Techno Science
International Scientific
Journal of Technical
Sciences

Using IT and mathematical software for modernising mathematics teaching

MAID OMEROVIĆ, ALJO DELIĆ, AHMED PALIĆ

FACULTY OF TECHNICAL STUDIES, UNIVERSITY OF TRAVNIK, BOSNIA AND HERZEGOVINA

ABSTRACT

This paper describes mathematics in a somewhat different way, i.e. the manner of its presentation, through contemporary trends affecting the society today. Information technology that has become a part of our everyday life should also have a positive effect on other, somewhat traditional forms of learning, which is, in this case, mathematics. We have "learnt" to study mathematics in a traditional way, only by using a blackboard and chalk, which, of course, should still be present but with some innovations such as applying information technology to that end. Today's generations grow up in the Information Age and it would be great to take advantage of their everyday information technology usage in studying mathematics. In this way, we would achieve progress, which is also demonstrated in the age-old statement by Pascal.

"The subject of mathematics is so serious that nobody should miss an opportunity to make it a little bit entertaining."

Blaise Pascal

Introduction

The appearance of computers in the area of mathematical education has brought forth an optimism for enriching the teaching process by adding a new dimension to learning mathematics. The mere presence of information and communications technology is not a prerequisite for quality usage in teaching. It is in the student's nature, as an active individual in the teaching process, to easily accept technological innovations, since they are already present in his or her everyday life. Curiosity, activity, speed, short-term attention, desire for new information and the performance of simultaneous activities are reflected in the students' nature, and therefore, a computer as a form and mode of operation could satisfy their needs. However, a relatively rigid education system with its foundations set by Jan Amos Komenský leads our students into a state of being passive, weary of school and resistant towards school and learning. The education systems today are highly stagnant and slowly react to the appearance of new tools and educational technologies, as well as to their application in the teaching and learning process. That is why it is important that teachers also share the same optimism and initiate an active, modern teaching process. Adequately constructed and utilised modern teaching tools enable a more comprehensive intellectual engagement of students in learning. Teachers' roles are not diminished by introducing modern technologies, but, on the contrary, they become even more significant and responsible.

By combining the traditional and modern approaches to teaching mathematics, teachers should not allow mathematics to be seen as an arid and boring subject by their students.

Mathematics as a science

For centuries, humans have thought about mathematics and defined it in different ways. Hence, we can find a definition that mathematics is a science of quantity, structure, space and change (studied by its branches - arithmetic, algebra, geometry and analysis). Mathematics is also described as a science studying structures it creates or those originating from other sciences (most frequently physics, but also from other natural and social sciences), and it describes the properties of those structures. The word mathematics comes from Greek μάθημα and it means learning, study and knowledge. Mathematics is constantly developed, and yet, 2000 or 4000 year-old mathematics would seem familiar to a Twenty-First Century student. For some people, not only mathematicians, the essence of mathematics lies in its beauty and intellectual challenge. For others, including many scientists and engineers, the primary value of mathematics lies in the possibility of its successful application in their field of study.

Mathematics has been developed out of the need for calculation, measurement and studying forms and objects from the real world. By using abstraction and the principle of logical thinking, mathematics has evolved into a systematic study of the quantity, structure and space, as well as their interaction. The earliest application of mathematics was in commerce, land measurement, painting and tablet weaving. More complex mathematics appeared around 3000 BC when the Babylonians and Egyptians began using arithmetic, algebra and geometry for taxation and other financial calculations, for construction, and for astronomy.

Mathematics is characterised by durability, universality and independence from the time and environment in which it is studied. The central idea of research in mathematics is, in every area of study, identifying a small group of basic ideas and rules out of which all other interesting ideas and rules belonging to that area can be logically deduced. Mathematicians are especially satisfied when it is determined that a previously unrelated part of mathematics can be deduced from some other mathematical theory. For many mathematicians, the beauty of mathematics lies not in finding complexity, but in finding simple representations and solutions. As mathematics progressed, connections between its individually developed segments were increasingly found, for example, connections between the symbolic representation of algebra and spatial notion of geometry. These interrelated connections between segments strengthen the belief in accuracy and unity of the entire structure. Mathematics, in its purest form, is a system independent and complete in and of itself, regardless of whether it is useful or true in the sense in which a human defines the truth. The reason lies in the fact that mathematical truth is not based on experience but on consistency within the system.

However, at the same time, mathematics has a lot of important, practical applications in each aspect of life, including information technology, engineering, economy, commerce and medicine. In the past, practical applications motivated the development of mathematical theories, which then became the subject of study in pure mathematics, where mathematics is developed primarily for its own sake. Theoretical mathematics and applied mathematics are inextricably intertwined. For example, mathematicians knew about the binary system, using only the digits 0 and 1, years before the knowledge became practical work on the computer. Games of chance contributed to the development of the law of probability. The need for data collection, its analysis and interpretation contributed to the development of statistics.
Therefore, mathematics is developed because it is needed as a language to describe the real world, and the language of mathematics leads to practical development in the real world.
Mathematics has its “rules of the game”. One of the mathematical rules is that a specific problem/question always has the same answer. Form can be differentiated when it comes to two answers to the same problem, but the value of both answers must be identical if both are correct.
The second rule is consistency. If a new rule is introduced in mathematics, it must not be contrary (or lead to different results) to any of the previously established rules. In addition, mathematics has its internal rules for verifying if a statement is valid, which means that this validity does not depend on opinion or circumstance.

Mathematics uses its special mathematical language comprised of numbers and symbols which are not subject to language barriers. Just like any other language, it has to be learnt. However, understanding mathematics demands complex, concentrated work and strictly logical thinking, without much room for error. Secrecy is an inevitable part of mathematics. It is still full of questions that have no answers and go far beyond the known theorems and results.

Traditional mathematics teaching and modernisation of mathematics teaching by introducing computers

Scientifically-based mathematics teaching methodology constantly searches for more rational and efficient approaches in conducting the significant teaching process so the youth would master quality mathematical knowledge.

Mathematics teaching has its *goals.* A goal marks the expected, imaginary future condition we want to achieve through certain activities and content. Goals formulate expected changes that will occur in students upon mastering the content in an education cycle.

The content of mathematics teaching is complex, it is often extremely difficult for most students since understanding the content demands complex thought processes, systematic focus and fundamental interest. Mathematical content is abstract, so, an appropriate methodological qualification is necessary to enable students to, through connecting with the reality, fundamentally understand and adopt it. In addition, mathematical content is closely interrelated, and therefore, misunderstanding one part of the matter leads to difficulties in mastering all content built on it. This requires special care on part of the teacher to make sure the student is not deprived of a single link in the chain of complete mathematical knowledge. Mathematical ways of thinking should be directionally developed from pre-school age and continued during the entire process of education, since it becomes increasingly necessary in a world formed by the influence of new technologies.

In traditional teaching, the student is mainly the object of the teaching process. The teacher provides the student with complete knowledge with the demand to memorise it as thoroughly as possible, and, when needed, know how to reproduce it as precisely as possible. Mathematics teaching, conducted by pedagogically qualified and conscientious teachers, has never been conducted without the teacher's insistence that the students rationally adopt mathematical knowledge and the demand for students' individual work while applying the acquired knowledge in the appropriate practice for solving the corresponding mathematical tasks. That is why it can never be claimed that it solely placed the student as the object of the teaching process. But, it is also necessary and possible to modernise and make such a teaching process more efficient.

What characterises *innovative, modern and teaching in development* are the conditions in which a student becomes the subject of the teaching process, and its essential direction is towards the development of mental, especially intellectual abilities and the student's personality as a whole. The students' development becomes the main goal of not only the teacher, but also the students themselves. When a student has the need and ability for improvement and the motive for self-development, the teaching process gets a clearly defined purpose which is their own comprehensive development. In such teaching, the student has a high degree of motivation, so, the teacher has the role to establish successful cooperation and function as a consultant and manager of the learning and developmental process.

In order to reach the ideal of modern mathematics teaching, it is necessary to continually search for methods resulting in the students' greater corresponding interest, more active and versatile participation in the teaching process and a true and permanent acquisition of knowledge and habits. The quality of mathematics teaching is becoming an increasingly important factor of a modern educational process. What conditions each teaching process, including mathematics teaching, is the students' work organisation during class. By defining the goal of mathematics teaching and the tasks related to its content, we discern that mathematics teaching is especially suitable for the usage of computers within the teaching process. For instance, this cannot be said for teaching philosophy or sports. Teachers who deal with these subjects can only find using computers helpful during work, class preparation, planning and teacher training. Yet, they cannot have as many possibilities for specific application in teaching, which is not the case with mathematics.

By using computers in mathematics teaching, the teaching and learning processes are raised to a higher level. Through corresponding and interesting content, both mathematics teachers and their students can even achieve maximum learning outcomes. Nowadays, as we are surrounded by digital television, computers, the Internet, digital cameras, mobile phones and many other products of

information technology, it is clear that the process of conducting mathematics teaching has to be changed and adapted to the demands of contemporary society. Students are no strangers to computers; they are present in their everyday life, so, in this area, it is not easy to balance their life with the work they do at school and outside of it. By doing this, schools no longer trail behind society as a whole in terms of using modern technology.
A computer in mathematics teaching should not only be used as a mere substitute for the blackboard and chalk (in the sense that the content of the teaching unit is shown on the computer instead of the blackboard). Yet, it is not good to overuse computers in teaching. A computer should not be used at all costs, during all classes, but only on certain occasions. Using computers should not become an end in itself. Mathematics teachers should determine the situations in which the computer will make the lesson better and more efficient.

The teacher's role in modern mathematics teaching

It is undeniable that the teacher's personality plays a significant role both in the complex teaching process and in the even more complex process of personality development. A majority of educated people fondly remember their teachers who have reached or at least came close to the ideal of a good teacher. Those teachers were, primarily through the regard towards their profession, able to endear a given subject to their students and develop a positive relationship towards it.
Since mathematics as a subject is essentially a difficult one, and most students fear it, the role of a teacher is most likely crucial for removing repugnance, developing interest and even instilling love towards this subject. Even the best devised curriculum, high quality textbooks and excellent collections of mathematical tasks are not a guarantee for a successful acquisition of mathematical content. The most crucial is the manner and volume of the teacher's qualification to make mathematics interesting for the students and available to each individual.It has been shown that teaching is successful only if it is implemented through diverse methods, In various forms, and by using different teaching tools, since, in this way, students accomplish the best possible achievements.

That is why a computer provides great didactic possibilities. As a teaching tool, it offers unimaginable perspectives to the mathematical education of students. Thereby, the teacher does not necessarily have to be a computer expert; it is sufficient to have a good level of computer literacy.

Many teachers still struggle with the task to efficiently use technology in teaching and learning mathematics. One of the reasons is the fact that even the usage of this medium requires a lot of time to prepare appropriate class materials.

However, the effort and hard work they put in are later highly worthwhile since most materials teachers prepare for class are such that they can be used in future teaching and can greatly facilitate subsequent preparation. Nor is it irrelevant that, during their education, many teachers have not been trained to use computers in teaching, making this a completely new experience for them.
The problem also lies in the fact that we publish a rather small number of professional journals (whether in print or electronic formats) dedicated to this topic, and that mathematics teachers are rarely provided with guidelines for using computers in teaching.With the goal to support teachers in the challenge to successfully integrate computers in teaching and learning mathematics, teachers are given opportunities for professional training through certified professional training seminars precisely dealing with this topic. In this way, they familiarise themselves with new approaches in using computers in teaching and become capable of integrating them in their teaching practice.
In addition, teachers can learn how to selectively use software in their classrooms and how to improve their students' success by providing new and efficient opportunities for learning.

However, the mere provision of new technologies for teachers does not guarantee their successful usage in teaching and learning mathematics.
It is also necessary to provide corresponding professional development with the goal to support teachers not only for using new software tools, but also for familiarising them with methods on how to efficiently use a computer in their teaching practice. Additionally, teachers must be prepared to face all complexities of such an environment that definitely creates more challenges for both the teachers and students than traditional mathematics teaching.

The impact of computers on the students' status in modern teaching

Student computer usage affects the development of a series of their psychomotor and cognitive abilities: the ability to solve problems, abstract thinking, logical reasoning and intuitive cognition and experience. It creates ease of reference in a world of symbols, affects the development of motor coordination, reading and writing skills, creativity, communication and motivation. The students' great interest in working on computers can be explained through internal motivation, stimulated in children by using new technology.
For students, working on computers represents a specific form of learning. In mathematics teaching, students tend to understand and master that which carries special significance and meaning for them.

By solving mathematical tasks using a computer, students fortify the obtained and adopt new knowledge, as well as become aware of new experiences. Alongside computer usage "the student has the opportunity to progress along his or her ascending path, with their own pace, thus satisfying their needs and interests"[1]

Working on computers makes the students actively engaged in the process of receiving information, creating an objective foundation for more permanent and efficient usage of the adopted mathematical concepts. This is extremely important since it is known that the fundamental function of computers in mathematics teaching precisely lies in the fact that a greater number of the students' perceptual abilities (visual, acoustic, audiovisual, etc.) are engaged in order to ensure quality adoption of mathematical notions and concepts. The process of acquiring mathematical knowledge by using computers, besides perceptions and notions gained through observation, also includes highly intensive intellectual activities (abstract thinking) which has to be taken into account if we want the usage of computers to be successful in mathematics teaching.
Computer usage will be have the function of developing mathematical thinking and successful adoption of mathematical concepts only if it ensures and stimulates the corresponding intellectual activities in students.

[1] Nikodinovska-Bančotovska S., Priprema nastavnika za primenu savremene tehnologije u nastavi, 2003.

By working on computers, students adopt certain perceptive data which have to be transformed into corresponding conceptual content, exclusively carried out through thought processes. When planning student computer usage during the teaching process, it is important to acknowledge both the individual mathematical and general intellectual abilities of students.Having in mind the characteristics of the Information Age we live in alongside the particularities of today's generations attending school, it is understandable why it is necessary to modernise the teaching process by using modern teaching tools.

A computer as a medium for writing the necessary teaching materials

Preparing materials for class (worksheets) and tasks for the students' written examination fall within the duties attributed to mathematics teachers. Unfortunately, a
significant number of mathematics teachers still prepare the tests writing them by hand. The teachers' handwriting is often illegible, so, the numbers contained in the tasks are sometimes hard to make out, leading to confusion when solving assignments.

The teacher's class preparations are susceptible to perpetual change. Since conscientious mathematics teachers continually analyse their classes, while constantly asking themselves the question of what should be changed in the preparation in order to make the class better in quality, it would be more practical to have the preparations in electronic form. A class preparation already written on the computer can be updated with new content, changed, and, as such, saved in electronic form, as well as printed if necessary. This would help avoid rewriting the content kept in daily preparations.

Using Internet content in mathematics teaching

During mathematics classes, it could be useful to search the Internet for content related to the matter currently dealt with or the matter that is somehow related to mathematics. We can already find online texts, images, videos or animations on almost all mathematical content used as a subject for study at school.

Such classes, which can be informal, can represent a respite from the usual, conventional structure of standard mathematics classes.
With the goal of browsing and searching Internet content in teaching, it is useful for the teacher to prepare for such an activity, i.e. to prepare web addresses which will be used in class, and to leave room for the students' individual research. They can be websites with the content strictly related to the matter, but also those with content that is more amusing such as websites with mathematical and logical games, mathematical jokes, etc. (Image 1. and Image 2.). Strictly mathematical content is not the only one that is suitable for joint analysis and discussion with students. Mathematical and logic computer games and even jokes can also be analysed in terms of finding out where mathematics is hidden in them.

Image 1: Mathematical, logic games and jokes

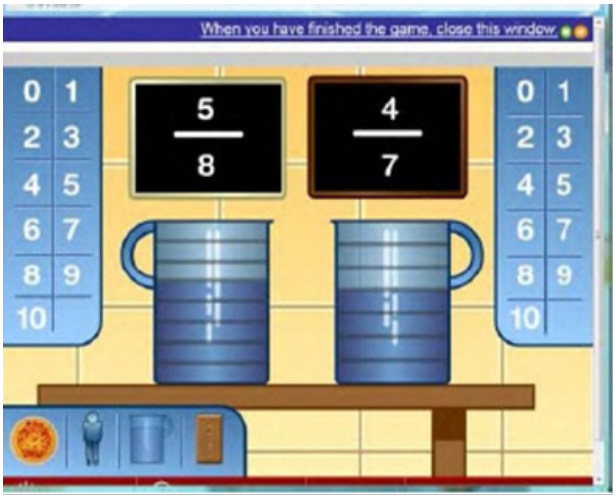

Image 2: Mathematical, logic games and jokes

Apart from using Internet content in class, students can be given research assignments for homework, including the search for information online. Homework can encompass finding appropriate articles on mathematics, images of geometric objects, historical data related to mathematics, the data on the life and work of great mathematicians, etc. The materials they have found are demonstrated in class by students who prepare a presentation on the given topic in groups or individually.

Using Internet content for education has various advantages. Namely, it generates a high-quality organisation of the students' leisure time. It is known that students spend more time on the Internet without supervision. This is a negative consequence pertaining to the sudden development of information technology. Neither parentscontrol the amount of time spent on playing online games and watching inappropriate content.
Teachers must have an important role in solving these problems.

By familiarising their students with educational online games, directing them to find Internet content as a part of homework assignments and supporting students in writing and posting Internet texts, teachers help in organising different, better and high-quality leisure time. Besides, this stimulates student education even when they are not in class. In addition, a student approaching the Internet in order to search for information is not only engaged in making decisions on the type of website they access, the information they gather and the process of gathering it, but also in validating the information.

The need to assess information validity is not something new, but, until recently, it could only be expected that most students use textbooks and collections of mathematical tasks, as well as other certified texts for class. When using online information, it is important to note that it can be published without being subjected to standard editorial policies, i.e. without factual verification and confirmation. That is why it is important to teach students not only to have the ability to select reliable information, but also to protect themselves from information which in terms of their quality, ethics and the value of their content do not correspond to pedagogical standards.

Mathematical software as teaching and learning tools

Among software suitable to be used for learning mathematics, we discern that in line with the mathematics curriculum and the software serving as mathematical tools, i.e. serving as aids in calculating, drawing graphs and geometric objects, etc. Nowadays, we detect an insufficient supply, i.e. a small number of educational software intended for mathematics teaching in line with its curriculum. Even with programmed learning that preceded the modern methods of using computers in teaching, there was a problem of an insufficient number of complete materials teachers could use in class.

GeoGebra software programme - a tool for learning mathematics

One of the most frequently used programmes for teaching and learning mathematics is GeoGebra. It is a free software encompassing geometry, algebra and analysis which is indeed truly helpful in connecting mathematical concepts. Its creator, Markus Hohenwarter, started the project in 2001 at the University of Salzburg, continuing it now at the University of Linz together with the help of open-source developers and translators all over the world. After being published online in 2002, an unexpectedly great number of teachers contacted Markus Hohenwarter to share their enthusiasm for the opportunity to use the GeoGebra software in classrooms. The immense positive feedback from teachers was followed by several educational software awards, including the European Academic Software Award in 2002. GeoGebra provides three different views of mathematical objects: a Graphics View, an Algebra View, and a Spreadsheet View (Image 3.). Thereby, all representations of the same object are linked dynamically and adapt automatically to changes made to any of the representations, no matter how they were initially created. Geometric constructions are created in the Graphics View with a mouse and the construction Tools.

Algebraic expressions are directly entered into the Input Bar, and their graphical representation is automatically displayed in the Graphics View.

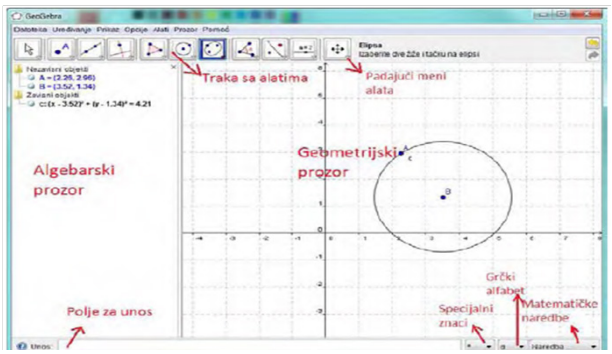

Image 3: Representation of mathematical objects in GeoGebra

It can be said that, for mathematics teachers, GeoGebra is really easy to use. That is because teachers understand mathematical ideas and the logic behind the tools offered byGeoGebra. However, it would be very useful to also instruct students on the usage of this programme for solving mathematical problems and researching mathematical relations. Construction of mathematical models using the software can be learnt at the same time as mathematics. Only certain examples for using the GeoGebra programme in teaching are presented here, but the possibilities for its application are indeed far greater. The power of visualisation and mathematical background of the GeoGebra programme can be used by teachers as means for developing the theoretical meaning of geometric concepts, namely, in the early stage of introducing geometric concepts. GeoGebra supports mathematically adequate development of the corresponding geometric concepts. When the notion of a line is being introduced, the student draws a straight line by using a pencil and a ruler. By using these tools, the student does not have to think a lot about the prerequisites for line determination. When a student uses the GeoGebra programme for drawing a line, he or she must place a point first. Then the line appears, but its direction is moved by the cursor. The direction is chosen by selecting the second point (Image 4.). Two different points determine precisely one line - a student can learn the theory while drawing a line in the GeoGebra programme.

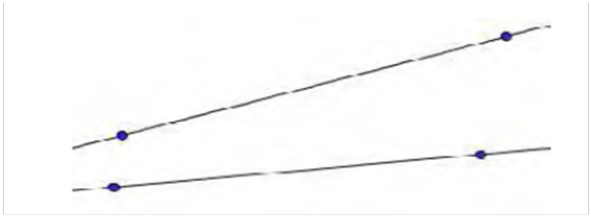

Image 4: Drawing a line in GeoGebra

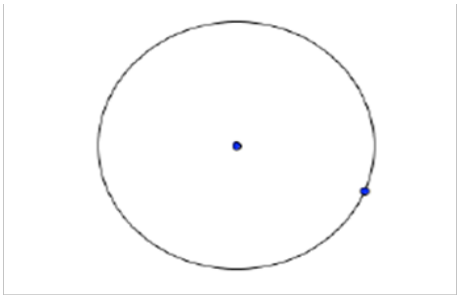

Image 5: Drawing a circle in GeoGebra

It is similar when drawing a circle. The first GeoGebra tool for drawing a circle requires a selection of a point (the centre of the circle) and the distance between the central point and the point on the circle (Image 5.). The second GeoGebra tool for drawing a circle requires a selection of a point (the centre of the circle) and the radius length.Thus, through this approach in construction, the student develops an awareness on the fact that a circle is determined by its centre and a permanent distance from that centre to the point on the curve (radius).

Since a coordinate system is integrated into the basis of the GeoGebra programme, this programme can be extremely useful for usage in introducing the coordinate system and its utilisation.

Moreover, a mathematics teacher does not primarily have to teach students how to draw points in the coordinate system and how to read the coordinates from the points on paper. The class can be organised in such a manner that students are simultaneously familiarised with the coordinate system and drawing tools provided by the GeoGebra programme (Image 6.).

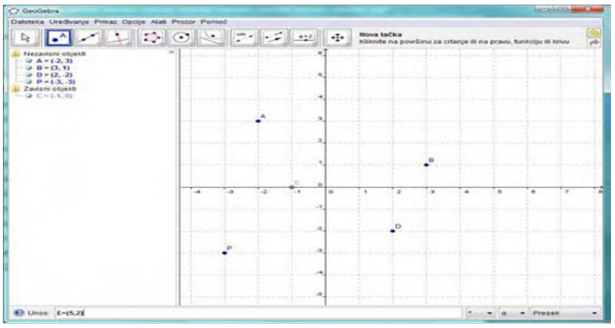

Image 6: Coordinate system

One of the main characteristics of the GeoGebra programme is the dynamic nature of the Views.

Unlike a sketch on paper representing a static model, it is possible to change certain parameters in the Graphics View in GeoGebra. Within the procedure of constructing mathematical objects, certain parameters are defined to be applicable on screen. This is enabled by using a slider. The dynamic nature of the GeoGebra programme is especially suitable for perception and visual representation related to dependence of certain mathematical objects on certain parameters. For instance, when dealing with the teaching unit Dependence of the Linear Function y=kx+n on parameters k and n, upon drawing the graph of the function in the GeoGebra programme, the parameters k and n can be defined as adjustable in the image by using a slider.

So, the student shall be able to observe the change in appearance for the graph of the function depending on the stated parameters, and be stimulated to independently make conclusions

Innovating mathematics teaching requires an increase in attention and interest of teachers to better solve certain issues related to it. Habits and routines in some parts of mathematics teaching are useful when they liberate the mind and release energy necessary to successfully perform other, more complex activities in mathematics teaching. However, it is not good when routine starts to restrain and both teachers and students loose creativity and interest. If boredom is one of the main enemies of mathematics teaching, then changes and innovation represent the primary weapons against it since they break the routine, releasing energy and creativity.The goal of introducing innovation is also to improve the students' achievements, develop mathematical and computer literacy, apply the acquired knowledge in real life and adequately prepare them for further education.
Moreover, the goal is to neutralise student resistance towards mathematics as a subject, i.e. to break down prejudice that "mathematics is the bogeyman". A teacher, as an organiser and coordinator of the teaching process, can and must contribute to raising the students' motivation to work. Through his or her actions, the monitoring and rewarding system, as well as other forms of outward motivation, a teacher can significantly impact the development of the students' inward motivation. Diverse ways of using computers in mathematics teaching are sufficiently comprehensive and can be implemented starting from the usage of the simplest mathematical editors for printing mathematical content to e-learning. Teachers do not have to be computer experts.

By having the basic level of computer literacy, teachers can use ready-made teaching materials, software or multimedia presentations. Teachers who are better versed in computer technology can independently create multimedia materials and post them on the Internet so as to make them available to the students at any time. Using computers in mathematics teaching contributes not only to the quality of the teaching process, but also to the quality of education.

"But in teaching children we must seek insensibly to unite knowledge with the carrying out of that knowledge into practice. Of all the sciences,mathematics seems to be the one that best fulfils this."

Immanuel Kant

References

1. Mićanović V., Osavremenjivanje početne nastave matematike primenom računara, Pedagoška stvarnost, 2007, vol. 53, No. 7-8, pp. 733-748.
2. Nadrljanski Đ., Soleša D., Informatika u obrazovanju, Pedagoški fakultet Sombor, 2002.
3. Mandić D., Didaktičko-informatičke inovacije u obrazovanju, Mediagraf, Beograd, 2003.
4. Budimir-Ninković G., Savremena obrazovna tehnologija i funkcije nastavnika, Zbornik radova 4. Međunarodnog naučnog skupa Tehnologija, Informatika, Obrazovanje - za društvo učenja i znanja, 2007.
5. Nikodinovska-Bančotovska S., Priprema nastavnika za primenu savremene tehnologije u nastavi, Zbornik radova 3. Međunarodnog naučnog skupa Tehnologija, Informatika, Obrazovanje - za društvo učenja i znanja, 2003.

Primjena IT i matematičkih softvera u modernizaciji nastave matematike

SAŽETAK

U ovom radu opisana je matematika na malo drugačiji način, odnosno način izlaganje iste, kroz savremene tokove kroz koji prolazi današnje društvo. Informacione tehnologije koje su postale sastavnica naše svakodnevnice trebalo bi da imaju pozitivan efekat i na neke druge pomalo tradicionalne načine saznavanja, kao što je u ovom slučaju matematika. Matematiku smo „naučili" da učimo tradicionalno i samo pomoću table i krede, što naravno treba da bude i dalje prisutno, ali uz neke inovacije, kao što je primjena informacionih tehnologija u te svrhe. Generacije koje odrastaju danas, odrastaju u informacionom dobu i odlično bi bilo iskoristiti njihovu informatičku svakodnevnicu i u izučavanje matematike. Time bi postigli napredak, što svjedoči i davno izrečena Pascalova misao.

„Matematika je suviše ozbiljna, i zbog toga ne treba propustiti nijednu priliku da se učini zanimljivom."

Blaise Pascal

Received: February 15, 2018 / Accepted: February 25, 2018
Correspondence to: Maid Omerović, Aljo Delić, Ahmed Palić, University of Travnik, Faculty of Technical Studies, Travnik, Bosnia and Herzegovina
E-mail: maid.omerovic@gmail.com