Computational Thinking and Mathematical Problem Solving, an Analytics Based Learning Environment

Newsletter 1

October 2022

Dear Readers,

It is time for the first of our CT&MathABLE Newsletter! The September, 2022 has marked the start of the international project *Computational Thinking and Mathematical Problem Solving, an Analytics Based Learning Environment* (CT&MathABLE).

CONTENT

1. About CT&MathABLE project

Computational Thinking (CT) together with Algebraic Thinking (AT), which are the focus of the project, are considered to be integrative skills to be addressed within the described model. The emphasis is put on the primary role of computational models in modern research-oriented education. In order to develop, to implement, and to study computational models that include both technical and social aspects, students of today need to have skills such as decomposing and generalising skills and skills to automate, algorithmize, calculate, and design, necessary for solving problems in a highly digitised educational environment.

CT&MathABLE main objective is to support digital transformation of students in multiple dimensions:

1) Improve school students digital skills and self-awareness based on learning-analytics;
2) Enhance computational thinking and algebraic thinking through the interactive tasks;
3) Integrate the STEM approach for task-based learning;
4) Create instruments for computational thinking assessment with learning-analytics, and
5) Provide the interactive tasks and assessment instruments in a format that can be integrated with various learning management systems.

The project aims to provide a learning-analytics based framework to support individualized learning trajectories for students in ages 9-14 across Europe. In this way, all children in ages 9-14 will be able to strengthen their computational and algebraic thinking skills, which are among the key competencies of the 21st century, with Computer Science and problem solving tasks.

The project also has specific objectives in terms of teachers, instructional designers and school curricula. One of them is through the implementation of the CT&MathABLE system, teachers will experience the integration of technology into classroom settings as well as observe the effect of personalized instruction accompanied with the formal curricula. This implementation process is expected to work in a blended learning approach which again will make teachers to think and adopt appropriate pedagogical strategies for the use of interactive tasks through collaborative learning.
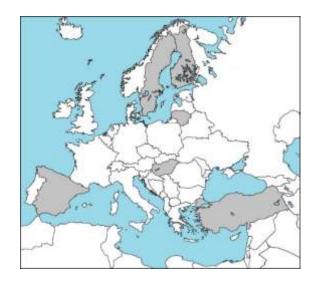
The CT&MathABLE enhances European educational resilience and capacity leveraging digital transformation tools and pedagogies to realise innovative school curricula to enable recognition and validation of skills and qualifications addressing future demands for citizens with the digital skills and computational literacy needed for digital transformation. The project delivers open, relevant and localized educational resources for developing computational thinking and algebraic thinking of primary and lower secondary school students with novel modes of interaction and high quality content.

CT&MathABLE delivers:
    - personalized learning trajectories (Learning Paths) in developing competencies of computational thinking and algebraic thinking combining a learning architecture and cutting edge learning analytics technologies with interactive tasks that have been proven to engage learners in accelerated intellectual development;
    - competency frameworks for integrated and automated assessment of learning in informatics (computer science) and mathematics;
    - large scale libraries of interactive tasks designed explicitly to hone computational thinking and algebraic thinking skills.

2. The project consortium introduced

The project partners are a cluster of leading European institutions in computer science education, computational thinking and mathematics education. Six universities and two schools from six countries are involved.

1. The project manager, Vilnius University (VU, Lithuania), in collaboration with all project members proposed the project outcomes templates and designed a project web page. Vilnius University will develop the interactive task development tool and set of tasks, including the state of arts and the best practice.
2. Ankara University (ANKU, Türkiye) is responsible for the Framework of interactive tasks, will contribute to Learning Path for computational thinking and algebraic thinking and the assessment tools development.
3. Eötvös Loránd University (ELTE, Hungary) is leader of the Work Package 2 and will develop Learning Path for computational thinking and algebraic thinking.
4. Basque Country University (UPV/EHU, Spain) will warrant the quality assurance and provide control of dissemination plan.
5. University of Turku (UTU, Finland) is leader of the Work Package 3 and will develop assessment tools for computational thinking and algebraic thinking with integration of learning analytics.
6. Royal Institute of Technology (KTH, Sweden) will focus on dissemination the projects outcomes and delivery recommendation for various target groups.
7. Two schools – Klaipėda Gedminų Progymnasium (KGP, Lithuania) and Mamak Özkent Akbilek School (MOAS, Türkiye) are responsible for collaboration in developing training materials for computational thinking and algebraic thinking, testing and piloting the developed resources.

3. The project manager Vilnius University

In this newsletter we would like to start with the brief introduction of the project manager, Vilnius University.

Vilnius University (VU) is the project manager and coordinates the project. It is the largest university in Lithuania and one of the oldest establishments of higher education in Eastern Europe, it was founded in 1579. The university has 12 faculties, 7 institutes, 4 study and research centres,

the most modern library, etc. Currently VU has over 3,750 academic staff and over 21,500 students. With its large scientific potential in terms of well-known researchers in STEAM-related disciplines, VU has a vision to make more active collaboration with the country's educational system through implementing scientific research and innovative teaching and learning methods in schools, e.g. problem-solving, IBL, RRI , to name a few. VU has previously coordinated a number of EU projects, including Eurostars (pen!6232 PEN), and has participated in a number of FP projects, such as BalticGrid, Baltic Grid Second Phase, EGIInSPIRE, VirtualLife, SkyScanner and Mascil.

Two institutes are directly engaged in these project: Institute of Educational Science (ESI) and Institute of Data Science and Digital Technologies (DSDTI). ESI finds itself within the faculty of Philosophy and is oriented towards the development of the modern education science. The priority areas include teaching and learning process, content, methods and teachers' education. ESI focuses on policy and management, the cultural and intercultural aspects and values of education. DMSTI is subdivision of the faculty of Mathematics and Informatics and focuses on scientific research and experimental development. The most successful directions of DMSTI are automated reasoning methods for knowledge and agent-based logics, problems of technology enriched education and human interactions with computers, software engineering methods, cultural heritage in digital space.

Key persons of the project team have been working in higher education in the mathematics and informatics education field for many years. Their research interests focus on the technology enriched learning and teaching especially mathematics and engineering, also they are interested in application of learning science and professional development of mathematics and science teachers in primary and secondary schools, with special attention to the mathematics reasoning and cultural approaches. VU has very good contacts with Ministry of Education and Science of Lithuania and their satellite institutions on teacher education and developing of curricula: we are involved in various expert groups at the Ministry, run advisory seminars to policy makers, in particular to developers of higher education curricula, etc.

VU actively collaborates with the Ministry of Education and Science in terms of performing scientific research on STEAM-related topics while implementing large-scale EU-funded projects. VU also directly collaborates with a network of innovative schools in order to implement sound pedagogical methods and approaches to enhance learning quality and effectiveness, in STEAM subjects including. Research based experience of the partners from VU provides a rich background and VU scientists are experienced in implementing information and communication technologies and math-based approaches in school education and therefore complement project knowledge and competencies in this direction.

Vilnius University is responsible for the general management of the project. The project management is performed by the Management Team:

Head of the Project – prof. Valentina Dagienė: valentina.dagiene at mif.vu.lt
(Overall project management, coordination of the IO implementation as well as teacher training activities and multiplier events)

Project administrator – Mamerta Ralytė: mamerta.ralyte at fsf.vu.lt
(Project administration activities: agreements, reports, supporting documents for activities, general dissemination activities and etc.)

Financial coordinator – Eglė Bobrovskė: egle.bobrovske at cr.vu.lt

(expertise in EU-funded projects, coordination of project finances)

Management Team will work closely together with National Agency of Lithuania. The team has well-established, valuable experience in international collaboration in the field of mathematics and informatics research, development and dissemination. Thus, they can rely on excellent local, regional and international connections to teachers and teacher educators, educational administrations, school authorities and Ministry of Education, Science and Sport. At the international level, they maintain contacts to numerous mathematics and informatics education researchers, teacher educators, European working groups (on Mathematics and technology, on teacher education, on schools), the European Schoolnet and the Bebras challenge on informatics and computational thinking networks (www.bebras.org).

The team members worked at localisation (translation) of several mathematics and science computer programs for schools and teachers last years, they met the different cultural approaches and reasoning in mathematics. We are paying special attention on teacher education for social diversity: we have quite a big amount of children from very low social skills families and various risk families (about 20%). The team members are experts at Learning Technology Standards Observatory; Personalising Learning Workgroup; the Special Interest Group of Advanced Learning Technologies, Open Educational Resources, and Standards under the Asia-Pacific Society for Computers in Education. They have been researchers in a number of EU-funded projects e.g. iTEC, LSL, CCL, META-NORD, CALIBRATE, ASPECT, iCOPER, eQNet, INSPIRE, te@ch.us, Iguana, eTwinning, Safer Internet etc.

4. The project management board and advisory board

The project the project management board with representatives from each partner (chaired by representative of Vilnius University) was established: face-to face meetings are held twice yearly to assess project progress, ensure meeting of deadlines, recommend personnel changes, modifications to activities, budget reallocation if necessary. Also some urgent questions can be discussed online.

The project management board

- Arnold Pears (KTH)
- Asta Jankauskienė (KGP)
- Fatma Özdemir Öncül (MAOS)
- Javier Bilbao (UPV/EHU)
- Mikko-Jussi Laakso (UTU)
- Valentina Dagienė (VU)
- Yasemin Gulbahar (ANKU)
- Zsuzsa Pluhar (ELTE)

The project advisory board

Partners appointed members to this board from external institutions. Advisory board enable the evaluation of the project activities, ensure quality, maximize impact. This board comprises international and interdisciplinary expertise, from policymakers and local stakeholders: Ágnes Németh (Hungary), Alvida Lozdienė (Lithuania), Filiz Kalelioğlu (Türkiye), Heikki Hyyrö (Finland), Matti Tedre (Finland), Marytė Skakauskienė (Lithuania), Tapio Salakoski (Finland).