New Technologies in Teaching Mathematics for Engineering and ICT Specialties

Ana COSTAȘ, Galina RUSU
Technical University of Moldova, Moldova State University
ana_costash@yahoo.com, rusugalinamoldova@gmail.com

***Abstract* — From the evidence available, new technologies are already changing the world. It is commonly thought that E-learning can strongly help in education. In no way traditional education can be replaced, but in this era of fast technological advance and minimization of distance, every teacher has be equipped with basic knowledge in technology, as well as use it as an instrument to reach a high level of education. In this paper, among general considerations of the use of ICT, we enumerate some possibilities for their efficient use in teaching Mathematics to engineering and ICT specialties.**

***Index Terms* — Education, E-learning, ICT, Mathematics.**

In the last decades, the interest in using information communication technologies in education has increased considerably, making it almost an obligatory tool. The role of digital resources in teaching and acquiring theoretical and applied competences is indisputable. Information technologies induce virtualization, delocalization and dematerialization of training actions. The concentration of knowledge only in certain rooms disappears.

The huge variety of potentially applicable types of learning equipment which facilitate the visualization, storage, processing, multiplication and reproduction of teaching materials, intelligent resources/software, virtual laboratories, social networks, virtual learning environments, which provide the ability to provide multiple and dynamic representations of phenomena; the possibilities of transferring course materials to on-line modules; the possibility of realizing online tests and quizzes, simulations and games, multimedia; the possibility of significant and differentiated interaction with each student in part etc. lead to the obvious actions to be implemented:

- to combine traditional and online courses,
- to train teachers in innovative teaching/learning/evaluation practices;
- to stimulate teachers' creativity in designing their courses;
- to discover flexible solutions for using the computer during the courses or extracurricular activities;
- to stimulate learning by harnessing students motivation to use computer interactivity etc.

Information and knowledge can be learned more efficiently using animation methods, interactive interaction of digital instruments. Skills can be formed through various exercises, selected according to the students' abilities, accompanied by control or self-control through ICT tools.

Countries with a high level of development, such as Great Britain, France, South Korea, Germany, Japan, USA, Australia etc. already have traditions known in this chapter, and governments of these countries invest considerable resources in the education system [1]. It is natural that as a result of the high-speed progress in science and technology, the process of study, especially of Mathematics, in both high school and higher education institutions, should be accompanied by the use of modern technologies.

Although:

- *Efficient integration of ICT in education* is one of the seven directions of the Education Strategy for 2014-2020 "*Education-2020*", approved in 2014 by the Government of the Republic of Moldova, in order to solve the main problems of education;
- the *application of information technologies and information management techniques* is the indispensable general competence of any graduate of higher education,
- The Education Code of the Republic of Moldova accepts distance learning as a form of training;
- last years, the Republic of Moldova has benefited from numerous donations and national or international projects (eg "*Rural Digital Inclusion*", "*Creating Moldovan E-Network for the Promotion of E-learning in Continuing Professional Education*" (TEACH ME), "*Création Réseau Universités Numériques Thématiques en sciences appliquées et sciences économiques en Moldavie*" (CRUNT) etc);
- in 2015 and not only the Ministry of Education has invested in procurement of equipment in some pilot high schools with the purpose of implementing the computer assisted learning process,

the education system suffers from a lack of funding, and technologies are almost not used in gymnasiums, high schools and often in higher education. The use of ICT is confused only with the use of power point presentations, the true possibilities of ICT remaining shady in incognizance. From inertia, hours, including those of Mathematics, are routine: the same standards as 60 years ago, sometimes the same teachers, the same examples, etc.

Obviously, much more efforts are required from the teacher who is preparing and conducting a course with digital technologies. Since teacher-student communication is mediated by technical means, its optimization involves both the existence of the right infrastructure and the acquisition of skills to use them by teachers and students.

In digital assisted learning process, the role of teacher is changing: it is not only the person who provides the knowledge but the person who facilitates their acquisition. And teachers of mathematics for Engineering and ICT specialties are bound to be those who during the course bring all the possible arguments to prove the indispensable

interconnection between Mathematics and Computer Science. The list of theoretical arguments which describe the possibilities and the role of the mathematical structures in the field of student training, during the course of mathematics has to be completed with the multitude of demonstrations that ICT offers: specialized software (Wolfram Mathematica, MATLAB, R, GeoGebra etc) simulation software, exercise software, knowledge testing software, educational games, etc [2]. The course of mathematics has to be enriched with many:

- **graphic representations**
- of some curves (both planar and spatial) defined by much complicated, so much interesting functions;
- of some parametric curves;
- of some curves defined in polar coordinates (figure 1);

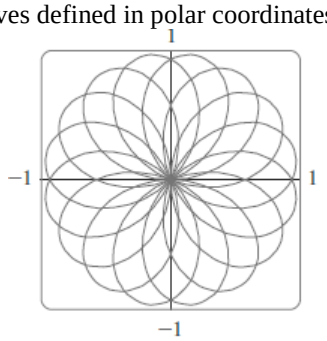

Fig.1.

- of some spatial surfaces (figure 2) and their sections, including their dynamics, accompanied by changes of the values of some parameters, to highlight their properties;

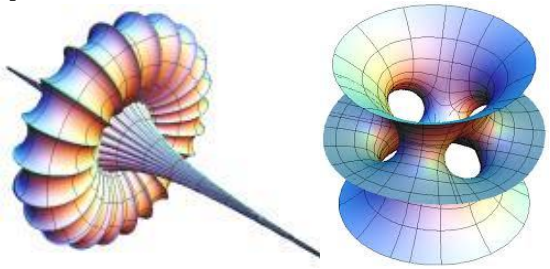

Fig.2.

- of some asymptotes to the graphs of some functions, to elucidate their role;
- of some level lines for two variable functions and their role in the intuition of the surface representing the graph of the function (figure 3), and in the 3D printing process;

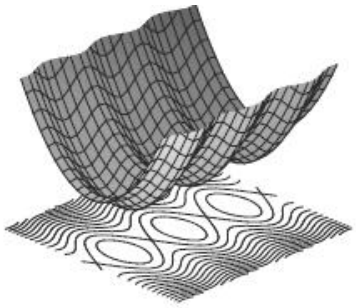

Fig.3.

- of some domains, the volumes of which are proposed to be determined using the double or triple integrals, including their projections on the coordinate planes;
- of some bodies from the geometry in space, including rotations, projections, deployments and intersections with other bodies (figure 4);

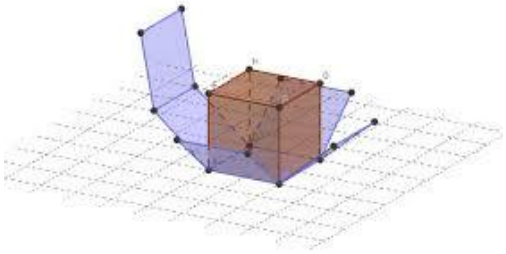

Fig.4.

- of some partial sums of series of functions, including the Fourier series in dynamics, emphasizing their properties;
- of some direction fields and of the table of variation of the solutions of some ordinary differential equations;
- of some figures/bodies representing the integral sums in dynamics, each time indicating the obtained values, both for the defined integral and for the double and curvilinear integrals;

- **calculations** in dynamics for a relatively large number of iterations to define and emphasize some properties
- of the limit of some numerical sequence, the limit of a function in some point, multiple limit etc, including the cases when the nonexistence of limit is proved;
- of the partial sums of some numerical series;
- of Taylor series etc

Depending on the higher institution's possibilities, it would be welcomed if the course of mathematics accompanied by laboratory hours, where the students would practice, would analyze the possibilities of existing software or would create themselves program products which would describe the analyzed models.

The inequity in computer use is to understand that it is not so important how often it is used, but in the ways in which it is used.

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