

## International Valorisation Conference “Key Methodology to Successful Competence Based Learning”

### Le-MATH: Learning Mathematics Through New Communication Factors

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*In this paper we introduce the guidelines for the two methods developed by the Le-MATH project, that is the MATHFactor and the MATHeatre methods. The guidelines are developed based on the collection and study of good practices in more than 10 European countries and they are available in 10 EU languages. Many pupils as well as parents consider mathematics to be a difficult and boring subject. Instead of studying mathematics (or other subjects) many students prefer to spend most of their time by watching TV, playing video games or on their mobile devices sending texts, pictures and videos. One way to bring pupils back to the “playing field of education” is to employ the use of similar tools - “weapons like the opponents”, in order to communicate the learning of mathematics in a non-traditional way, like a game through theatre or competitions similar to the well-known X-Factor and other. The Le-Math project, funded by the European Commission and coordinated by the Cyprus Mathematical Academy with 12 participating partners, undertook the creation of these tools, in the period from November 2012 until its completion in October 2014.*

#### 1. 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.

#### 2. Objective

The aim of this project was the development of a methodology in the teaching and learning of mathematics, with the creation of two main tools that can be used by teachers. The methods were created in such a way so that they can be used in an in-service training course for teachers who teach mathematics to pupils of age 9-18.

The two methods are:

A. MATHeatre: Teaching and learning mathematics through math theatre activities

B. MATH-Factor: Teaching and learning mathematics through mathematics communication activities

## **International Valorisation Conference “Key Methodology to Successful Competence Based Learning”**

These methods are expected to be able to compete with the interests and the activities of the students belonging in the aforementioned age group, outside the school system. The project is being developed through nine work packages. Below follows a description of some of them.

### **3. 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).

### **4. MATHeatre 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 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.

### **5. MATHFactor Method**

The MATHFactor 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.

## **International Valorisation Conference “Key Methodology to Successful Competence Based Learning”**

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.

### **6. 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.

The evaluation report is published on the project's website in the listing of outcomes.

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.

### **7. Exploitation**

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 will be held during the EUROMATH 2015 student conference on the 25-30 March 2015 ([www.euromath.org](http://www.euromath.org)).

## International Valorisation Conference “Key Methodology to Successful Competence Based Learning”

### Short professional profile of the speaker:

*Dr. Gregoris MAKRIDES, holds a Ph.D. in Applied Mathematics from the Illinois Institute of Technology (IIT) in Chicago, USA. He worked as a teacher trainer at the Cyprus Pedagogical Institute (1995-2000), as the Dean of Enrolment Management at the University of Nicosia(2000-2006) and since 2006 is the Director of Research and International Relations at the University of Cyprus and in parallel the Executive Director of the European Office of Cyprus. He has publications in refereed journals, conference proceedings and in public press. He coordinated 9 European projects since 2002 and has been a partner in many. He founded several series of international events, such as MEDCONF in Mathematics Education, EUROMATH pupil conferences, EAST-MEETS-WEST on Innovation and Entrepreneurship, the SEEMOUS Olympiad, the MATHFactor Europe Competition and many more. He is an organizer of and trainer in several EU training courses, mainly for teachers and has offered more than 60 courses since 2005, including courses on Career Guidance and Counseling. He has chaired the organizing committee of more than 50 conferences since 1997 and has organized more than 100 National and Multinational competitions since 1995. He is the President of: the Cyprus Mathematical Society(CMS), the European Association of ERASMUS Coordinators(EAEC), the European Association of Career Guidance(EACG), the Mathematical Society of South-Eastern Europe(MASSE), the THALES Foundation of Cyprus. He is also a Bologna Process Expert for Cyprus and the initiator of ERASMUS+ Barometer 2014. He was also the head of Eurydice Unit of Cyprus from 1995-2000.*

\* Coordinating Organization of the project is the Cyprus Mathematical Society (CY-Gr. Makrides, A. Philippou, C. Papayiannis) along with 12 partners from Cyprus, Greece, Bulgaria, Romania, Austria, Sweden, France, Spain, Czech Republic, Belgium and Hungary. The cooperating bodies are **Thales Foundation of Cyprus** (CY-A. Skotinos, P. kenderov, E. Christou, L. Zeniou-Papa, C. Christou), **Charles University in Prague-Faculty of Education** (CZ-J. Novotna, A. Jancarik, K. Jancarikova, J. Machalikova), **Loidl-Art** (AT-H. Loidl), **VUZF University** (BG-S. Grozdev), **“CALISTRAT HOGAS” National College Piatra-Neamt** (RO-N. Circu, L-M Filimon), **Lyckeskolan** (SE-M. Manfjard Lydell), **LEOLAB** (ES-M. Munoz, B. Dieste), **Junior Mathematical Society Miskolc** (HU-P. Kortesi), **European Office of Cyprus** (BE-CY-R. Strevinioti, D. Tsikoudi, C. Katsalis), **Collège Saint Charles** (FR- K. Treguer, E. Gueguen, **E. Dares**), **National Technical University of Athens**, **Institute of Communication and Computer Systems** (GR- K. Karpouzis, A. Christodoulou), **Com2go Ltd** (CY-G. Economides, N. Nirou, V. Cheminkov).