



How we Integrated Movement and Storytelling for Inclusive Math Learning

AN IMPLEMENTATION GUIDE

PREPARED BY:



FERMAT SCIENCE
Une autre idée des maths



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Introduction

The European Math&Move project suggests a dynamic approach to learning mathematics, integrating movement, storytelling and accessibility for all types of learners. This innovative initiative aims to transform the way pupils approach mathematics by engaging them in fun and interactive physical activities while captivating them through stories.

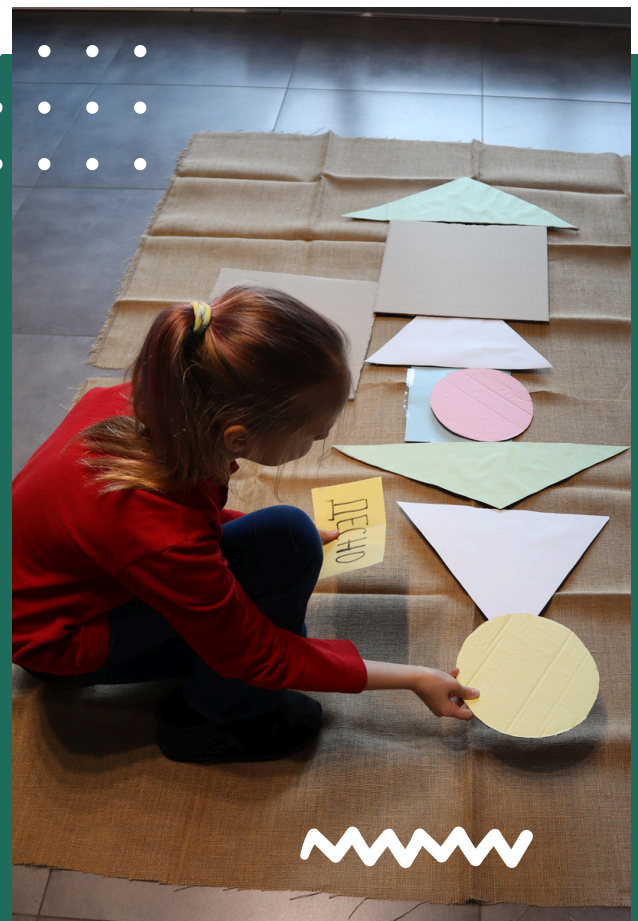
By including storytelling in mathematics learning, Math&Move offers a narrative dimension that captures children's imagination. These stories serve as a backdrop for exploring mathematical concepts in a concrete and meaningful way and allow learners to connect emotionally and intellectually to the topics covered. Whether through the adventure of architects building a city of the future or the exploits of a team of friends hunting for a treasure using orientation cues, the stories add a fun and immersive dimension to the learning.

Additionally, Math&Move's approach emphasises accessibility to all types of learners.

Recognising that each pupil has different needs and learning styles, the project provides varied and flexible activities that allow everyone to fully engage in learning mathematics. Through both group activities and individual challenges, Math&Move offers a wide range of educational approaches to meet the diverse needs of learners, no matter their profile.

By adopting this approach, this project seeks to stimulate pupils' interest in mathematics and to foster a dynamic and motivating learning environment. By encouraging collaboration, creativity and problem-solving, it aims to develop not only their mathematical skills but also their social skills and self-confidence, with the ultimate aim of combating math-phobia.

The European Math&Move project thrives on the exceptional cohesion and dynamics between its partners, a crucial factor for the success and impact of the initiative. Whether educational institutions, nonprofit organizations, or education professionals, they all share a common vision of the importance of approaching mathematics education through movement, storytelling, and an inclusive approach, fostering a sense of community and shared purpose.



The cohesion between the partners is manifested by their commitment to collaborate closely in all phases of the project, from the design of activities to their implementation and evaluation. By sharing their respective expertise and working collaboratively they have created innovative educational resources and tools and thus offered qualitative educational resources adapted to the needs of teachers and pupils. In addition, the geographical and disciplinary diversity of partners enriches the project by bringing varied and complementary perspectives.

In summary, the Math&Move project approach represents a new perspective on learning mathematics that paves the way for more interactive, engaging and inclusive teaching.



Math&Move resources, such as our lessons involving movement and our ebooks, have been created to emphasise various strategies to enhance accessibility for learners with specific learning disorders.

- **Visual, tactile and auditory learning aids**

Our lessons and ebooks do not rely on traditional written instruction to relay information; instead, they incorporate learning aids for more hands-on learning, as follows:

- Use of visual fraction models and large, easy-to-read clocks to help pupils understand abstract concepts of fractions and telling time.
- Incorporation of tactile materials like string or sticks to create geometric lines and tangible objects to illustrate sides, edges, and units of measurement.
- Inclusion of clickable elements in all ebooks that reveal the different parts of the story and mathematical concepts gradually.
- Inclusion of musical elements in all ebooks, to help learners better identify important story plots or just create an engaging and pleasant atmosphere for learning.





- **Simplified instructions**

- Breaking down instructions into simple, manageable steps, especially for complex tasks like semaphore coding and multiplication/division.
- Providing step-by-step guidance and clear, simple definitions of mathematical terms and concepts to ensure all pupils can follow along.

- **Real-life contextualisation**

- Relating mathematical concepts to real-life contexts, such as using the movements of their peers to explain fractions or their own body parts to teach units of measurement.
- Immersing pupils in a narrative where they take on different roles, such as acting as architects to build a futuristic city, so that children see the practical applications of math topics like geometry in real life.

- **Collaborative learning**

- Promoting group work and peer assistance to foster a collaborative learning environment. This helps pupils with learning disorders to receive support from their peers and build social skills.
- Allowing children to work in pairs or small groups, especially for tasks involving addition, subtraction, multiplication and division.

- **Positive reinforcement**

- Providing positive feedback and encouragement to build confidence and motivation in children. This is a necessary element to maintaining engagement and interest, especially for learners who may struggle with certain concepts.
- Incorporating counting songs, rhymes, and games to make learning fun and engaging.



- **Practice and repetition**

- Allowing extra time and repetition for pupils to practice and master concepts, ensuring they have sufficient opportunity to build mathematical understanding.
- Incorporating repetitive physical activities and movement-based learning to help pupils with spatial awareness and orientation.

By implementing these strategies, the Math&Move project ensures that every child, regardless of their learning pace or style, can benefit from and enjoy learning math in a way that is best suited to them.

CONTEXT OF THE TESTING

The testing of the Math&Move approach was carried out in diverse educational settings to evaluate the effectiveness and inclusiveness of the resources. Diversity in testing was reflected in the variance in testing countries, educator profiles, as well as our decision to include two groups of pupils in our evaluation: those who tested our resources, and those who did not (serving as a “placebo” group). This was done so that we could note whether responses to the same general questions about math differed between the two groups, allowing us to possibly assess the potential impact of our resources. The tests were held in the countries of the partnership: France, Belgium, Greece and Serbia.

The target group consisted of 208 pupils in the testing group, ranging in age from 5-10 years old, and 71 pupils in the placebo group. The tests were organised and carried out by a total of 15 teachers and 10 parents. Among the pupils, several were identified as having special educational needs, including those facing geographical/social obstacles and those with specific learning disorders such as dyslexia and dyscalculia.



To conduct the test, each session began with the reading of the introductory story, designed to engage the pupils and set the context for the lesson. This story was read aloud by the teacher, ensuring that all pupils, regardless of their reading abilities, could follow along. Following the story, the pupils participated in the lesson activities as outlined in the Math&Move resources. The lessons incorporate movement-based activities to reinforce mathematical concepts, with a focus on making learning both interactive and accessible. The pupils were encouraged to engage physically with the material, which helped to cater to various learning styles and needs. Teachers provided support and adaptations as necessary, ensuring that all pupils could participate fully in the activities.

The overall goal of the testing was to assess not only the comprehension and engagement of the pupils but also the practicality and effectiveness of the resources in a real classroom setting. Feedback was collected from both teachers and pupils to gain insights into their experiences and identify any areas for improvement.

Trying out the Math&Move Approach: testimonials from teachers and pupils



TESTING THE MATH LESSONS AND ACTIVITIES FOR IMPROVING MATH LEARNING

Various test sessions in one or more classes and schools were also organized in the four countries concerned to evaluate the lessons and activities.

The implementation was facilitated by using easy and inexpensive materials and by the warm welcome from all the schools willing to participate. Some pupils even contributed to creating the materials, for example, by cutting out cardboard geometric shapes or creating the magician's wheel. The "lesson" part of the event took place in the classroom, while the "activity in motion" part took place outdoors or in a room with a large enough space to facilitate the process.



• THE PUPILS' EXPERIENCES

The pupils were very enthusiastic about discovering our tools and participating in physical activities while learning mathematics. They paid close attention to the instructions and were keen to apply them properly. They volunteered to set up the equipment needed for the activities.

The pupils asked pertinent questions about the lesson in class, which made them feel more at ease afterwards during the activity. This provided an opportunity for discussion and interactivity about mathematical concepts and teacher/pupil and peer interactivity.



They demonstrated good team spirit and did not hesitate to encourage and congratulate each other as the activities unfolded. Some of them, who were less at ease at first, eventually managed to familiarize themselves with the tools and participate actively, and they were very proud of this.

Skim reading through the questionnaires answered by pupils it is evident they clearly show their interest in using different forms of learning, particularly with movement. For more than 70% of them, activities involving movement give them a better understanding of the subject and make them want to do more mathematics.

Incorporating fun activities makes learning mathematics more fun and enjoyable for them. The majority of the students were pleased and expressed the wish to use these activities again in class.





For comparison, several groups of 'placebo' students were asked to complete a questionnaire without having participated in the lessons or activities. This questionnaire included five of the seven questions from the "test pupils" questionnaire.

The results of these questionnaires also show a real desire on the part of the pupils to approach learning mathematics in a more playful way, in the form of stories or physical activities. It seems clear to over 80% of the pupils surveyed that doing mathematics can be fun; for 3 out of 4 of them, it seems that doing activities outside the classroom makes them want to learn more; and finally, around 70% of these pupils think that learning mathematics through physical involvement helps them to understand mathematical concepts better.

• TEACHERS' AND PARENTS' EXPERIENCES

Teachers and parents were equally enthusiastic, and many were keen to participate in the test phase. At the end of the tests, teachers and parents expressed great satisfaction with the format and content of the resources on offer. They were also invited to tell us how they felt about the proposed tools and how they observed their pupils and children during the lesson and the activity.

On the whole, their feedback was very positive, with the vast majority of them to state their satisfaction with the content created. More specifically, their comments focused on the following:

FOR THE ACTIVITIES:

- The ease with which activities can be set up using simple, inexpensive equipment.
- The fun aspect of mathematics through movement and play.
- Activities are easy for both pupils and teachers to understand.
- Learning situations that are easy to reproduce and highly motivating for pupils.
- Activities are easy to adapt and can be used in various mathematical areas.
- The activities make learning easier.
- Useful for children with learning difficulties.

FOR THE LESSONS:

- The simple images and precise, specific vocabulary are beneficial to pupils.
- The case studies are useful for getting learners involved and understand the mathematics notions.
- The format of the lesson is short, which keeps pupils focused.

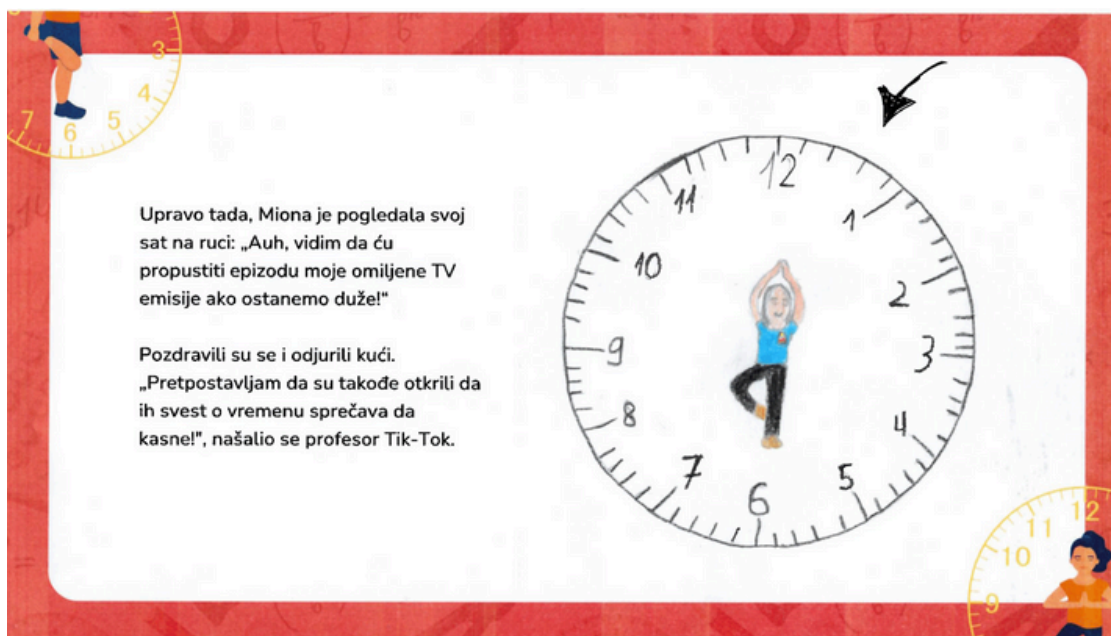
This testing was essential to assess the impact of the MathandMove project. This evaluation enables the partnership to adapt and improve the teaching resources created, maximize their effectiveness, and meet the needs and expectations of the various stakeholders for whom these tools are developed.

TESTING THE E-BOOKS FOR IMPROVING MATH LEARNING

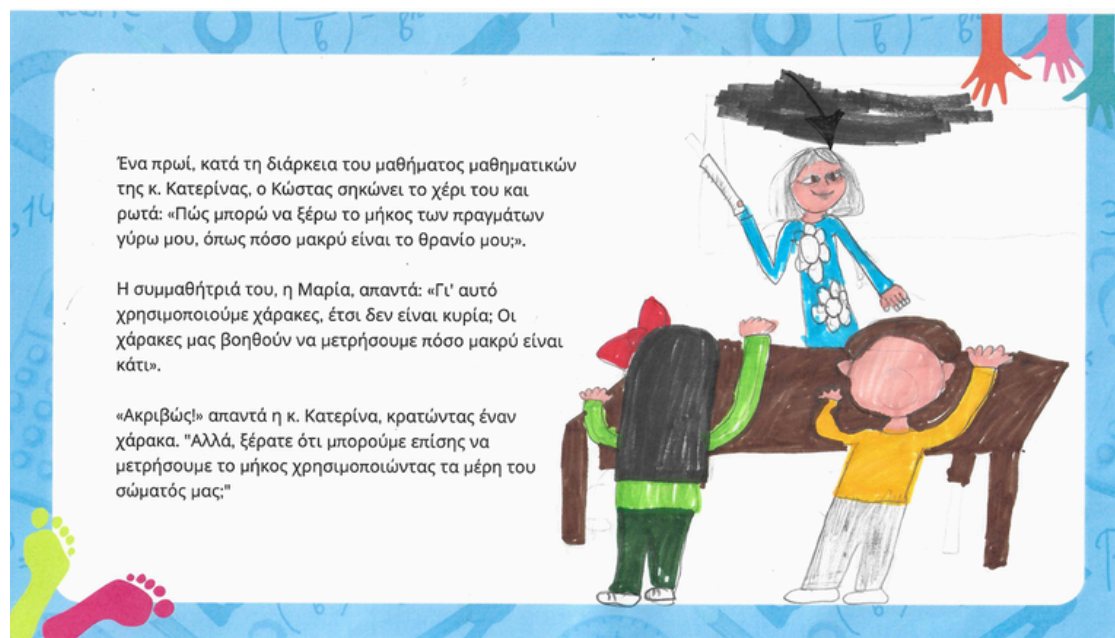


For the testing of the ebooks, the school partner testers engaged in a unique activity where they not only tested ready-to-use ebooks but also illustrated their own versions, using the provided story text as a base. This process of "co-creation" was implemented to assess how well pupils could visualise the mathematical concepts presented in the story they read, following their exposure to an illustrated ebook.

The Serbian pupils engaged in the creation of ebooks for the stories: "I can jump like a frog!" (for the topic of Addition) and "I can move like the hands of a clock!" (for the topic of Telling time). The Greek pupils engaged in the creation of ebooks for the stories: "I can measure with my hands and feet!" (for the topic of Units of measurement) and "I can sort into groups! (for the topic of Venn diagrams) (seen below in their mother tongue).



(excerpt from "I can move like the hands of a clock!" cocreated ebook)



(excerpt from “I can measure with my hands and feet!” cocreated ebook)

• PUPILS’ AND TEACHERS’ EXPERIENCES

The co-creation activity was met with enthusiasm by the pupils, who embraced the opportunity to bring their own interpretations to the story after having experienced the interactive ebooks. Both the Serbian and Greek pupils demonstrated creativity and enhanced understanding of the mathematical concepts as they illustrated scenes and added visual elements to their ebooks, matching the descriptions from the story text.

Teachers observed that pupils were able to effectively translate the mathematical ideas into drawings, showing a good grasp of the concepts. For instance, in the story about learning to tell time with your body, pupils were able to replicate the descriptions from the story to connect characters' arms and legs to the numbers on a clock face.

The co-creation process also fostered collaboration among pupils, as they worked in pairs or small groups to discuss their ideas and create joint illustrations throughout the pages. This collaborative effort not only enhanced their learning experience but also helped build their communication and teamwork skills.



Feedback from pupils expressed their satisfaction with the incorporation of storytelling elements to learn mathematical concepts. This was reflected in their responses to the testing questionnaire statement: “Stories with characters make learning math more fun.” Pupils could either answer that they agreed with this statement, neither agreed nor disagreed, or disagreed. Here is a breakdown of their responses, categorised according to age:

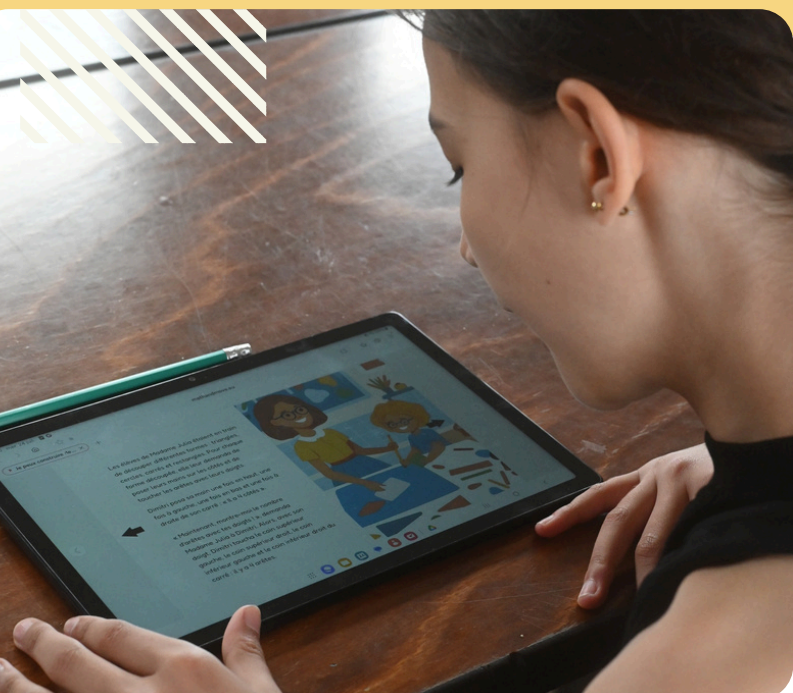
“Stories with characters make learning math more fun.”

- All pupils in the 6–7-year-old group agreed in the Serbian class, as well as the Greek testers.
- All pupils in the 7-8 year-old group agreed in the Serbian class, while a big majority agreed among the Greek testers (31 out of 38 pupils)
- All pupils in the 8-9-year-old group agreed in the Serbian class, while the vast majority agreed among Greek testers (14 out of 15 pupils)
- All pupils in the 9-10-year-old group agreed in the Serbian class, while the majority agreed among the Greek testers (13 out of 19 pupils)

We might be able to draw a tentative conclusion with the further use of the resources that pupils' exposure to learning and creating with ebooks positively impacted their responses on the utility of learning math using stories, given that all placebo groups rated the same statement more negatively across testing countries than the testing group responses.

This has been broken down like so:

- Around 1/3 of Greek placebo group respondents stated that they disagreed or couldn't say whether stories with characters make learning math more fun (11 out of 35 pupils), compared to 1/5 of testing group respondents responding the same, across the same age groups
- Around 1/4 of Serbian placebo group respondents stated that they disagreed or couldn't say whether stories with characters make learning math more fun (5 out of 20 pupils), compared to 0 pupils in the testing group responding the same, across the same age groups



Based on these observations and tester feedback, we can surmise that the process of testing the ebooks offered valuable insights into how well pupils could internalise and represent mathematical concepts through storytelling and illustrative elements. Tester responses highlighted the effectiveness of the Math&Move approach in making math both fun and educational, while also providing a platform for creative expression and deeper understanding.

Conclusion: Best practices from our partner schools in Greece and Serbia

Due to their experience creating and implementing our project resources, we have also collected testimonials from our school partners related to best practices they can share when it comes to using and exploiting our ebooks and math lessons with movement.

SERBIA -

Savremena primary school



Due to their experience creating and implementing our project resources, we have also collected testimonials from our school partners related to best practices they can share when it comes to using and exploiting our ebooks and math lessons with movement.

This modern elementary school was a participant in the European Math&Move project. From January to June 2024., their teachers and pupils participated in the creation and testing of the project resources.

In the beginning, all participants of the recording and testing sessions, both teachers and pupils, had a bit of trepidation because they were facing a new challenge. However, as soon as the preparations began, we realised that we would learn in a fun way and present mathematics in a completely different light. A new learning method was presented to the pupils and they accepted this innovation with interest and enjoyed the lessons.

The younger group of pupils (ages 6-7) had the task of learning to count time with the help of their bodies (hands were small and feet were the large hands of a clock) and to determine the place value of a digit by throwing a certain colour of ball into the appropriate basket.

The older group of pupils (8-9 years old) had the task of using their body to make geometric bodies, and to notice the difference between 2d and 3d shapes (between a geometric body and a geometric figure).

Pupils also learned units of measurement and measuring length, width and height using their body (how they can measure the length of the classroom, desk, notebook, object... using movement and their body).



All lessons were recorded with the participation of pupils and teachers and were transferred to educational videos. After that part, the testing of e-books took place. Test results show that pupils who used e-books with movements achieved better results on knowledge tests compared to those who learned using traditional methods. They particularly excelled in areas requiring spatial reasoning and object manipulation, suggesting that physical interaction with the material can facilitate the understanding of abstract concepts.

Feedback from teachers and parents indicates that the use of e-books with movements has a positive effect on concentration and cooperation among pupils. Pupils showed a greater willingness to work in groups and helped each other in solving tasks, which further improved their social development.

This way of working helped pupils to understand abstract mathematical concepts more easily through practical examples and situations. Through movement activities, pupils understood spatial relationships and geometry more easily. The interactive approach to learning increased students' motivation and interest in mathematics.

During the implementation of these classes, a lot of props were used, which resulted in an easier understanding of mathematics with the help of movement. This especially benefited pupils who learn better through visual and interactive methods. Combining math with story and movement helped them better understand math concepts and apply them to practical situations.

This type of learning was particularly useful in working with pupils who show learning difficulties because it allowed them to use multiple senses and different ways of learning to master the material.

After the testing was completed, we exchanged experiences regarding possible difficulties that may accompany this type of learning. Difficulties that may arise when learning mathematics through movement may include a lack of space for physical activities in the classroom, lack of time to plan and implement such activities, as well as lack of trained personnel who could implement this type of teaching. However, with the right support and resources, learning mathematics through movement can be very beneficial for all pupils.



GREECE- Arsakeio primary school

The project we implemented concerns a learning style, which uses verbal and visual learning, in which the pupil uses physical activity. In essence, the association of movement and narration with mathematics was attempted in the age group of pupils from 6-9 years old, through worksheets, videos and interactive e-books, which particularly helped pupils with Special Learning Disorders (SLD).

Specific goals achieved through Math & Move in Greece:

- We helped pupils to understand mathematical concepts in depth by utilising kinaesthetic learning
- We improved pupils' physical condition
- We developed teamwork skills as peer tutoring has proven to be very effective in problem-solving
- We involved parents in the learning process through the dissemination of the Math & Move project and through testing
- We made the project and its practices known to other teachers and pupils of our schools as well as other schools
- By using attractive, collaborative and innovative methods that respond to the interests and motivations of the pupils, we practically aimed to change the attitude of the pupils towards specific subjects (mathematics, S . T . E . A . M) with the ultimate goal of improving their performance
- Pupils' communicative and narrative skills were strengthened
- Inclusion was enhanced as the activities were friendly to pupils with Specific Learning Disorders (SLD)

One could say that a feature, and at the same time a particularity, of the project is its easy accessibility and application outside the school context, such as at home. Through appropriate supporting material (interactive e-books, explanatory videos, instruction booklets, pedagogical guides) parents are given the opportunity to interact supportively with their children, strengthening their children's math skills at whatever pace and/or frequency they wish. The easy-to-use and continuously enriched website of the project (<https://mathandmove.eu/>) contributes to this direction.

The success of the testing period, and by extension the success of the Math & Move project, was evaluated based on two parameters: a) the criteria/goals set by the teachers and b) the impressions of pupils and parents as reflected through responses to related questionnaires.





Before the beginning of the testing period, specific success criteria were set by the teachers who participated in it. These were the following:

- The degree of improvement of pupils' performance in the relevant subjects
- The acquisition of a positive attitude towards mathematics
- The high participation rate of pupils
- The effectiveness of the project's resources
- The response and participation of students with Specific Learning Disorders
- Dissemination of the program to parents and other educators

At the end of the testing period, questionnaires were distributed to pupils and parents in order to assess the impact of the project. Observing the responses of those involved, it is clear that the opinions of all, both pupils and parents, converge towards the inseparable and indisputable relationship that connects mathematics with physical activity . Pupils consider that this innovative method of approach gives a more interesting aspect to the specific lesson, and they look forward to a forthcoming similar experience. Parents, on their part, found the project's resources useful and helped them to enrich their prior knowledge.

In addition, it is worth noting that the activity of e-book co - creation was enthusiastically received by pupils , who seized the opportunity to give their own interpretations of the stories. The teachers observed that the pupils were able to effectively render mathematical ideas in drawings, showing a good understanding of the concepts.

In conclusion, the best practices evidenced by the Greek and Serbian school partners allow us to conclude that the entire process of the testing period proved to be beneficial for the pupils as within a short period of time they managed to strengthen their self-confidence and acquire a positive attitude towards a traditionally difficult subject such as mathematics. The variety of mathematical concepts, the range of activities, the variety of the available resources combined with a playful approach are consistent with the essential effectiveness of the Math & Move project, making mathematics fun and at the same time meaningfully educational.

The testing and implementation of e-books and lessons that use movement in mathematics teaching has shown promising results and points to the potential for innovation in education. Further research and development in this area can significantly contribute to improving the quality of teaching and better educational outcomes for pupils.

