

# Le-MATH: Learning Mathematics Through New Communication Factors

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## Introduction

Many students claim that mathematics is often too abstract and therefore difficult to understand. As a result, this project developed different and innovative approaches by inviting teachers and pupils together to apply new communication methods in the learning of mathematics, which could be fun and enjoyable at the same time. An approach, that brings new ideas in the context of “play and learn.” This European project developed a new methodology for the learning and teaching of mathematics to students aged between 9 and 18, which subsequently can be used in any school environment. It will also make learning more attractive and enjoyable for all students and it will strengthen their skills for creative thinking. These methods could be used in other subjects of the education curricula, as well as for other age groups. The consortium comprises partners from universities, schools, mathematics associations, foundations, theatre schools, art schools and enterprises. The project activities contribute to the Education and Training 2020 as it is enhancing creativity and innovation among youth. It also contributes to the benchmark for decreasing low-achievers in basic skills (mathematics and science) to 15%. It promotes the European Cooperation on schools in fundamental aptitudes, by supporting the key competence for mathematics.

## Good Practices In The European Space

In this work package we collected practices relevant to the subject and we developed them in an e-book. In this electronic manual one can find current or past activities. The final version of the manual can be found on the website of the project [www.le-math.eu](http://www.le-math.eu) (click on the menu Guidebooks 2014-2015 and choose folder).

## **Mathetheatre Method**

The Math Theatre follows the same rules of a normal theatrical play, but with the content of the play directly related to mathematics and with the actors being students between the age 9 and 18. It can have all the forms that characterize theatrical plays such as drama, comedy, musical etc. and the central plot can be based in any mathematics related subject from the school curriculum or from the history of mathematics. The difficulty of this activity lies in the fact that the dialogues of the actor-students must pass some mathematical knowledge to the audience. For supporting this part the project developed a Manual of Scripts for MATHeatre, so teachers and pupils can use in developing their own theatre play for communicating mathematical learning.

The “MATHeatre Guidebook”, is published on the project website, which contains the guidelines and the accompany tools. The electronic publication is presented in two different forms, one with the tools attached as links and one self-contained interactive book. A competition was launched through the project, for the writing of such plays and the submitted plays are published in the Manual of Scripts for MATHeatre. Furthermore, the project published theatre play dialogues in mathematics especially for the age group 9-12, called “Mathematical Stories for Theatre”.

During the second year of the project, a European competition with international participation, titled MATHeatre EUROPE 2014 was launched. Schools, organizations or groups of students were eligible to participate, by applying the first draft of the guidelines published in September 2013 and preparing a play of a total duration of 5-12 minutes, with 2-10 participating actors. During the first phase of the competition (Sept. 2013-Feb. 2014), the participants had to upload their theatrical play on the Le-MATH platform. After the first evaluation process the best participants of two different age groups (9-13 and 14-18) were invited as finalists. The finals were held during the EUROMATH student conference on the 24-28 of April 2014 and the results are published on the project website.

The participants in the MATHeatre Competition and Evaluation were:

### MATHeatre EUROPE 2014

AGE GROUP 9-13

PHASE I: Submissions: 14 teams

Number of Students: 80 students

Countries: Bulgaria, Czech Republic, France, Hungary, Italy, Romania

PHASE II Finalists: 6 teams

Number of Students: 37 students

Countries: Czech Republic, France, Italy, Romania

*For the final competition in Cyprus, 5 teams with 31 students participated.*

#### AGE GROUP 14-18

PHASE I: Submissions: 17 teams

Number of Students: 104 students

Countries: Bulgaria, Cyprus, France, Lebanon, Greece, Serbia, Slovenia

PHASE II Finalists: 8 teams

Number of Student: 52 students

Countries: Bulgaria, Cyprus, France, Lebanon, Slovenia

The evaluation criteria of the math theatre are published in two different forms; one for activities within the school environment and the other for open public competitions like MATHeatre Europe 2014. Evaluation criteria are flexible to be adapted to different education systems. The evaluation criteria for MATHeatre are shown in the next section below.

### **Assessment Criteria for MATHeatre**

The criteria below can be used according to the education system of each country or school.

The assessment concerns:		Qualitative levels			SCORE (Factor)
		Lower 5-6	Intermediate 7-8	Higher 9-10	
1	Mathematical content				X
	Relevance of concept(s) discussed				
	Ability to make a mathematical theory comprehensible				
	Approach used to explain theoretical elements				
2	Theatrical aspect				Y
	Quality of expression: <ul style="list-style-type: none"> <li>• Delivery: speed of the speech (slow or fast)</li> <li>• Volume: speech is loud enough to be understood.</li> <li>• Articulation: clear pronunciation</li> <li>• Vocabulary : richness of the vocabulary used</li> </ul>				
	Space management and interaction				

	Respect of instructions : <ul style="list-style-type: none"> <li>length: 5 minutes to prepare the stage,</li> <li>5-12 minutes to play</li> </ul>				
3	Creativity of the staging				Z
	Originality of the appearance and use of costumes				
	Use of the electronic back screen of the stage: originality of the projection on the screen and harmony with the play				
	Originality and appropriate use of sound effects and music, if needed				
	<b>TOTAL X· Y· Z</b>				

### Mathfactor Method

The MATHF actor is an individual activity of communication related to mathematics, in the sense that a student will have to prepare and explain within a short time of 3 minutes, mathematical concepts, theorems, applications, or aspects of the history of mathematics etc., in a simplified manner so they can be understood by non-experts or students of same age. During the presentation the use of interactive projection tools and the blackboard is not permitted, but the student may use small visual objects that can be carried using one hand. A good presentation will be evaluated based on the high articulation of the participant and his/her ability to impart knowledge to the audience, the presentation of mathematical concepts, for its content, its innovative approach in presentation and the talent exhibited to the viewer. The whole approach it is based on the well-known TV game X-Factor, but it is centered on mathematics instead of singing. This method could be used as an educational activity within the classroom and/or in open public competitions.

The evaluation criteria for MATHeatre are shown in the next section below.

The assessment concerns:		Qualitative levels			SCORE (Factor)
		Lower 5-6 points	Intermediate 7-8 points	Higher 9-10 points	
1	CONTENT				X
	The degree to which the student demonstrates understanding of	Displays basic knowledge	Displays good knowledge	Displays excellent knowledge	

	mathematical concepts and relationships between these				
	The quality of the student's analysis, conclusions and reflections, as well as other forms of mathematical reasoning	Uses some substantiated reasoning to make the mathematics understanding easy	Uses acceptable mathematical reasoning to make mathematics understanding quite easy	Uses excellent mathematical reasoning to make mathematics understanding very easy and almost obvious	
2	CLARITY				Y
	The quality of the communication. How well the student uses mathematical expressions (language and representation)	Expresses him-/herself simply, but understandably, using a mathematical language and approach suitable for the topic and non-expert audience	Expresses him-/herself clearly using a mathematical language and approach suitable for the topic and non-expert audience	Expresses him-/herself very clearly and confidently using a mathematical language suitable for the topic and non-expert audience	
3	CHARISMA				Z
		Displays some adaptation to the audience, e.g. by looking up, speaking clearly and/or showing commitment.	Displays relatively good adaptation to the audience by looking up, speaking clearly and presenting facts in an interesting or engaging way. Presentation and body language that causes impression the audience.	Displays good adaptation to the audience by looking up, speaking clearly and presenting facts in an interesting and engaging way. Presentation and body language that causes impression and excitement to the audience	
<b>TOTAL X·Y·Z</b>					

## Experimentation and Evaluation

The experimentation and evaluation process took place in different phases and levels.

MATHeatre EUROPE 2014

MATHFactor EUROPE 2014

The whole effort was based on an international level competition. Participants were divided into two different age groups (9-13 and 14-18), in order to better serve the overall aim of the project and in order to give the necessary incentives and spark the interest of both students and teachers. The first phase of the competition opened on September 2013 and closed on February 7, 2014, with the participation possible via online submissions. After evaluating of the online first phase the finalists were invited to participate in the live international finals which took place during EUROMATH 2014.

During this process, the involvement and the activities of the students were evaluated, as well as the role and the impressions of the teachers that supported the effort. Additionally, their comments and remarks regarding the first draft of the guidelines were taken into account. The international finals were also assessed and the results are used for improving the procedures in 2015 as well as supporting sustainability. Additionally, the results were used for improving the guidebooks for the MATHFactor and the MATHeatre methods as well as the transparency of the procedures.

### MATHFactor EUROPE 2014

#### AGE GROUP 9-13

PHASE I Submissions: 4 students

Countries: Cyprus, Czech Republic

PHASE II Finalists: 4 students

Countries: Cyprus, Czech Republic

*All students were invited to participate in the final competition in Cyprus, as this number was low.*

#### AGE GROUP 14-18

PHASE I Submissions: 24 students

Countries: Bulgaria, Croatia, Cyprus, Greece, Hungary, Iran, Romania, Serbia, Slovenia, Spain, Sweden

PHASE II Finalists: 7 students

Countries: Bulgaria, Croatia, Cyprus, Greece, Serbia, Slovenia

*All students participated in the final competition in Cyprus on 26 April 2014 at 17.00 at Hilton Cyprus.*

The evaluation report is published on the project's website in the listing of outcomes ([http://www.le-math.eu/assets/files/Work%20Package%204\\_REPORT31%2010%202014.pdf](http://www.le-math.eu/assets/files/Work%20Package%204_REPORT31%2010%202014.pdf)).

An important part of the project's sustainability is also the creation of a five-day training programme for teachers, which is offered as a training course open for participation through funding provided by the ERASMUS+ KA2 programme managed by the ERASMUS+ National Agencies of the programme countries. The course outline and learning outcomes can be read in (<http://www.le-math.eu/index.php?id=528>). The first session is organized on 25-31 March in Athens, in parallel to EUROMATH 2015 conference.

### **Learning And Exploitation/Conclusions**

The Evaluation Report presented on [http://www.le-math.eu/assets/files/Work%20Package%204\\_REPORT31%2010%202014.pdf](http://www.le-math.eu/assets/files/Work%20Package%204_REPORT31%2010%202014.pdf), provides evidence and analysis of the positive impact that the method had on students attitudes and improved performance. From September 2014 the project Le-MATH published the final version of the Guidebooks 2014-2015 and the competitions MATHeatre Europe and MATHFactor Europe 2015 inviting teachers from all over Europe and beyond to apply the methods and use the competitions as incentives to attract the interest of their students. Letters to all Ministers of Education in European countries and beyond are sent inviting the Ministries to support local regional or national competitions using the fact that winners of such competitions earn a place to the finalists of the final international competitions. Those interested to apply directly are invited to participate in the two Phases procedure through the Le-MATH platform. Phase I is the online submission of their video and if approved to be invited to the finals. The international finals is held during the EUROMATH 2015 student conference on the 25-30 March 2015 ([www.euromath.org](http://www.euromath.org)).

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