole fingers are resting on the table or the hand is to low and only the finger tops are on the device.
- 3- Able to grab of the mouse with the hand palm resting on the lower part of the mouse and the fingers over the upper part with a relaxing muscle tense.

Switches: The student is able to move his arm in the direction of the switch. His hand is resting on the table below the switch and he is able to press the switch with a part of his hand or fingers. Or the student is lifting the arm and hand and during his movement to the switch he ends in hitting the switch with the whole hand. The amount of tension during hitting must be enough to activate the switch but not that hard that you hear a lot of noise by hitting the switch. The score will look as follow for the switch placement:

- 1- Able to start the movement towards the switch, but he is missing the switch during hitting.
- 2- Able to touch the switch during hitting, but with the wrong amount of tension. The student is hitting very hard of too soft.
- 3- Able to touch the switch during hitting with the right amount of tension.

Instructions for the user: Try to grab this object in order to use it.

Score:

- () 0 Not able to grab or place the hand on the device.
- () 1 Able to grab or place the hand on or near the device without a correct action.
- () 2 Able to grab or place the hand on the device with a moderate action.
- () 3 Able to grab or place the hand on the device with a perfect action.

13. Making targeted movements with a mouse or switches and moves the cursor across an object on the screen.

Instructions for the professional:

Mouse: The student is able to grab the mouse and move it with adapted muscle tension and coordination to the object on the screen. It is ok if it isn't a straight line, but a complete haphazard movement without the intention to reach the object on the screen is not correct.

Switches:

The student is able to move his hand and/or finger(s) from one switch to another. The student is using the right switches to move the cursor in the direction of the object on the screen. It is ok if it isn't a straight line, but a complete haphazard movement without the intention to reach the object on the screen is not correct.

Instructions for the user: Try to bring the cursor to the object. Stop when you reach the object.

Score:

- () 0 Is not moving the cursor.
- () 1 Moves the cursor, but not in the direction of the object on the screen of 5 x 5, or goes in that direction but shoots over the object
- () 2 Moves the cursor to the object of 5x5 on the screen and stops in time.
- () 3 Moves the cursor to the object of 2x2 on the screen and stops in time.

14. Completing a left-mouse-click action or activates an object on the touchscreen by a single tap.

Instructions for the professional:

Use the same device you have tested in 13 + 14. If the student manage more than 1 device, choose the most difficult one to go on with. Make a note of that.

When the student is able to get the mouse cursor on the object on the screen or his finger above the object on the touchscreen they have to activate the object by clicking or hitting it. Say then to the student: push the button (we refer then to the left mouse button, enter key on the keyboard or by use of the switches the fifth switch that is connected to the enter function of the keyboard) or hit the screen. During the testing process it is o.k. to support him verbally but not physically. This item has to be tested 4 times.

If the student never worked with left-mouse-click action, you can show him once or twice. Choose the device the student is going to work with and show what is happening with the object on the screen if you use it (and show how you use it). You can ask for his hand to do it together for once or twice.

Respond:

Mouse: The palm of the hand is resting on the lower part of the mouse and the fingers over the upper part with a relaxing muscle tense. One of the fingers is able to bend and reach the left mouse button to push this one down far enough to activate the button. The mouse stays (almost) in place so that the mouse cursor isn't moving from the object on the screen while pushing. After activating, the student is also capable of relaxing the finger and releasing the left mouse button.

Switches: The hand is able to move and reach the fifth switch that is connected to the enter key on the keyboard and push this one down far enough to activate. The student does this without pushing one of the other switches at the same time. After activating, he is also capable of relaxing and/or lifting the finger or hand to release the switch.

Touchscreen: The palm of the hand is resting on the table or at the student's body. The finger(s) may float over the touchscreen without touching it. The hand is able to move and reach the object on the touchscreen without touching the screen on his path. The student is able to touch the object on the screen with one tap on the right place without shooting away with the finger and making a swipe movement.

Instructions for the user: Try to bring the cursor to the object. Then left click/push the switch/touch the screen.

Score:

- () 0 There is no movement towards pressing the left-mouse button / switch or tapping on an object on the touchscreen.
- () 1 Presses the left-mouse button / switch down but not far enough to get a reaction (or hitting too hard) / the mouse shoot away during pressing or makes a tap movement on the touchscreen but the finger swipes away.
- () 2 Completes the left-mouse-click action or activates an object on the touchscreen by a single tap in 1-3 out of 4 times.
- () 3 Completes the left-mouse-click action or activates an object on the touchscreen by a single tap in 4 out of 4 times

15. Dragging and dropping with a mouse, switches or with the touchscreen.

Instructions for the professional:

Use the same device you have tested in 13 + 14 + 15. If the student manage more than 1 device, choose the most difficult one to go on with. Make a note of that.

Explain to the student that he has to take a visual object on the screen to a target at an other place on the screen. During the testing process it is ok to support him verbally but not physically. This item has to be tested 4 times.

If the student never worked with dragging and dropping, you can show him once or twice. Choose the device the student is going to work with and show what is happening with the object on the screen if you drag and drop (and show how you use it). You can ask for his hand to do it together for once or twice.

Respond:

Mouse: The student must be able to select the object with the left mouse button and hold this. While holding the left mouse button down he is moving the mouse and so the object on the screen to the target. This is not needed in a straight line, but in complete haphazard movements isn't correct. He must hold the selection until he has moved the object above the target on the screen. Then he must be able to release the left mouse button while the object is staying on the same place.

Switches: The student must be able to select the object with the fifth (enter) switch and hold this. While holding this switch down he is moving the object on the screen with the other (arrow) switches to the target. This is not needed in a straight line, but in complete haphazard movements isn't correct. He must hold the selection until he has moved the object above the target on the screen. Then he must be able to release the fifth switch.

Touchscreen: The student must be able to select the object on the screen by touching it with a finger and hold his finger there. With the same amount of tension, he has to swipe the object with his finger over the screen above the target without touching the screen with other fingers or parts of his hand. This is not needed in a straight line, but in complete haphazard movements isn't correct. Reaching the target the student has to release the finger in a single movement without making a last swipe movement over the screen by which the object is moving the wrong way from the target.

Instructions for the user: Try to bring the object to the target on the screen.

Score:

- ☐ 0 Not able to activate the select function and/or dragging the object on the screen.
- ☐ 1 Uses the select function correctly and drags the object over the screen, but isn't able to move it in the direction of the target or only 50% or less of the right route.
- ☐ 2 Uses the select function correctly and drags the object over the screen to the target and drops the object at the right place, at least, in 2 out of 4 times.
- ☐ 3 Uses the select function correctly and drags the object over the screen to the target and drops the object at the right place in 3 out of 4 times.

Appendix IV: Screening instrument of ICT skills for students with MDVI (BLIND)

The **aim** of this screening instrument is to know what skills related with the use of Information and Communications Technologies (ICT) are mastered by children with multiple disability and visual impairment (MDVI). This screening instrument would allow the professional to know the degree in which ICT could be used at school to teach and train new skills to this population, and it would allow measuring the progress in ICT skills over time.

Equipment needed:

Chair (with armrests), table, personal computer with a screen of at least 22" (recommended 24" with touchscreen) or iPad, switch (i.e. Buddy Button), stopwatch, specific apps to test some items.

Application protocol

Carry out the test in a quiet room with no other students where you can blindfold the windows when necessary and adjust the brightness of the light. All the items should be analyzed with the student sitting down in front of the computer screen and sitting at the table with the computer screen. If an item cannot be evaluated in a student, the score of that item would be 0. In any item, if the respond to the stimulus is negative (i.e. screaming, turning away because the student does not want to see it, touching to the screen out of frustration) the test may stop.

Completion:

Time: 10 min

Scoring: A four-point scale from 0 to 3. "0" indicates the lowest level of function and "3" the higher level of function. Maximum score = 24

Interpretation:

0-7 = ICT could not be used in the learning process of the student to train any skills.

8-14 = ICT could be partially used in the learning process of the student to train new skills.

15-24 = ICT could be used in the learning process of the student to train new skills.

Score Sheet

Name:		Age:	
Date:		Distance eyes-screen (if it's lower than 30 cm):	
Item	Score (0-3)	Item	Score (0-3)
1		5	
2	S / T ⁵	6	
3	S / T ²	7	
4	S / T ²	8	
		TOTAL SCORE	

⁵ Choose if the item is performed with a switch or touchscreen

A. Focusing Attention

1. Keeping attention on an auditory stimulus.

Instructions: Make sure the student is sitting in front of the computer screen. Advice to the student that you start the activity, then you can run the program. Observe what kind of reaction you see by the student during the time the stimulus can be heard. Measure how long the student is keeping his attention to the stimulus from the moment he is listening in the direction of the stimulus. To make sure the reaction is no coincidence we offer this stimulus 4 times to the student.

When the student has problem sitting towards the screen or focusing, you may make sound by tapping on the screen to get their attention once as a practice to show what stimulus you are offering him. Then you should offer the stimulus again and from that moment they have to keep their attention by themselves. Make a note when you do this.

Respond:

By a positive respond you may see one of the following reactions. Starts smiling / try to touch the place where the sound is coming from / turn their ear to the sound / getting closer with the ears to the speakers / start swinging at the music, etc. When the student is really turn their ear to the sound / get closer and/or sit still to listen or starts swinging only when the music plays we can say that there is auditory attention for the stimulus.

Instructions for the user: If you perceive any auditory stimulus, try to pay attention on it at it as long as possible.

Score:

- () 0 Not able to keep attention on the stimulus or giving a negative respond.
- () 1 Able to keep attention on the stimulus less or equal than 5 seconds.
- () 2 Able to keep attention on the stimulus more than 5 seconds but only 1-3 out of 4 times.
- () 3 Able to keep attention on the stimulus more than 5 seconds in 4 out of 4 times.

B. Pressing and Releasing

2. Pressing a switch or touching the touchscreen.

Instructions:

Make sure the student is sitting for the computer screen and behind a table with the right ergonomic height to place the switch on. Ask the student to press at the switch after letting him feel or hear where the switch is placed. Give the student some time to react to this question. When using a touchscreen here, make sure that the touchscreen is placed in a way that the student can reach the touchscreen with his hand without lifting his arm or reaching his arm to far. Let the student repeat this 4 times.

When the student shows no respond on your question to press at the switch or hit the touchscreen, you may practice a few time. You can do it yourself once or twice so that the student can hear what is happening when you press at the switch or hit the touchscreen. You can ask for his hand and do it once or twice together, so he understand the movement. However, after that the student must do it by himself and you start score the item.



Respond:

The student must make a movement with his arm and hand towards the switch or touchscreen and touch it. Besides touching, he also has to press downwards to activate the switch and make a real pressing movement. In this item, it doesn't matter if the student is using another body part instead of his hand to touch and press. But make a note when the student is using his head, nose, arm or something else but manage to press or touch at the adequate place.

Instructions for the user: If you perceive something, try to press the button/touch the screen.

Score:

- () 0 No movement reaction towards pressing and/or touching at the stimulus.
- () 1 Reacts to the stimulus and starts a movement towards pressing and/or touching without pressing the switch or hit the touchscreen.
- () 2 Is making a pressing or touching movement but only get to the adequate place 1-3 out of 4 times .
- () 3 Is making a pressing or touching movement and get to the adequate place 4 out of 4 times.

3. Pressing a switch or hit the touchscreen and hold it.

Instructions:

Make sure the student is still sitting for the computer screen and behind a table with the right ergonomic height to place the switch on. Ask the student to press at the switch and hold it. Give the student some time to react to this question. When using a touchscreen here, make sure that the touchscreen is placed in a way that the student can reach the touchscreen with his hand without lifting his arm or reaching his arm to far. Let the student repeat this 4 times.

When the student may not understand why he has to hold the switch or touchscreen to let the activity go on in the program, you can show this once or twice. But after that the student must do it by himself and you start score the item. You may give verbal support at this point. By example by saying to hold the switch down or hold the hand at the touchscreen, but no physical support.

Respond:

The student must make a movement with his arm and hand towards the switch or touchscreen and touch it. Besides touching, he also has to press downwards to activate the switch and make a real pressing movement. Beside pressing and touching, the student must hold the switch down or hold his hand on the touchscreen for a longer time so the activity goes on in the program. In this item it doesn't matter if the student is using another body part instead of his hand to touch and press. However, make a note when the student is using his head, nose, arm or something else but manage to press or touch at the adequate place.

Instructions for the user: If you perceive something, try to press the switch/hit the screen and hold it.

Score:

- () 0 Reacts to the stimulus and presses or touching very briefly for less than 1 second
- () 1 Reacts to the stimulus and presses for 1 second.
- () 2 Reacts to the stimulus and presses for 1 - 3 seconds.
- () 3 Reacts to the stimulus and presses for more than 3 seconds in, at least, 2 out of 4 times.

4. Pressing a switch or hit the touchscreen and releases it.

Instructions:

See the instructions by item 2. You now ask to press the switch or hit the touchscreen. When the student does that, you ask to release the switch or touchscreen. Only then, the activity starts in the program. Let the student repeat this 4 times.

When the student doesn't understand that he has to release and keeps his hand resting on the device you may practice this once or twice. Lift his hand together so he hears that the program goes on at the right moment he loses contact with the switch.

Respond:

The student must make a movement with his arm and hand towards the switch or touchscreen and touch it. Besides touching, he also has to press downwards to activate the switch and make a real pressing movement. To release the student must lift his hand from the switch far enough that the connection is lost with the computer or slide it away from the switch or touchscreen so that there is no contact anymore with the device. In this item, it doesn't matter if the student is using another body part instead of his hand to touch and press. However, make a note when the student is using his head, nose, arm or something else but manage to press or touch at the adequate place.

Instructions for the user: If you perceive something, try to press the switch or touch the screen and release it.

Score:

- () 0 Leaves the hand on the switch or does not press the switch or hit the touchscreen at all
- () 1 Releases correctly 1 out of 4 times.
- () 2 Releases correctly 2-3 out of 4 times.
- () 3 Releases correctly 4 out of 4 times.

C. Action and Reaction

5. Responding to an auditory instruction and knows when to proceed.

Instructions:

Computer: You have to place the mouse cursor in the center place where the animation with sound has to be activated. The student is only using the switch. Say to the student that he has to wait with responding after the auditory cue is given. Start the program so the auditory cue is given by the computer.

Tablet: Say to the student that he has to wait with responding after the auditory cue is given. Start the program and listen the first song together and then the auditory cue is given on the tablet.

The student has to repeat this 4 times.

When the student doesn't understand yet that he has to wait you may practice it once or twice. You can use verbal language by saying "wait" till the cue disappear and then say press now / hit now.

Respond:

The student is pressing the switch or hit the touchscreen the first time. A song is starting which the student can listen to. After the song is finished, the program will give a short auditory cue to start the



next song. Only by pressing or touching this one will start. The student only press or hit after the cue is given by the program. It is no problem if the student is doing that once or twice quickly after each other. However, it is not correct when he keeps pressing or touching repeatedly while the next song is already playing or let his hand resting on the switch or screen.

Instructions for the user: If you perceive something, try to press the switch or hit the screen.

Score:

- () 0 Not able to wait at the auditory instruction or doesn't respond to the instruction at all.
- () 1 Respond to the auditory instruction with an action in 1 out of 4 times.
- () 2 Respond to the auditory instruction with an action in 2-3 out of 4 times.
- () 3 Respond to the auditory instruction with an action in 4 out of 4 times.

D. Operation

6. Placing the hand correctly on the (adapted) keyboard or switches.

Instructions for item 6 + 7 + 8:

These items are observed at once. Give a (adapted) keyboard or multiple direction switches to the student. Ask if the student can choose a sound on the program of his choice with the device you hand over to him. During the testing process, it is ok to support him verbally but not physically. When he reach his choice and doesn't know yet how to activate this (item 9) you activate his choice so he gets a reward. You have to test this item 4 times.

If the student never worked with making a own choice in a program and navigating to it, you can show him once or twice. Choose the device the student is going to work with and show what is happening if you are navigating (and show how you use it). You can ask for his hand to do it together for once or twice.

When you are not sure which device the student can handle, start with the keyboard. When that is physical too difficult you can use the switches. Navigating on a touchscreen with voiceover can be very difficult and when you choose this one you can skip item 8 (with voice over you can't navigate up and down, only left and right). Only choose this one if you think that someone is capable of. Make a note of which one is suiting the student and use this device for the rest of the items.

Respond:

(Adapted) Keyboard: The student is able to move his arm in the direction of the keyboard. His hand is resting on the table next under the keyboard. The finger(s) is resting on the lower keyboard keys without pushing them down. The score will look as follow for the keyboard placement:

- 1- Able to place the hand on the device, but the whole hand is resting on the keyboard and/or is pushing the arrow key(s) already down.
- 2- Able to place the hand on the device with the palm of the hand resting on the table and the finger(s) floating over the keyboard, but is pushing the arrow key(s) already down.
- 3- Able to place the hand on the device with the palm of the hand resting on the table and the finger(s) floating over the keyboard or resting on the arrow key(s) without pushing them.

Switches: The student is able to move his arm in the direction of the switch. His hand is resting on the table next under the switch. The finger(s) is resting on the switch without pushing them down. The score will look as follow for the switch placement:

- 4- Able to place the hand on the device, but the whole hand is resting on the switch and/or is pushing the switch already down.

- 5- Able to place the hand on the device with the palm of the hand resting on the table and the finger(s) floating over the switch or resting on the switch, but is pushing the switch already down.
- 6- Able to place the hand on the device with the palm of the hand resting on the table and the finger(s) floating over the switch or resting on the switch without pushing it down.

Instructions for the user: Try to grab this object in order to use it.

Score:

- () 0 Not able to grab or place the hand on the object.
- () 1 Able to grab or place the hand on the object without a correct placement of fingers.
- () 2 Able to grab or place the hand on the object with a moderate placement of fingers.
- () 3 Able to grab or place the hand on the object with a perfect placement of fingers.

7. Making targeted movements left and right with the (adapted) keyboard / switches or swiping on the touchscreen to scroll over different choices with speech support.

Respond:

(Adapted) Keyboard: The student is able to lift his finger to push down the arrow keys one by one. He may use more than one finger when possible. But when one finger is changing between the arrow keys is also good. The student is using the correct arrow keys to move the focus into the direction of the sound he likes to hear on the screen.

Switches: The student is able to move his hand and/or finger(s) from one switch to another. The student is using the right switches to move the focus into the direction of the sound he likes to hear on the screen.

Touchscreen with voice over: The student is able to put one finger on the screen with the right amount of tension and make a horizontal straight swipe movement over the touchscreen to move the focus while keeping the same tension. It can be difficult not to tap on the screen by starting the swipe movement. In that case, the student will select an option sound instead of navigating through the choices.

Instructions for the user: Try to bring the focus to the object. Stop when you reach the object.

Score:

- () 0 Is not able to go to the left or right on the screen with the device.
- () 1 Is making the right navigating movement, but only 1 out of 4 times.
- () 2 Is making the right navigating movement, but only 2-3 out of 4 times.
- () 3 Is making the right navigating movement 4 out of 4 times.

8. Activates an object with the (adapted) keyboard / switches or on the touchscreen by a double tap with speech support.

Instructions:

It is possible to observe this while you are testing item 6 + 7 + 8. Then someone has navigate to the sound of his choice and may activate it immediately. Otherwise, you can give the student some specific instruction by this item. Say that he goes to the sound of his choice. Say that he can hear the sound by pushing the enter key / fifth switch / double tapping on the touchscreen. You may support him verbally in this process but not physically. You have to test this item 4 times.

If the student never worked with activating a choice in a program, you can show him once or twice. You can ask for his hand to do it together for once or twice.



Respond:

(Adapted) Keyboard and switches: The student is able to move his hand / finger(s) to the enter key or fifth switch and push this down without pushing other keys or switches down.

Touchscreen with voiceover: The student is able to release his hand after swiping without making a next swipe by coincidence. After that he is able to tap twice in the right speed and with the right tension without any movement to the side over the screen. Then the touchscreen recognize this action as the activating action for the chosen sound.

Instructions for the user: Try to bring the focus to the object. Then push the switch/double tap the screen.

Score:

- () 0 Is not able to find the activating key/switch or making the double tap movement on the touchscreen.
- () 1 Is able to find the right key/switch or making a double tap movement, but doesn't push the key correctly (or more at the same time) or doesn't tap in the correct way.
- () 2 Is able to use the activating key/switch or using the right double tap movement, but only 1-2 out of 4 times.
- () 3 Is able to use the activating key/switch or using the right double tap movement 3-4 out of 4 times.