EVALUATION PLAN

DDMATH PROJECT

Digital learning in mathematics

for blind students

ERASMUS+ Program

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DDMATH

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Project within the ERASMUS+ program - School Education Gateway - Action KA2 - Strategic partnerships for digital education KA226 - Convention n. 2020-1-IT02-KA226-SCH-09557

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Abstract: In this document we will describe the evaluation activity plan. It includes different questionnaires, administered to corresponding users' categories.

1. Executive summary

In this document, we will describe the evaluation activity plan. It includes different questionnaires distributed to different types of users (teachers, parents, students, study assistants, specialized teachers, transcribers)

Paccini coordinator proposed the assessment framework and started a discussion on the document draft via consortium list and Google Meet. During the google meet meeting the partners discussed and agreed on the general goals as well as methods, deadlines and expected outcomes. The Polish partner afterward circulated draft questionnaires to be analysed, commented upon, refined by all the partners, and finally approved.

The Google Meet meetings, led by Paccini partner, took place in the months of late August and September 2022.

The different assessment procedures, as well as the questionnaires, have been tested in advance during the month of September 2022 by users and teachers of the Paccini association, who checked the validity of the questionnaires, the related documents and schedule. In addition, the questionnaires' length and content were purposely constrained, to assure a good level of accessibility and suitable time for completion for the users. In fact, during the discussion, it emerged that the first version was too long and demanding could condition and limit user participation.

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2. Table of contents

3. The DDMATH Project

Studying mathematics has always been a great challenge for blind students and consequently, it has affected their performance, motivation to study, and ultimately access to scientific Degrees. The problem is faced by the entire generations of visually impaired people.

This issue is of particular importance in the time of Integrated Digital Education (IDE), which requires from the teachers (both in common schools and special institutes) maintaining an effective remote dialogue with the disabled student. To achieve this objective, every teacher has to develop new teaching techniques and prepare personalized digital materials, to be used in combination with the specific methods of distance learning.

For this reason, it is necessary to combine the computer aids with valid and tested didactic solutions, which can promote a real inclusion of the blind in the mainstream education and "guarantee everyone equal access to all educational activities" (MIUR).

The DDMATH project aims to create adequate resources, developing a new didactic model for IDE, based on information technologies. In the final stage of the project, it will be possible to experiment with the new solutions by involving teachers, students and families during the pilot phase in the real school environment.

DDMATH will surely have a positive impact both on students who will gain facilitated access to the material and thus obtain better results, and on the new generations of teachers who will be able to acquire new skills in the area of accessible mathematics, through the implementation of new teaching models, based

on Braille with the use of new technologies. This will also happen through a collaborative process between schools at the European level.

As a secondary objective, the project will launch a trial to test Lambda to the benefit of the users with other disabilities.

In the period of lockdown (closure of schools in Italy took place between April and May 2020) a number of suggestions and indications were received from some teachers who are desperately looking for useful solutions which would make them capable of doing mathematics with students who:

- are visually impaired (low vision)
- have severe motor disability in the upper limbs (being able to use only special keyboards)
- are dyscalculic

For these categories of disabled people, the following characteristics of Lambda prove to be particularly valuable:

- linear lambda coding (usually usable with Braille line, but also on PC monitor),
- the Lambda editor for "doing math" equipped with various compensative solutions,
- video presentation of the linear code with special glyphs for sighted teachers,
- speech synthesis that reads mathematical signs,
- Exclusive use of the keyboard (not the mouse),
- the visualization of mathematics in the traditional graphic format.

Based on their experiences, the consortium intends to verify this new potential of Lambda and create a prototype and a dedicated guide.

The consortium includes the following partners:

- Association Paccini, which has been engaged for years in proposing Lambda software solutions, for better accessibility of mathematics, for its 2200 students present throughout Europe.
- the EKMS association, having a deep knowledge of the needs and requirements of blind users, which will guide the project in the right direction to respond specifically to the users'

needs;

- the University of Toulouse "INSPE Toulouse Midi-pyrénées ". Its pedagogy department has a printing and Braille transcription centre, which will contribute to develop the didactic proposals for teachers and students;
- the company IN2, which for years has been engaged in the specific accessibility sector, will propose a production service of mathematical texts in Braille and conversion modules, which can be used directly from the project portal.
- Europole network: The National Network of Educational Institutions for Pedagogical Research and Innovation in Europe.

4. Methodology

4.1 Protocols and evaluation tools

The pilot phase consists of an initial activity of inviting potential users to use the materials such as video lessons, manuals, content, and softwares on the website. It also includes the distribution of a series of evaluation questionnaires that will complete the final project evaluation report. The evaluation questionnaires were created for the contacts made and are connected to the feedback from teachers interested in using the content created by the DDMATH project

The consortium is aware, and we will repeat this concept in other reports, that it will take some time for the extensive work of producing materials and educational content for the DDMATH project to be widely exploited and receive significant attention from teachers. They will gradually become more attentive and interested in the future, thanks to word of mouth and recommendations from the first users. Consequently, the work consists of an initial evaluation so that we can improve the readability of the portal in the future. We will continue, even at the end of the project, with the maintenance and updating of content and with dissemination and promotion among users.

Therefore, as described in our work plan, we have two different demonstration phases:

- Dissemination and involvement of users for experimentation, inviting them to use the resources of the DDMATH portal and the Lambda and Visual Lambda editors, to be carried out in their curricular teaching activities.

- Evaluation of the results of the aforementioned experimental activity through interviews based on pre-set questionnaires.

From the answers provided through the questionnaires and interviews, we will also gather information on how the practical activity (the pilot phase) of using the materials and contents has been carried out. The same tool will allow us to describe the interests of teachers towards different contents and the usefulness (or lack of usefulness, which will also be recorded in the evaluation report) of the contents in their teaching work with blind students.

The objective of the DDMATH Project is to provide clear training, good practices, be a place for discussion, and exchange of materials. However, with regard to the evaluation process, it is worth mentioning that the invited teachers will most likely present different needs and interests. This means that they will be interested in experimenting with only some of the resources made available on our portal, while others may be of relative interest, or require more time to understand their use or become familiar with new proposals and contents. The various dissemination activities have already highlighted that there are different levels of interest and attention to the proposals and good practices highlighted in the project. There are those who have struggled to reach their own teaching method and specific competence and show no interest in learning about good practices activated in other countries, while others are dissatisfied with the resources employed and are interested in more effective and easily acquired solutions.

In order to facilitate the teachers', work we listed the resources available on the portal, in order that the testing could be done, as far as possible, using the resources already available, whilst recognising that not all of the resources would be relevant to the work of every teacher involved.

To facilitate the approach to the portal, a short video is available. It provides the opportunity for immediate understanding of the numerous resources present in it in an effective and immediate way. The idea of the short navigation video aims to further engage users and encourage them to understand the work of the DDAMTH project.

Here is the list of resources:

Video Training	Link
1.1 Science and Blindness Do blind people have more difficulty understanding scientific disciplines?	https://ddmath.eu/en/videogallery-didattica/
1.2 Lambda Tutorial Lambda programme learning video lessons	https://ddmath.eu/en/tutorial-videogallery/
1.3 Lambda and didactic Solving strategies, teaching tips	https://ddmath.eu/didattica_videogallery/
1.4 Transcribing into Braille How to transcribe textbooks into Braille using technology via MathM	https://ddmath.eu/produrre-libri-di-testo-in-braille/
Resources	
2.1 LaTeX Find out how to use LaTeX for accessible mathematics	https://ddmath.eu/latex/
2.2 Download files A collection of Braille Lambda informed texts produced by the project	https://ddmath.eu/download-file-lambda/
2.3 Sweet Maths Download the free textbook Sweet Maths	https://ddmath.eu/matematica-dolce/
2.4 Teaching resources Educational resources, articles, manuals, guides, tips, good practices, web resources etc.	https://ddmath.eu/risorse/
DDMath App	
3.1 VisualLambda Visually impaired app for students with DSA and motor disabilities	https://ddmath.eu/en/download/visuallambda/
3.2 Lambda2.0 Editor	https://ddmath.eu/en/download/lambda2editor/

Download the app to read Lambda format files with braille display and speech synthesis.	
3.3 Math online Editor Online editor that saves in XHTML and downloads directly into Lambda	https://lambda.ddmath.eu/?_ga=2.197278767.1419450560.1669379993-672707350.1668589942
3.4 State of the art database	https://ddmath.eu/banca-dati/

A guide on what exists on the site (divided by theme) has been presented on the project site, at this link: https://ddmath.eu/navighiamo-tra-i-contenuto-del-sito-ddmath-eu/

As can be seen from the above list, due to the considerable number of available materials, the DDMATH project requires various checking methods to provide useful information on the several aspects investigated.
Considering this particular aspect of our work, we have decided to draw a list of goals, which would be the basis of our evaluation tools, in order to assess the effectiveness and adequacy of our resources, and how far they meet our interlocutors' main professional interests.
The interlocutors (through multiplier events and dissemination activities carried out) were invited to access our DDMATH portal and navigate through its pages/resources, based on the following evaluation criteria and according to the following work hypothesis.

- didactic units' quality as models for the construction of similar materials by the teachers.
- Completeness and quality of material,
- the usability and accessibility of Lambda editor;
- the usability and accessibility of VisualLambda editor;

- the potential of Lambda editor and VisualLambda as educational tools.
- the completeness and functionality of the Lambda system.
- the clarity and cohesion of the Braille math code.
- the accuracy of the conversion tool (MathML to Lambda Braille and viceversa).
- The information provided on other systems used in Germany based on the LaTeX code.
- Completeness and usefulness of the database on programs and systems available to address mathematics for blind students.

The plan involves three types of evaluation:

- recording and checking of responses from all those who took part in meetings, conferences, exhibitions and other events which were organised by the consortium, in particular during the period from September 2022 until March 2023, that is after the portal had been completed with all planned materials.
- Direct contact by phone or personal contact.
- Specific tests on available materials, carried out in real concrete learning situations, and the filling in of an evaluation questionnaire, or alternatively, interviews with users asking similar questions to those present in the questionnaire.
- reports by experts on automatic production (conversion module, math editor).

Demonstration activities and corresponding evaluation tasks have been subdivided into different working phases, some of which have been arranged in a timeline order and therefore have been numbered as V1, V2, etc.

This grouping method offers some advantages, such as a clear idea about which activity should be carried on, by whom, how and when, with how many users, appropriate goals in a given experimentation activity, about which tools are best

suitable, appropriate protocols for administering questionnaires, and finally suitable evaluation criteria.

Please note that:
The first working phase includes making sure that there exist necessary conditions / requirements in view of the real demonstration work. For this purpose, we have designed specific questionnaires, in V1 the Q1, in V2 the Q2, in V3 the Q3, as specified below:
V1 is intended to describe the first contact with each interlocutor. The contact can occur for different reasons and in different occasions. E.g. The interlocutor (e.g. teacher) can be one of the contacts belonging to the contact network of a given partner. Two further contacts will take place (V2 and V3) in order to support the teacher in the comprehension and use of the project resources with the aim of having his participation during the demonstration phase.
V2, in particular, aims at assessing the interlocutor's need for help / support, with a view to preparing specific learning material for his / her student /s, if necessary. If help / support is needed, the interlocutor notifies this need by phone, or via mail, and the Consortium takes charge of the preparation of the required material.
The portal has also been equipped with a forum to facilitate dialogue in case of difficulties encountered by users of different kinds, such as being unable to install the Lambda or Visual Lambda program, install scripts for the screen reader, or find difficulties in digitizing certain specific symbols.
With V4, the demonstration phase can be considered accomplished, and the following activity will be focused on gathering information about testing activity, and on gathering every useful feedback from our interlocutors, including comments, suggestions, criticisms, new ideas, offers for further cooperation.
The V5 and V6 are technical tests aimed at evaluating the performance and accuracy of the conversion modules, VisualLambda and other resources created on the web site. This stage does not involve users, but the consortium members and some expert of the user group.

4.2 TARGET GROUPS

Our plan takes into consideration several target groups, namely:

1) mathematics teachers
2) and teaching assistants,
3) working in either inclusive schools or special schools
4) and their students and/or parents

TARGET GROUP 1: Math teachers

Current situation and framework information:

In an inclusive school for example lower compulsory school or higher school, may be asked to enrol one or more students with visual impairment. Consequently, nowadays a growing number of teachers, especially those who could attend special training courses or those who achieved their qualification in recent years, have had the opportunity to get to know basic concepts concerning special education and didactic strategies for students with disabilities.

In special schools, where only blind students are present.

These schools can rely on stable and experienced teachers with long experience in Braille mathematics. Unfortunately as we have experienced, such teachers strong in their knowledge are very reluctant to experiment with new proposals and new solutions that depart from their established practice. The institution itself has over time implemented a curricular teaching and programming that is applied to in a uniform manner year after year for all students in the institution.

It is important for the project to contact the maximum number of teachers in special schools. We presume that many of them will be meet through the several dissemination activities.

A school system based on *special education teachers working* in inclusive schools is very common in some countries, as in Italy. In fact, there is a specific type of professional teacher called a “support teacher”, who has specific competences

concerning all kinds of students with disabilities. These teachers have the same rights and duties as their curricular peers, they participate in every common activity, such as planning and evaluation, and work alongside their curricular colleagues, either in the same classroom or, if necessary, in separate classrooms. Their task is to develop and to implement didactical work in cooperation with curricular teachers in such a way that all students can share didactical goals, timing and activities as much as possible. In many cases resource teachers are not specialists for Braille Mathematics, but they can be employed also for mathematics lessons, in order to support the curricular teacher. For this reason, it is very appropriate to offer them general information about our project and its benefits.

In many European countries, VI students receive help and support from some specific professionals, called *school assistants, home readers, mediators, communication facilitators, as well as from expert professionals,* such as Orientation and Mobility (O&M) instructors, visual rehabilitation experts, personal care experts and Independent Living Skills instructors. All of these professionals aim to develop the independence of their VI students, both in school activities and in personal activities. They help the students in the use of specific techniques / aids / strategies, in relation to different subjects, such as writing, reading, geography, drawing, maths, foreign languages, the use of IT, and also music if necessary. Financial resources for these professionals are provided by Local Authorities. They either employ them or pay for their work entrusted to private companies, associations, or directly by the family. These professionals work mostly at home with the student, and in some cases they cooperate with teachers at school.

In Italy all new training courses for teachers of all kinds of school include specific modules also in the domain of special education and special didactics corresponding to at least 3 credits (see the legislation called the 24-credit pathway for access to competitive exams, which will be changed probably from Nov. 1, 2023 to a more demanding pathway called the 60 CFA teaching qualification).

This kind of organisation of teacher training is to be considered part of a general policy, aimed at raising the level of awareness, competence and responsibility of every single teacher with regard to students with disabilities, and consequently aimed at reducing the need for specialised support teachers or external support during class activities.

Evidence of this tendency can be found if we take into account the growing number of training opportunities in the field of special education, bonuses, grants and allowances for those attending training programmes and Master courses in this domain, Or through official examination programs for qualifying competitions to become full-time teachers..

In Italy there is a specific professional teacher called “support teacher”, who has specific competences concerning all kinds of students with disabilities. He is a teacher for the entire class and he has same rights and duties as his curricular peer, he / she participates in every common activity, such as planning evaluation, and works side by side with his / her curricular colleague in, either in the same classroom or, if necessary, in separate classroom. His task is to develop and to implement didactical work in cooperation with curricular teachers in such a way that all students can share didactical goals, timing and activities as much as possible. In many cases resource teachers are not specialists for mathematic in braille, but they can be employed also for mathematic lessons, in order to support the curricular teacher. For this reason it is very appropriate to offer them general information about our project and its potential

In France, the situation is more different:

As revealed by the responses of the questionnaire on the needs of teachers who supervise blind students, such specialized teachers working in regular schools feel the need for new information and updates on issues of access to scientific texts by blind students in particular to build teaching that is truly inclusive Help can be obtained from associations or institutes like the IJA (Institut des Jeunes Aveugles)

but the link with the teacher is not easy. The DDMATH project can help teachers to better understand their students and help them to use new technologies.

Recent French legislation has promoted a diploma for teaching the blind:

- CAEGADV: certificate of general education for the blind and visually impaired.
- CAEMADV: certificate of aptitude for teaching music to the blind and visually impaired.
- CAFPETADV: certificate of aptitude for teaching technical education to the blind and visually impaired.

These certifications allow teaching blind youth in facilities or services under the responsibility of the Ministry of Solidarity and Health.

The title is a real diploma issued by the Ministry of Solidarity and Health.

Training takes place over 3 years at the National Institute for the Young Blind (INJA) and at the National Training Center for Teachers Working with Youth with Sensory Disabilities in Chambéry (CNFEDS).

This course takes place with two periods (Period 1 : 8 weeks for theory, 300 hours in a specialist school, one week in normal school; period 2 : 8 weeks for theory and one week in a specialist school-

The certification is obtained after two big examinations. It is a very long process and the teachers with this certificate are very few.

The DDMATH project can help them to integrate more technology into their courses.

In Poland

There are mainly special institutions for the blind, but these also allow access to able-bodied students. For less severe cases, for example low visually impaired children, there is also the possibility of attending inclusive schools

Nowadays parents are more likely to place their blind children in mainstream inclusive schools. However, if a blind pupil is admitted in an inclusive school, it is often the case that he/she receives very little special assistance because there are very few teachers with special tyflopedagogic qualifications. Tyflopedagogues are

trained on special courses organised by regional educational authorities on post-diploma courses run by universities. They are qualified to provide assistance to visually impaired children in various subjects and techniques, but not specifically in mathematics and BRaille. Pupils enrolled in mainstream schools have a right to some extra lessons (4-8 hours a month), but such lessons have to be carried out by tyflopedagogues.

Mathematics teachers who happen to work with a blind student usually have to rely on their experience (if they worked with the blind in the past) or to learn how to cope with the situation on the basis of some literature.

One of the major obstacles to the work of mathematic teachers is lack of equipment (especially computers with Braille displays).

When a child attends an inclusive mainstream school in Poland the support role is sometime played by the families. Parents often help their children, sometimes directly or through study assistants. They often have to bear the expenses of the necessary equipment and supplementary Braille materials.

In Germany

In Germany by existing a federal system, education for blind students is handled independently and diversely by the different regions. In general, blind students are enrolled in special institutions, although for some years now there have been increasingly active initiatives to include blind children in mainstream schools.

The Marburg Institute for the Blind in 1955 (and later updated in 1986) implemented a 6-point braille mathematical coding that has been successful throughout the country and also in most neighboring states. Children are therefore introduced to Marburg- 6-point braille.

Subsequently, in 2015, a manual was published that unified the coding for all German-language users. It is called "Das System der Mathematikschrift in der Deutschen Brailleschrift

In the years around 2000 the various centres and special institutes promoted a wide discussion on the best system and coding for math for blind high school students going so far as to promote the use of speech synthesis and the LaTeX code.
Specialist teachers are therefore required to be familiar with both the Braille system and the Latex system, While mathematics teachers benefit from being familiar with LaTeX, which they learned during their university studies, and can therefore use it immediately in their teaching activities.

4.3 Pilot activities target group 1 (teacher and school worker)

General goal
- raising awareness about potentialities of VI students in the domain of Mathematics studies, if they can use appropriate tools, such as for examples products / services which have been developed within DDMATH project;
- offering the teachers good reference points in case they have to deal with VI students during their professional life.
- promote the work carried out by the DDMATH Project, by providing information about our products and services;
Inviting teachers to develop and implement one didactic unit (related to activities planned during the school year from September to November).- raising awareness of the advantages of cooperation and exchange of experience, especially with regard to European citizenship and European awarenessTo this end, the portal has been implemented with a forum to collect any requests or problems encountered, whose answers can also be useful for others, or to receive additional information on the contents of the portal.
Once teachers have agreed to collaborate with the project we listen to their requests and needs, in the light of the resources available on the portal.

If they agree to participate in the pilot and evaluation activities of the project, teachers, based on the contents of the portal and their individual work plan, will identify an activity to be carried out in their class involving a blind student. But not only that, they must also consider, in the choice of work for the experimentation phase, whether their student is familiar with and has adequate computer tools and aids, whether their student knows 6- or 8-point math Braille, their level of knowledge of LateX code or other accessible code.

It is important that the testing activity should not limit the school course already begun by students; therefore, the materials used as the basis of training activities will possibly be the same as the ones previously adopted by the school. The teacher, if requested, will be supported in order to design and to develop the didactic unit using appropriate strategies / products / services from our project.

4.4 TARGET GROUP 2: students from 11 to 19 years old

The questions to this group aim to find out whether they find it more or less interesting to study with the aid of computer rather than with traditional methods. They are asked about the extent to which they already use IT in their work and which software they are familiar with. They are also asked for their feedback concerning all the software and resources available through the DDMATH project.

4.5 The Summary table of evaluation plan

DDMATH Demonstration Phases and Evaluation Plan

1) Initial planning of demonstrative activity

	Contact	**Object**	**Method**	**Instruments**	**Beginning Time**	**Finishing Time**	**Sample kind**	**Sample number**
V1 First meetings with teachers See also dissemination activities	Personal contact in planned meeting or Info day, participation, exhibition, conference, Contact by email or by phone	Recording and analysis of users' first contact with the project Collect the names (asking consensus) of those who are interested to download and install the programs on the website. Collect data and their phone number. (Such information will remain anonymous and will not be disclosed.)	Direct observation and simple questions on satisfaction level	P1 and Q1 Recording grid	From March 2022	By September 2022	Teachers (inclusive school or specialised school etc.) Educators	several users in each country (about 8 or more)
V2 Starting the dialogue with nominatives	Phone call of email contact	V2 In September 2022 there will be the contact with the teachers to know if they have had problems installing programs and opening the various didactical units. They will be asked if they are interested in building their own didactical unit to play with their blind pupils. In this case it is proposed to assist them during the work of realization of unit. From September to October, make themselves available for possible contacts and requests for information to the knowledge and use of resources in the portal.	Direct request by phone or by email, Report of answer on Q2	P2 and Q2 Recording grid	After about September 2022	-	As above	All the people who leave the contact phone number, with a minimum of 8 teacher for country
V3 Contact verification	Phone call of email contact	Second contact through the phone by September / October 2022 in order to verify that all material, the installations are ready for use and testing activities that the teacher wants to achieve. .	Contact by phone or bay email	P3 and Q3 Recording grid	After about 30 days after the (V2)	-	As above	All the people who answered in affirmative way to the request of V2

2) Verification activity on performed tasks

	Contact	Object	Method	Instruments	Beginning Time	Finishing Time	Sample kind	Sample number
V4 Satisfaction questionnaire	Direct interview (by phone or by email) with pre-defined questions.	Analytically record the users' satisfactory level regarding DDMATH system; Evaluation of the effectiveness of the system and its usability, based on utilisation of the didactical unit realised. Quantify how much work is accomplished by the new system. There will be a questionnaire aimed at teachers and a simpler one for students and parents. This will make it possible to obtain information on the same activity from different points of view (teacher, parents, students) in order to compare the different data.	With pre-defined questions.	P4 and Q4.1 Q4.2 Recording grid	From November 2022	Not later than December 2022	As above	All the people of the V3
V5 technical text	Verifying of MathML conversion, VisualLambda test	The evaluation of V5 will be only technical because it wants to evaluate the correctness of the conversion, the relevance or not to Braille Mathematic rules	Technical checks based on different score as Test Suite. The checking of the notation's accuracy and suitability is carried out by expert teacher, who compare the print result with its Braille original version, from which the example has been drawn..	Free Test Suite selected by the users	As soon as the conversion software and VisualLambda are completed	Not later than December 2022	Expert of the user group	2 blind experts
V6 Accessibility of the portal	Technical evaluation..	A specific evaluation on accessibility of the portal web site.	Internet tools.	report		Not later than December 2022	Not applicable	Not applicable

5. Valuation Tools

Validations V1, V2, V3 and V4 are associated to:
- a protocol with instructions for evaluators (P1, P2, P3, P4)
- a response form (Q1, Q2, Q3, Q4.1 Q4.2 and Q4.3)

5.1 Validations V1

This consists of the first dialogue with the users considered as reference, such as teachers and trainers,
The first contact can be carried out in two different forms:

- Taking advantage of the several dissemination activities that have been undertaken in 2022
- direct contacts of the teachers by e-mail and phone.

The first contact in dissemination activities
During the presentation the portal is presented in order to let the participants familiarise themselves with the many resources available. Information is given about how to download and install the Lambda and VisualLambda programs and how to carry out the conversions from MathML to Braille Lambda and vice versa, use the on line math editor. Given the variety of dissemination activities planned, the first contact with teachers could be of several kinds, such as:

- Suggestion to leave their own e-mail address at the end of the meeting
- Or to fill in a form that can be handed around among the participants
- Or leaving the project's e-mail address and asking the participants to contact the partner project in order to be called back afterwards. In case of a direct contact, the contact is recorded on the Q1
- Suggesting that the participants consult the project's portal and download the Lambda program during the meeting

During the presentation, it is necessary to observe the general level of interest and to answer the participants' questions. Some of the project's leaflets are given out, and the participants will be asked to give a short interview in order to fill out a brief questionnaire asking their impressions about what has been shown them.
Some basic information (contact details, age, school level, computer equipment) is necessary in order that users may be followed up.
At the end of the meeting/first contact, the users are asked to install the Lambda program or Visual Lambda on their PC in the days that follow and to use the on-line conversion modules, to look at the didactic units on the website and, for those who left their phone number, a second contact will be made as stated in the V2
If it is possible to have data on the basis of the information gathered on the meeting day, the DDMATH project's partner will fill out the Q1 questionnaire.

For the second teachers' group, that is those able to get in direct contact, a telephone appointment will be fixed or, if it is possible, a face to face meeting or in videoconference, to show them the portal resources and expressly asking them to participate in a short demonstrative phase using the resources for the construction of a didactical unit. They will also be asked to answer a few questions in order to gain their first impression on what has been shown them.
Part of the V1 is the registration through the Q1 of teachers that work in inclusive classes and that currently do not have blind students in their school but are,

however, teachers who have an adequate preparation in the mathematics and disability fields.

P1 Evaluator's instructions

The Q1 questionnaire will be used to gather data from teachers interested in the project and to record their possible interest in collaborating with the project's testing phase. We recommend collecting information discretely and quickly.

One way of doing this would be to make a note of the important information and then, at a later time, to record the data collected in the questionnaire.

It is important to remind the potential users of the reason for recording this information, which is to check their first impressions and to ask about their possible willingness to collaborate in the demonstrative phase. When collecting names, it is important to stress that these data will not be disseminated but kept by the person in charge only for making contact. The users need to be reassured that personal data collected will not be disseminated in any way but that all data published will be anonymous.

If the participating teachers have used the Lambda program or used the website and the editor pages then they may be asked further specific questions. It will also be useful to include information that can show the teachers' interest in a didactic that takes advantage of the IT aids, their attitude to use new technologies, record the suggestions and impressions of this first test by the evaluating partner.

5.2 Validations V2

About in September 2022, after the first contact, if an interest in taking part in the demonstration has been received, a further contact will be made in order to check:

If the interest shown in the first contact is still present

If the teacher was able to install the Lambda editor or Visual Lambda program and ask him if he had any installation difficulties.

If he has had the opportunity to look at the resources on the website and if he has already formed an idea of the didactic unit that he would like to realise and use at the beginning of the following academic year

We will also monitor the questions and requests that will be posted on the project forum, or the emails that will be sent directly to the DDAMTH consortium partners"

At this point, the partners ask whether help is needed for the preparation of didactic units or which of the available tools are of interest to be used with their students. If their interest is oriented towards their own training, they may use the video guides present in the project. It is important that the teacher should choose the subject freely and that the interviewing partner does not influence him. This allows us to understand which of the available resources have proved to be most preferred and selected by the teachers.

This will help us to understand for the future, which contents to develop rather than others.

P2 Evaluator's instructions

The aim of the Q2 compilation is to make sure that the commitment is still present and ask the teachers if they were able to access the website, download the programmes and use the available services.

It is important that the conversation is perceived above all as an offer of help from the DDMATH team and not only as a request for information. The interview should be open, inviting users to express freely how the first use of the programme on their own computers worked.

Once again all questions asked by the user need to be recorded carefully. In gathering the questions, we can obtain a clear idea of what information, contents, and materials are missing in the tutorials provided on the portal.This will apply both to the teachers that train blind students and to those who work in an inclusive class.

If it is possible the teacher is free to provide his personal e-mail address so as to continue the dialogue via e-mail.

5.3 Validations V3

A second contact, it might be necessary but it is not strictly obligatory, shortly after the beginning of the demonstrative phase (at the end in September or October If necessary, also November 2022.) will also be carried out by e-mail in order to understand if the suggestions given both of technical and didactic character were useful and, therefore, check how the didactic units are developing, What was of particular interest to them, and ask whether they need our help in realisation of further material. At this point we would also ask if there are any technical difficulties with the installation and use of the DDMATH app.

P3 Evaluator's instructions

The third contact is simply aimed at ensuring that the consultation of the resources on the portal and any practical actions that the teacher may have taken to implement them in their school have been carried out.

5.4 Validations V4 Appreciation questionnaire

The V4 evaluation represents a final check of users' satisfaction with the activities carried out. It will be carried out through an interview, personal contact, email, or any other possible form. At the end of the dialogue, the collected data will be used to fill out a questionnaire for teachers.

Finally, we have a short questionnaire for students and one for parents.

In order to avoid complicated acceptance declarations, in the case of students under 18 years of age, all the collected data will not include personal information or names.

P4 Evaluator's instructions

Questionnaire 4 is more complex, and requires more time to be filled in, but it can be sent via e-mail, or can be administered as a face to face, video-conference or telephone interview. This questionnaire has a certain number of boxes to mark, but, in case the interlocutor is a visually impaired person, the questionnaire has been duly adapted. Indeed, the questionnaire is delivered in Word format, and an "X" is used as a marker for the selected option. Where participants are asked to give ratings, numbers are used for the convenience of visually impaired interlocutors.

If any of the questions are incomprehensible to the interviewee, the interviewer will try to establish whether this is through a lack of clarity in the question or whether the function/subject on which the opinion is required, is unknown to the interviewee. In the former case, the question will be explained in another way, in the latter case the corresponding row will be left empty (or cancelled with a horizontal line). Obviously, the row will be left empty if the interviewee declares he/she does not know or, for example, he / she has never used that specific function of Lambda or VisualLambda or on line editor.

5.5 Validations V5

The evaluation activity under V5 will involve a small user groups to assess the quality of conversion with respect to a collection of test cases proposed by the users themselves.
At least two experts will be involved in the above mentioned activity.

This kind of evaluation activity will be focused on verifying the effectiveness of the conversion modules, from MathML to Braille. Partner Paccini will offer support and technical assistance to the experts involved.

For this purpose the experts will be asked to use some specific examples of different types and different complexity, as well as some examples from the own Exercise book.

5.6 Validations V6 Accessibility

A specific evaluation activity will be cover technical aspects, particularly the accessibility of the website. This evaluation procedure will be based on automatic accessibility test procedures available online.

6. Q Validation Questionnaires

Below are templates for different types of questionnaires, including first, second, and third contact questionnaires, as well as teacher, student, and parent satisfaction questionnaires

-

Project DDMATH

Demonstration phase - Questionnaire 1

Main goal

This interview aims at:

Establishing initial face-to-face/distance/email/by phone contact with a teacher responsible for a visually impaired student, informing and introducing available learning materials on our portal;

- encouraging our correspondent to try it and if possible, to develop new didactical material for his / her specific needs.

Section 1 – compiler

Filled in by:

_____

Date:

_____

Type of contact

- ☐ Face to face
- ☐ e-mail
- ☐ phone
- ☐ mobile app
- ☐ Skype
- ☐ Other (please specify):

Project DDMATH

Demonstration phase - Questionnaire 1

Section 2 personal data of interviewee

Enter only the initial letters of the first and last name (it will be not disseminated and made public in the project documents)

_____

Country: _____

Email (not mandatory, it will be not disseminated and made public in the project documents)

_____

Type of activity

- ☐ Teacher
- ☐ Educator
- ☐ school assistant
- ☐ volunteer
- ☐ tutor
- ☐ Other:

Organization _____

Questions:

1. How did you get to know about www.ddmath.eu portal?

_____

2. Which class / level is your student attending at present?

_____

3. Your activity in teach domain:

□ private lessons;

□ inclusive school;

□ special school;

□ private school;

□ other (please specify)

4. Does your student use assistive / adaptive technologies?

If yes, please describe most familiar technologies

_____

5. What do you generally use for teaching math?

□ Braille Perkins

□ IT solutions;

□ spoken math

□ other (please specify)

6. Are you aware of LaTeX code and Latex editor programmes for sighted persons?

_____

7. Are you aware of math editing programmes for visually impaired persons? If yes, please specify.

---

8. Would you like to be contacted again in order to experiment one or more of the available solutions on our portal www.ddmath.eu, in order to carry out a didactical / learning activity?

Note for the interviewer.
If the answer to this question is yes, the interviewee is encouraged to visit our portal and to devote some time to get familiar with one or more of our resources, and to think of a possible teaching / learning activity based on those new resources.

Participants are advised that all data provided in this report will be used for the sole purpose of evaluating the results of the project. No personal data in any capacity will be disseminated outside the project, but only the results of the evaluation responses provided will be published. The questionnaires are collected in a strictly anonymous form, so please do not include personal data, names, or facts that could be useful in tracing the respondent. In case there is such data, the questionnaire after reading the data will be trashed and not kept. All data collected for the purpose of this project will be processed in accordance with the GDPR [(EU) 2016/679]. Data subjects may at any time lodge a complaint against the processing of their personal data with the European Data Protection Supervisor.
PARTICIPANT'S DECLARATION: The undersigned, by participating in this evaluation activity, declares that he/she has read and accepts these conditions, authorizing that the information provided (and it is my responsibility not to provide data of a personal nature) may be used for the purposes necessary for the proper implementation, promotion and realization of the DDMATH project as well as for other actions supported or promoted by the Entity.
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DDMATH Project

Demonstration phase

Questionnaire 2

Note for the interviewer

In case the interviewee is already familiar with resources / solutions available on DDMATH portal, this questionnaire can be administered immediately after the previous one. Otherwise, it should be submitted to the interviewee about in September 2022.

Main goals:

- make sure that the interviewee has entered the portal and has gained sufficient familiarity with one or more of the available resources;
- make sure that the interviewee has installed some DDMATH APP programme;
- gather first feedback;
- investigate about any issue he / she is particularly interested in;
- check whether he / she found what he / she was interested in;
- to have his / her cooperation in experimenting one or more teaching / learning activity based on solutions available on our web portal.

Section 1 – compiler

Filled in by:

_____

Date:

_____

Type of contact

- ☐ Face to face
- ☐ e-mail
- ☐ phone
- ☐ mobile app
- ☐ Videoconference
- ☐ Other (please specify):

Section 2 personal data of interviewee

Enter only the initial letters of the first and last name (it will be not disseminated and made public in the project documents)

Country: _____

Type of activity

- ☐ Teacher
- ☐ Educator
- ☐ school assistant
- ☐ volunteer
- ☐ tutor
- ☐ Other:

Questions

1. Were you able to access our web portal ddmath.eu?

2. What was your main interest in accessing our portal?

Did you find the information:

- useful;
- interesting;
- helpful for your work.
- Other (please specify):

3. Available resources: did you

- download one or more?
- view one or more?
- use one or more?

Can you specify which?

4. Do you have specific questions for us? (Your questions will be published on our web forum);

5. Do you have any suggestions, aiming at ameliorating our web portal?

6. After you accessed our web portal, do you think you will be able to use one or more of the available resources in your teaching / learning activity?

_____

7. (FOR TEACHERS) - Are you available to carry on one or more lessons with your VI student, using our resources? If yes, do you need any help support by our team? (if yes, please specify which kind of help / support you need); If no, please explain why, because your explanation in negative case helps us to improve our work.

_____

8. (FOR TEACHERS). Are you interested in realizing a short didactical unit for your VI student, based on one or more of available resources?

_____

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DDMATH project

Demonstration phase

Questionnaire 3

Note for the interviewer

Once the teacher has carried out the agreed activity (see Q. 2), the interviewer contacts his / her interlocutor via e-mail or via phone.

Main goal

- check level of satisfaction of interviewee with regard to effectiveness of visited solutions;
- check level of satisfaction about accessibility.
- check whether extra help / support is needed.

Section 1 compiler

Filled in by:

_____

Date:

_____

Type of contact

- ☐ Face to face
- ☐ e-mail
- ☐ phone
- ☐ mobile app
- ☐ Videoonference
- ☐ Other (please specify):

Section 2 personal data of interviewee

Enter only the initial letters of the first and last name (it will be not disseminated and made public in the project documents)

Country: _____

Type of activity

- ☐ Teacher
- ☐ Educator
- ☐ school assistant
- ☐ volunteer
- ☐ tutor
- ☐ Other:

Questions

1. Did you develop some new material? If yes can you describe please?

_____

2. Did you realize also one or more didactical units? If yes, please describe

_____

2. In case you received some help / support from our team, please describe in which terms
3.

_____

4. Which resources of the web portal are you going to use during your experimentation?

_____

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DDMATH Project

Demonstration phase

Questionnaire 4: Final evaluation

This questionnaire has been designed after having accomplished the test activity with teachers, students, parents, and other users according to our work plan.

Main goal

The aim of this questionnaire is to report feedback from teachers, students, parents after the planned testing activity has been completed.

On the basis of the information collected, we would like to improve the quality of the resources/learning materials already available on our web portal.

In particular, the following main aspects have been taken into consideration:

- Which resources/materials were used most frequently?
- What activities were most commonly undertaken by users of the DDMATH Project: didactic units, conversion/transcription of exercises, use of reference resources etc.?
- What are the advantages and disadvantages of the website (with reference to learning time, organisation of didactic units, availability of resources)?
- What changes are suggested by the interviewees?
- What are the most urgent needs in the area of math education for the blind that have not been fulfilled so far?

Specific questions have been targeted at each of the above mentioned groups separately.

Section 1 – compiler

Filled in by:

Date:

Type of contact

- Face to face
- e-mail
- phone
- mobile app
- Videoconference
- Other (please specify):

DDMATH Project - Demonstration phase - Questionnair: Final evaluation

After inviting teachers, students, and parents to consult the contents of the DDMATH website, inviting teachers to follow some proposed paths through the video guides, and inviting them to use one or more resources available on the website for their students, the final phase, which is the purpose of this questionnaire, is to collect the impressions and overall evaluation of all users.

In this school year 2022/23, the pandemic emergency and lockdown closed with the return of students to the classroom. Therefore, an important factor that we would like to understand through this questionnaire is also to assess whether or not today, with the return to the classroom, the effort and results of the project are still valid and current, and whether or not teachers today are returning to previous methods and systems of work in mathematics education, (e.g., reusing embossed paper, dactyl braille) or are appreciating and using the innovations of the DDMATH project in the area of computer science and digital mathematical braille.

Based on the information gathered, we would like to improve the quality of the resources and educational materials already available on our website. In particular, the questionnaire considers the following main aspects:

Which resources/materials were used most frequently?

What were the most commonly undertaken activities by users: creation of didactic units, conversion/transcription of exercises, use of video guides, etc.?

What are the aspects/themes that users found most interesting or less interesting, also with reference to the learning time, organization of didactic units, and quality of resources?

What changes or improvements are suggested?

What are the most urgent needs in the field of mathematics education for the blind that have not been met so far?

Specific questions have been separately addressed to each of the aforementioned user groups.

*Campo obbligatorio

Questions for Teachers, Educator....

1. Type of activity: *

Seleziona tutte le voci applicabili.

- [ ] Teacher
- [ ] Educator
- [ ] School assistant
- [ ] Volunteer
- [ ] Tutor
- [ ] Other:

2. Email (not mandatory, it will be not disseminated and made public in the project documents)

3. School to which it belongs

4. How did you become aware of the DDMATH project?

5. Can you indicate which contents you have consulted the most when visiting the DDMATH.eu website?

6. Have you created a didactic unit using the programs or other content offered on the DDMATH website? If yes, please briefly indicate the title and objectives

7. We kindly ask you to indicate what you consider the strengths of using the content of the DDMATH website compared to traditional methodologies:

8. Have you used the online math editor to produce a MathML or Lambda file? If so, do you think the editor was useful? Easy to learn? Easy to produce documents for teachers who are not experts in Braille math syntax?

9. Have you tried the suggestions in the video lesson for speeding up Braille text production using Infty? If you felt the information was useful, easy to learn and put into practice?

10. Among the over 100 video guides available on the DDMATH portal, which one(s) have you followed and consider more interesting compared to others?

11. Do you think that with the return of students to the classroom the effort and results of the project are still valid and current or is it good and return to previous methods and systems of work in mathematics education, (e.g. reusing embossed paper, dactylobraille).

12. If you have used the Lambda program or the VisualLambda program with your students, please provide a satisfaction rating between 1 (lowest) and 5 (highest). Please leave any rows that do not apply to you blank.

Contrassegna solo un ovale per riga.

	1 Insufficient	2 Poor	3 Satisfactory	4 Good	5 Very good
Ease of learning					
Management of the program with Braille display					
Clarity of mathematics through the voice of the screen reader					
Input of mathematical elements					
Ease of remembering shortcuts (hotkeys)					
Managing very long mathematical expressions					
Understanding, through the screen reader or the description on the status bar, of mathematical symbols never used before					
Clarity of the manual and other documents					

documents related to it

related to it

13. Do you have any suggestions to make to the consortium of the DDMATH project to improve the service offered?

disclaimer

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DDMATH Project - Demonstration Phase - Questionnaire 4.2: Evaluation by students and/or their parents.

After inviting you students along with your parents to go through the contents of the DDMATH website, the final step that is the purpose of this questionnaire is to collect the impressions and overall evaluation of all students.
In this 2022/23 school year, the pandemic emergency and lockdown closed with the return of students to the classroom. Therefore, an important factor that we would like to understand through this questionnaire is also to assess whether or not today, with the return to the classroom, the effort and results of the project are still valid and current, and whether or not today your teachers are returning to previous methods and systems of work in mathematics education, (e.g., reusing embossed paper, dactyl braille) or are appreciating and using the new features of the DDMATH project in the area of computer science and digital mathematical braille.
Based on the information gathered, we would also like to improve the quality of teaching resources and materials already available on our web portal.

*Campo obbligatorio

1. Student or Parents *

   Contrassegna solo un ovale.

   ◯ Student
   ◯ Parent

2. Email (not mandatory, it will be not disseminated and made public in the project documents)

3. School of affiliation

4. How did you become aware of the DDMATH project?

5. Can you indicate which contents you have consulted the most when visiting the DDMATH.eu website?

6. Your teacher created a teaching unit using programs or other content offered by the DDMATH website. If so can you briefly indicate what you used?

7. Informatica compared with traditional modes can you indicate the strengths or weaknesses?

8. Do you think that with the return of students to the classroom the effort and results of the project are still valid and current or is it good and return to previous methods and systems of work in mathematics education, (e.g. reusing embossed paper, dactylobraille).

9. If your son or daughter have used the Lambda program or the VisualLambda program , please provide a satisfaction rating between 1 (lowest) and 5 (highest). Please leave any rows that do not apply to you blank.

Contrassegna solo un ovale per riga.

	1 Insufficiente	2 Poco	3 Soddisfacente	4 Buono	5 Molto buono
Facilità di apprendimento	◯	◯	◯	◯	◯
Gestione del programma con display Braille	◯	◯	◯	◯	◯
Chiarezza della matematica tramite la voce dello screen reader	◯	◯	◯	◯	◯
Inserimento degli elementi matematici	◯	◯	◯	◯	◯
Facilità per ricordare le scorciatoie (tasti di scelta rapida)	◯	◯	◯	◯	◯
Gestione di espressioni matematiche molto lunghe	◯	◯	◯	◯	◯
Comprensione, tramite lo screen reader o la descrizione sulla barra di stato, di simboli matematici mai utilizzati prima	◯	◯	◯	◯	◯

Chiarezza del manuale e di altri documenti ad esso relativi					

10. Do you have any suggestions to make to the consortium of the DDMATH project to improve the service offered?

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7. Conclusions and further work

One of the main difficulties in assessing effectiveness of our resources is the fact that math literacy based on Braille sign has dramatically declined in all the consortium countries. This is mainly due to the evolution of teaching methods, which tend to rely on extemporary access to material, often unpredictable sources of information for education purposes. Another important factor is certainly the very considerable difference between Braille math and normal graphic representation. In fact, a Braille exercise is nothing else but a kind of text with symbols placed one after another in rows, whereas a graphic math exercise gives a 2-dimensional visual representation of the structure of the expression. Thirdly, the introduction of integrated schooling models, although preferable for the development of social skills, very often does not fulfil special needs and is not able to realise the full potential of visually impaired students. Limited mathematical literacy could well be mentioned as significant examples. The main practical cause of this situation is the lack of well-trained mathematic and Braille teachers, even in the countries where auxiliary/support services are widespread and effective. It must be borne in mind that only about 2.5% of all disabled students suffer from visual impairments of different kinds and degrees. This circumstance can explain why math braille literacy among the visually impaired in Europe is in decline. As we found in our investigation, only a very small number of students are enrolled in scientific high school classes, which includes a major math track. This makes it really difficult to identify the desired number of users for testing purposes.

Notwithstanding all these obstacles, our consortium has carried out the planned activity with regard to identification of a meaningful number of users of different

kinds, in order to test the effectiveness and usability of the main resources available on our website.

During the project's life information has been collected, showing that, despite the decay of braille mathematical literacy among visually impaired people, interest in mathematics studies seems to be thriving; the above mentioned obstacles induce a large number of them to adopt different kinds of strategies for learning a mathematic expression, and trying to penetrate its details.

The information we gathered during the project's life confirms our starting hypothesis, that there is still a need for and an interest in mathematical literacy among visually impaired people, but they never imagined that new solutions were available, capable of reducing significantly the need for external help, capable of offering the real possibility of "unveiling" the math sign in Braille score, unfolding all the mysteries which are hidden in the written symbols.

On this basis, we have designed and implemented our battery of questionnaires / interviews / feedback gatherings, in the realistic hope that the outcomes would confirm our expectations.