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GENERATION XD – EDUCATIONAL TECHNOLOGIES IN THE SERVICE OF MATHEMATICS

Abstract

The article focuses on the changes in mathematics education under the influence of new educational technologies. „A child of digital era” – generation XD has been described together with a draft „New teaching methods in mathematics”. An analysis of the research results with the use of these methods in teaching practice has been presented. The development of educational technologies and the methods to collect and distribute information pave the way for alternative forms of education in the society of knowledge. They are invaluable in recognizing the merits of exploring and developing constructive solutions to problems in different areas of our lives. Mathematics, information technology, computers are contemporary and historically in strict correlation. The new technologies are changing the style of teaching and learning mathematics.

Key words: digital media, neomedia, generation XD, mathematical practice, educational technologies, mathematical skills

Introduction

Manuel Castellsa’s words from his book „The Internet Galaxy” can serve as an introduction to considerations on mathematical education [...] I imagine someone saying: „Why don’t you leave me alone?! I don’t need even a piece of your Internet, your network society! I just want to live my own way! Well, if you think so, I have bad news for you. Even though you do not care about the network, they will take care of you. As a matter of fact, as long as you want to live in a society here and now, you will have to deal with the network society because we live in the Internet Galaxy” (M. Castells, 2003, p. 313).

Neomedia – benefits?

The features of our „new” world involve common space for a variety of human activities, peaceful symbiosis of people and nature, global space of information occupied by networks. The Internet is the most important digital media, in terms of technical architecture and institutional and social organizations. It has been created in large universities and research centers. Network societies operate on the basis of free communication and the ability to find their own place in the network. They can create their own space to place their own information and implement a new form of expression, an interactive use of network. Web entrepreneurs, interested in making the money, transformed the Internet culture in the new economy based on culture of innovation, risk, expectations and faith in the future. The modern societies (cyber societies) communicate through the networks, social life breaks away from home and social relations are changing.

Subcultures are arising from enclaves managing information technology. Groups of students with high dexterity and mental agility create hermetic groups of experts for whom the computer is a drug. The purpose of modern education is to teach groups of students and to seek the best forms of assistance in learning the individual units as well as forcing them to active acquisition of the learning environment. In educational technology can be observed a shift from the knowledge, which is a collection of information with a particular structure in a given discipline, embedded in a particular place and time, to the knowledge which can be available to the person concerned at any time and place. The enormous potential for change is being created in which the learning path leads from those who provide information (teachers) to those who receive it (learners); (S. Juszczak, 2002, p. 39, 40). Universities place a great emphasis on asynchronous education connected with the Internet as well as the interactive methods such as video conferencing, discussing forums, online classes.

There is a need for international cooperation in setting standards and mechanism to support and protect the international achievements and introduce equality in the access to the digital space (M. Castells, 2003, p. 202). The Internet, as a symbol of social network and a new and therefore unknown wavelength, causes justified fear among many people who foresee a potential threat to jobs, education, social security and lifestyles. Such fears involve the environmental degradation, increasing poverty and inequality in many areas of the digital influence. Some opponents argue that the Internet is subject to the collective imagination of

the public. This 'demonic' attitude should be improved and the Internet ought to be perceived as a tool necessary for work, science and life.

The American critic and scholar Neil Postman introduced to literature the notion „technopol”, which can be understood as the inevitable consequence of the development of the information society. He presented it as a kind of immune deficiency syndrome to the adverse information against which even such social institutions as family, school, religion, legal and political systems cannot defend themselves (N. Postman, 1995, p. 246).

The new technology drives and supports globalization which is the spirit of transition times. Borders of the countries do not restrict trade and exchange of information. A common space for various activities of modern man has been created (S. Juszczak, 2002a, p. 329, 330). Part of the world has been enriched excessively, leaving other nations behind, excluding them from the world of new information technology. One of the founders of computer networks, Bill Joy accurately defined the most important contradiction associated with the rise of network society: the disparity between super-technological development and institutional and social underdevelopment.

A new gap is being created between „the information rich” and „the information poor” (J.P. Foley, p. 4). Cyberspace should be free and available for all social groups, should serve the people regardless of their place in the world, skin color or language they speak. The Internet and still developing technologies convey the way of thinking about the human condition, social relations, religion and family, the novelty and glamour which may challenge and overwhelm the traditional cultures; (J.P. Foley, p. 5, 6).

Digital media pose to humanity and thus, to each person a lot of challenges. To such challenges belong: freedom, teaching all of us, but especially the younger generation, how to process information and develop knowledge. The society must acquire learning skills for the whole life; structural searching, systematic approach and make use of information to acquire the necessary knowledge in order to reach the intended purpose. However, this requires a profound change of our education system. There is a need of new pedagogical approach involving the cooperation, individual learning, development of independent thinking skills and shaping the personality of the student (J. Kandzia, 2011, p. 13-19).

Generation XD

The cyberspace includes: work at a distance, cyber-manager – middle and senior management. Engineering offices, tax advisors, lawyers, public relations consultants,

advertising and promotion agents belong to institutions which can function without any offices or desks. A huge disparity has been created between the rate of development of the human brain and technological progress. Biological, behavioral reactions, physiological and emotional needs remained virtually at the same level as thousand years ago. The enormous technological progress of civilization enforces definite lifestyle. We are bombarded with a lot of information at an enormous pace. Our life can be compared to a train at high speed.

That is true that contemporary children can cope with modern technologies very well. They are born with „a mouse in hand”. Their first sounds and photographs are transmitted by a mobile phone from the delivery room. Babies watch films on the laptop, a bit older play computer games and video; listen to music from MP3, MP4 players. Surprising results brought the report „Zero to Eight. Children media use in America” published in 2011. It indicated that in the United States 10% of the babies to their 1st year of life had benefited from the Smartphone or iPod. Numerous television programs, games and electronic toys – this is our reality. Our children, before they learn to speak well, already know that there is always somewhere the enter, on/off or a button that activates or opens any device.

The websites dealing with entertainment and fun are the most popular among young people especially social networking sites (about 70% youngsters visit one of them). Apart from possibilities to produce „anything”, their main target is to earn money owing to the users’ activity. In the forefront there are also websites such as culture/entertainment, e-commerce and sites for adults. Children are particularly active users of games (80% of the Internet users from 7-14 age group) and video on the web (2/3 users of 7-14 age group). Their interest in the auction portals and popularity of company websites (especially among boys) prove that the Internet constitutes an important source of market information for children. Moreover, 89% of young people in Poland (6-17 years) surf the web regularly (every day) including 23% 3-6 years old, 35% 7-9 years old, 62% 10-14 years old. Television still remains the most important medium for children up to 8 years of age and the Internet does not have a chance in this battle. However, after this stage of child’s development, television gradually loses its influence on teenagers. The eight-year-old children undergo a kind of evolution. They broaden their ‘media’ horizons and as a result computers, with the access to the Internet, and mobile phones become more important for them. (They start to send many text messages and stay in touch with their peers using social networks and IM messengers).

Results of the survey „Children in the net” conducted by the Interactive Market Research Institute (IMRI) indicate that in younger age groups (3-6 year old and 7-9 year old)¹ television can greatly affect the search for content on the Internet and the selection of websites for children. Other research projects At Media – „The story of a love affair” (2010, in cooperation with GfK Polonia) and „Three targets” (2009, in cooperation with Millward Brown SMG/KRC) also prove the strong interaction between television and the Internet².

Our young man represents generation XD. Contrary to older generations, he does not know the world without the Internet. This change was noticed and described by Disney³ on the occasion of his study concerning feelings and behaviors of teenagers. Three thousand children from six European countries: Poland, France, Germany, Italy, Great Britain and Spain were examined (on behalf of The Walt Disney Company – the second largest media corporation in the world⁴). Two letters perfectly characterize the new generation. „X” refers, in this case, to children (parents 35-45 years old) born in the years 1995-2001, and „D” stands for „digital”. Hence we deal with children who are currently 8-14 years old, of which 60% cannot imagine life without a mass – digitalization and the Internet access. It should not be surprising because they have never lived in such a world. They are digital natives, „digital-age children”.

The latest international study, (12 countries) concerning children’s ownership of mobile phones, indicates that Poland belongs to countries in which the largest number of 10-year olds have their own mobile phones: Poland (83%), Great Britain (73%), Brazil (73%), Germany (69%), Mexico (68%), China (49%), Spain (37%), USA (31%), Australia (31%), Japan (20%), Canada (17%) and France (10%). Why do children need their own mobile phone? 16% of 10-year olds use a mobile phone to download video, 15% send photos and 13%, owing to their mobile phone, benefit from the access to social networking sites. Despite the age limitations, the youngest students suggest Facebook as their favorite website⁵.

The studies also indicate to something else. Young people are often perceived as being spoiled, deprived of higher values, so strongly absorbed by the virtual world that they forget about the real world. This judgment is very superficial and unfair for generation XD. Parents

¹ Information on children, age group (3-6 years) the Interactive Market Research Institute obtained from their parents, data of children age groups 7-9 and 10-14 were collected from two sources: directly from children and their parents (quantitative survey method CAWI; 660 questionnaires), www.iibr.pl [02.03.2013].

² *Ibidem*.

³ Disney did research for his new television channel targeted at children – Disney XD.

In the name of the newly formed group the abbreviation: XD was left, [M. Buszek, http://www.egospodarka.pl](http://www.egospodarka.pl) [26.09.2012].

⁴ *Ibidem*.

⁵ *Ibidem*.

are still leading figures for the younger, digitally conscious generation, and not, as one might assume, more assertive classmates, celebrities or fictional, fashionable characters. Everyday life and „true” friendships cannot be replaced by websites. They use the Internet to maintain and strengthen contacts which are made in the real world. It is true that the young people use the network mostly for entertainment. The sites concerned with education, information and journalism are definitely much more neglected. However, the second most frequently performed activity is the search for information, helpful while doing homework (75%). Thus, the Internet is powerful educational tool. Children of generation XD are also entrepreneurial (70% save pocket money), free (65% want to run their own company), ecological (7% believe that it is important to protect our planet and 74% segregate rubbish). In other words, a positive attitude to society⁶.

As previously signaled, the mobile phone is inseparable „company” of every student. The situation of a student in the classroom can be compared to the flight by plane: we take off – the student enters the classroom, we fasten the seat belts and turn off mobile phones, we fly – the lesson goes on. Our student is „cut off from the world”. He can bear it somehow, like on a plane one better than other. The end of the flight – the end of the lesson; the student turns on his mobile phone and...calls (sends text messages) at least to his classmate who was and is beside him. Finally, he returns to reality, he is alive. The student receives what he was dreaming about „during the whole flight” (i.e. lesson).

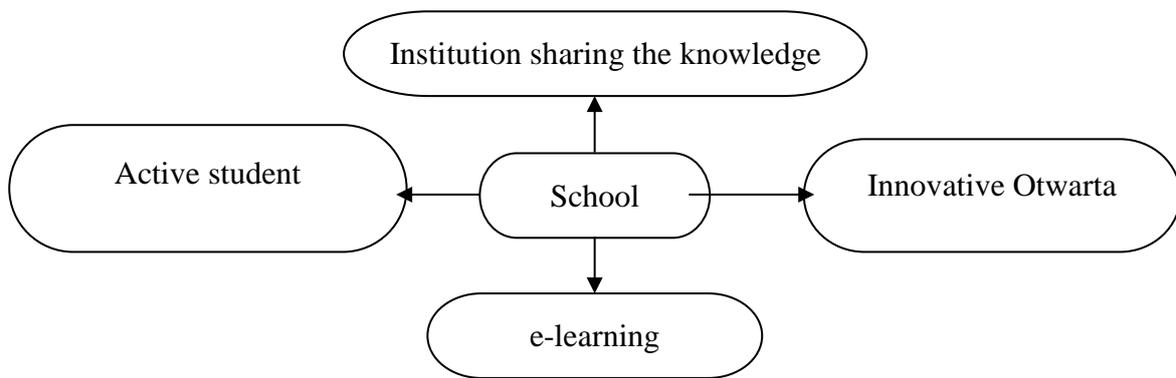
Thus, perhaps the mobile phone shouldn't be ‘the forbidden fruit’. Perhaps one should look more favorably at its communication, information or educational potential. Perhaps methods of the best use of this tool should be developed. Each method that encourages broadening of knowledge should be taken into account, especially in the network society. In addition to the knowledge, there is a need to integrate the current teaching and learning as well as the development of key competences such as; innovative and critical thinking, being imaginative and creative together with interdisciplinary approach enhancing civic and business awareness or global perspective.

Apple Company held the Apple Education Event in New York City in January 2012. To reach the hearts and minds of children, the brand decided to change, everything they do not like e.g. science associated with boredom, and introduce interactive learning with the help of iPod. There were presented the educational advantages targeting both children (learning through interesting play) and teachers (tools facilitating interactive lessons). The Apple

⁶ *Ibidem.*

engages in partnerships with schools and sponsors, among others, the equipment of classrooms. In supporting the young, the company foresees benefits in the future⁷.

Such actions, mostly if not primarily, relate to mathematical education which is recognized by the international environment as a basic social task. We are all aware that mathematics plays an increasingly important role in people's lives. Teaching starts at an early age of the child, basic mathematical concepts constitute a nucleus of the individual and social development. There is no doubt that these issues should be the main focus of educational policy makers, communities, and above all – parents and teachers.



Graph 1. Proposed integration of teaching and learning
 Source: prepared by the author [Excerpt from the article: J. Kandzia, 2011, p. 212-214]

Polish student's mathematical skills in PISA study

A report from the study skills of 15-year olds, announced by PISA (Program for International Student Assessment) in December 2010, indicates that the skills of the Polish teenagers are changing (R. Czeladko, <http://www.rp.pl>). Polish students do not develop the courage of thinking, which is necessary to deal with real problems. Habits are not everything but the schematic thinking should be given up. Young people often can neither justify their position nor formulate a statement. Schools should teach responsibility for decisions. The results reveal that Polish schools have gone for training average students forgetting about the good and the very good. In the opinion OECD (Organization for Economic Cooperation and Development) there are hopes that addressing the progress of the weaker student can reduce problems in the flexible labor market in the future.

The PISA study attempts to measure the preparation of the 15-year olds to use mathematics in the world around them⁸. The tasks are placed mostly in practical context and

⁷ *Ibidem.*

although their solutions do not need advanced knowledge of mathematics in most cases they do not resemble routine tasks at school. Therefore the difficulty is, like in adulthood, how to cope with a problem for which we do not have the ready pattern of conduct (20% of Polish students are low achievers at school). The strong points still are: reading charts, diagrams and tables⁹.

The best Polish students are often weaker than the best students in the world. They have problems with independent creative or abstract thinking. The average age of Polish students in 2009 compared to 2006 has not changed and remains at 495 points, which places at 25th position among all countries participating in the study. The best results were achieved by students in Shanghai and Singapore – both regions took part in the survey for the first time.

Michał Fedorowicz, head of the Polish team PISA, director of the Institute of Educational Research, claims that the reversal of students from the board in a typical classroom and working in small groups generates their activity, intellectual daring, creative attitude towards discussed issues. The inclusion of digital media into the classroom activities, working with educational resources, web pages www, brings numerous teaching and educational benefits. One can talk here about: an active attitude to lessons, gaining self-knowledge, active construction of their own abilities, the correct definition of important concepts and functional dependencies, ability to draw conclusions, structuring knowledge distributed at different web addresses as well as shaping cultural behavioral patterns and socially accepted lifestyle, mutual acceptance and understanding between teachers and students. Digital media can be very helpful in the development of mathematical thinking, the development of thinking guiding to symbols and mathematical abstractions¹⁰ (J. Kandzia, 2011, p. 118, 119).

The contemporary world requires a new set of students' skills so that they will be able to make full use of the rights and opportunities of the developing knowledge society. We can talk here about: creativity and innovation, critical thinking and problem solving, effective communication, searching skills, analyzing and information management, the ability to use digital media, efficiency of using new tools of information and communication technology,

⁸ Poland falls into handful countries in the world, in the field of reading charts, mathematics and natural science, which in the last decade clearly improved level of knowledge and skills of young people who complete compulsory education at school. In all areas of PISA, Poland has currently its position among the eleven leading EU countries (5th in reading, 7th place in science, 11th in mathematics). Poland achieved such results despite much lower position in the EU (e.g. measured by GDP per capita) lower incomes of teachers and lower education of parents.

⁹ Statement prepared by the Team of PISA IFiS PAN, Internet 10, http://www.znp.edu.pl/element/740/Wyniki_badania_PISA.

¹⁰ The subject has been thoroughly described and analyzed on the basis of the earlier author's natural pedagogical experiment, in her book: *Shaping teaching and educational values in the process of mathematical education*.

initiative and making independent decisions about their own lives, their ability to cope with a diverse and multicultural environment as well as leadership skills and responsibility for decisions (J. Kandzia, 2011).

Educational technologies – generation XD – mathematical practice

Preparing for life in the Society of Knowledge is a civilization challenge and a decisive element of the dynamic development of Poland. Education cannot function without reality. It has to adapt to the new conditions which means making use of modern technologies. The education system is facing the clear tasks of technological preparations of all types of students and schools. They require actions concerning substantive arrangement of the educational process as well as creation of appropriate conditions for its implementation. The educational technologies (computer, information, communication, and media) are perceived as cognitive tools to support the learner, the learning process and current educational practice. They create conditions for learners to active acquisition of knowledge (M. Śniadkowski, 2007, p. 85). Teachers, students and parents are constantly looking for new solutions in teaching and education. The introduction of technology in education requires methodological adaptation of education and the reorganization of the educational process. The appraisal of its impact on students' achievements is equally important. The education technologies encompass: relevant and effective ways to deliver information; methods that enable the processing and communication; the design of interesting methods of teaching, learning; modern teaching aids; innovative ideas; the teacher's creativity involving the collection of information and working out effective ways of enforcing knowledge.

A few words on education technologies which belong to practical teaching. It becomes a discipline in education which not only is interested in the technical media but also in the whole process of education. The concept of educational technology¹¹ was well settled in modern scientific and practical thinking. Technology becomes the dominant indicator of humanity. The educational technology can be described as follows: equating it with educational resources (media) – technical and educational infrastructure, treating such

¹¹ www.portalwiedzy.onet.pl/41514,technologia_ksztalcenia,haslo.html [26.01.2012] – **Technology education, educational technology**, a discipline dealing with the optimization of the learning process by incessant introducing into the teaching practice scientifically verified educational innovations and achievements of other sciences and disciplines – especially psychology, sociology, cybernetics, computer science, ergonomics, communication theory etc., and simultaneous evaluation of the effects of their implementations. Technology education disseminates using technical means of education and methods of activating students. It strongly opposes verbalism in teaching and aims to eliminate randomness of the learning process through strict programming teacher and students activities.

technology as a legitimate scientific set of teaching conduct or a unit based on educational experience and standard, recognized it as a scientific discipline with varying range of research interests. The modern electronic devices used in education, rapidly developing science result in the development and shaping the identity of technology education.

The generation XD expects/requires teachers who are versatile in new technologies and as a result of applying the modern educational technologies; they are able to develop students' knowledge. Thus, the need has arisen to give the teachers of mathematics the new directions in teaching their subject and indicate how they can use possibilities of digital media to make mathematics a dynamic, still developing discipline of their studies. Therefore the idea of the project originated and has been implemented – „New methods of teaching mathematics”.

Objectives of the project – New methods of teaching mathematics

From 18 February to 31 December the author was implementing the project „New methods of teaching mathematics”. The project was co-financed under the Operational Program Human Capital, Priority IX „Education and competence development in the regions”, Measure 9.4 „Highly qualified staff of the education system”.

The motivation to take this topic was a suggestion that one of the main problems of teaching mathematics, at all levels of education, are unattractive forms of the knowledge transfer. The traditional methods are used in which emphasis is put on stereotypical activities. These are observations of an experienced teacher of mathematics and computer science (the author) in secondary schools as well as students of the Faculty of Mathematics and Natural Science after their teaching practices.

In 2008 the Ministry of Science and Higher Education introduced competitions for co-funding of the ordered education to increase the percentage of graduates in mathematics, natural sciences and engineering. In the developing society of knowledge the young people who complete their education at school should have the skills to use new technologies. Therefore it is necessary to educate young people using the methods which are the most useful in the real tasks they meet in their adult life.

The project was directed to 60 teachers and teaching staff from schools or educational institutions from the Mazowiecki region of which 70% were teachers who lived and were employed at schools in rural areas. The target groups were women of all ages who completed minimum bachelor degree. According to data from the Education Information System (database SIO) of 30th September 2010 in the Mazowiecki region there were: in public and

private schools 92605 teachers including 77432 women (83,62%); and men teachers 15 173 (16,38%). There were 24917 teachers employed in rural areas of which 21060 (84,52%) were women and 3857 (15,48%) men. There are large disparities between the number of men and women teachers. The reason for such disproportions can be found in low incomes and low prestige of this profession.

The number of teachers over the age 40 in the Mazowiecki region amounts to 50722 persons including 42224 women, who make up 83% of the total. Why teachers from rural areas with the emphasis on over 40 years of age? It is assumed that there are teachers who are in favor of traditional methods of teaching. This group finds it much more difficult to adjust to the new reality and new educational techniques. The program of training has been designed to help students upgrade their workshop. Thus, to prepare them better not only for the exams but also to meet the citizen requirements of the knowledge society. The project is in line with the Recommendation of the European Parliament from 18th December 2006 on key competence for life long learning. A competent teacher means qualified students and the rise in prestige of the school.

From 30th March to 3rd April 2011 the research was carried out on the needs of teachers training in the Mazowiecki region. The analysis of the auditorium survey 197 teachers (including 169 women) indicate that up to 137 persons (including 119 women) are interested in enhancing their teaching using modern methods and educational aids, whereas 138 teachers out of 197 expressed their willingness to participate in activities on the platform of distance learning (women – 85%).

The program consists of eight courses in the forms of lectures and workshops for three editions of twenty people. The subjects of training projects „New methods of teaching mathematics”: Multimedia mathematical lab; Project in mathematical education; Activating methods; Mathematical modeling and modern information-processing technologies; Educational technologies in the teaching and cognitive process; Platform of remote learning; Programming for mathematics; Classes on the e-learning platform; Neo-media in mathematics; Educational planning (J. Kandzia, 2012).

The twin project, „Working with a student gifted in science”, was characterized by similar parameters. Subjects of the training were a bit different, however, there were also classes with the use of new educational technologies: Mathematical multimedia studio; Mathematical modeling and modern technologies of processing information. In the traditional form: History of mathematics; Methodology of private lessons with a student; Philosophy of mathematics; Modern mathematics; Olympic tasks; Classes on the e-learning platform: Number theory and

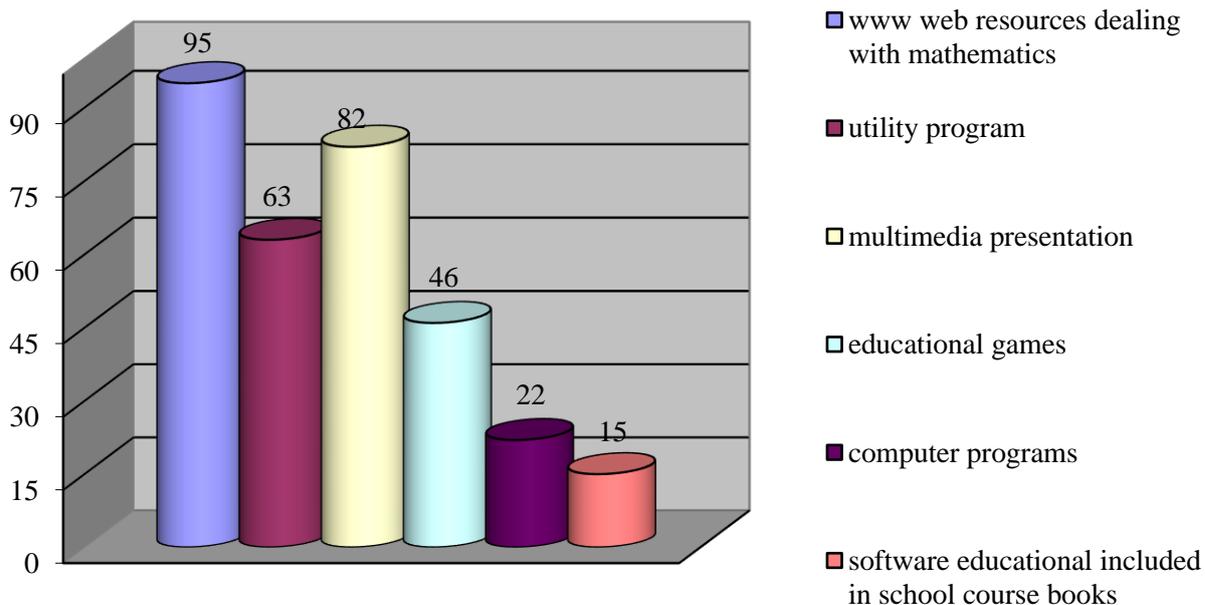
algebra; Geometry; Combinatorics. The study was conducted on the participants of the two projects.

Analysis of test results

120 teachers of mathematics, of whom 30 taught both mathematics and computer science, took part in a survey on the use of new educational technology. In the study group there were also those, who except for mathematics, conducted also classes in such subjects as: security education (2), nature (1), technology (4), physics (5), basics of entrepreneurship (3), biology (3), geography (2) and adoption defense (1). In the group 89 (which represents 70% of respondents) there were teachers living in rural areas, 11 (13,1%) were men. In the group of 120 persons there were only 23 men (19,2%).

The most numerous group 52 (43,3%) involved teachers with the work experience from 5 to 15 years; 36 people with work experience from 16 to 25 years, 18 people who worked less than 5 years and 14 above 26 years of work. 48 respondents taught in primary schools, 45 in middle schools (of which 9 at both levels), 26 in secondary schools and 10 in secondary vocational schools.

21 (17,5%) persons, among the respondents, do not have possibility to use their school computer lab, 19 teachers do not make use of mathematical tools of information technology during mathematics lessons, and 36 use them sometimes. It means that only 54,17% of mathematics teachers support mathematics lessons with digital media. The most popular web sides www online are those dealing with mathematical problems – 95 votes, media presentations – 82, media utilities (e.g. Spread Sheet) – 63, educational games – 46, educational software for school course books – 15, function drawing programs – 12, GeoGebra (dynamic mathematics software) – only 10 persons. It is a sad fact that the free mathematical software, which do not require installation and can be downloaded from the Internet are not popular with mathematicians.



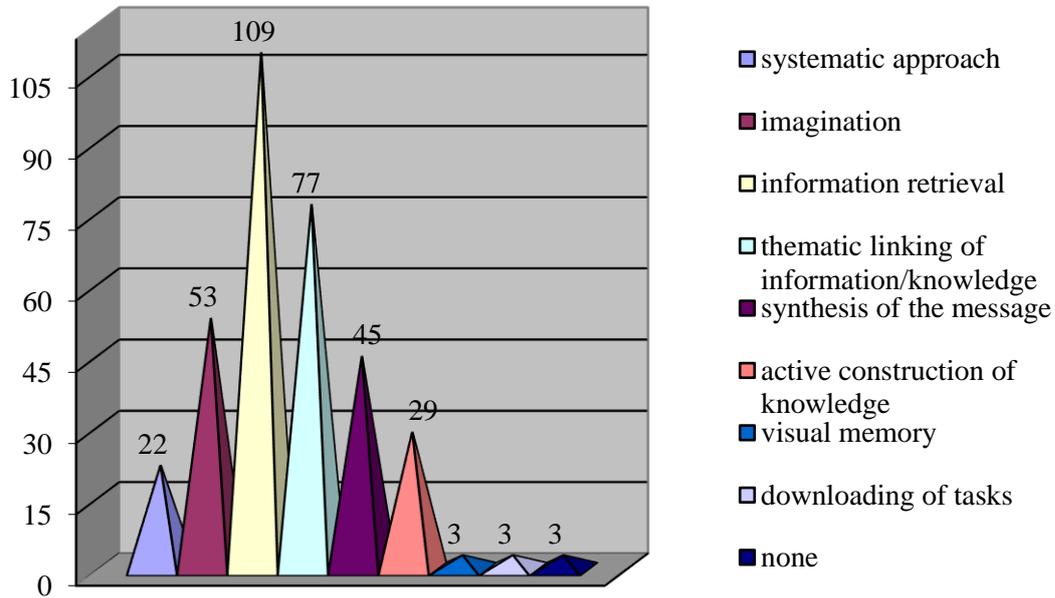
Graph 2. Information technology tools used by mathematics teachers in classrooms
Source: prepared by the author

Only three people use multimedia tools during each lesson, 36 once a week, 44 once a month, other teachers (37) – occasionally.

Is knowledge of information technology useful for conducting mathematics lessons? On the scale of 1-5 points, 41 respondents admitted 5 points, 45 – 4 points, 29 – 3 points and 4-2 points. One person believes that it is not necessary at all. 113 (94,16%) teachers encourage their students to use the Internet resources on web sides www concerning their subject. What is their knowledge? Are children/young people willing to use it? 61 persons said yes, 33 do not have an opinion, whereas 26 said no. Do parents put pressure on their children to get used to a computer at mathematics lessons? As many as 97 (80,08%) respondents said they did not. Are parents interested in new methods for their children to prepare them for life in the knowledge society? Only four people confirmed that, 19 did not know anything about it. 76 respondents claimed that classes with the use of computer supported students with difficulties in learning mathematics, 36 had no opinion, 8 said no. 110 (91,67%) commented that the visualization of mathematical problems helped students to acquire mathematical knowledge, 10 had no opinion.

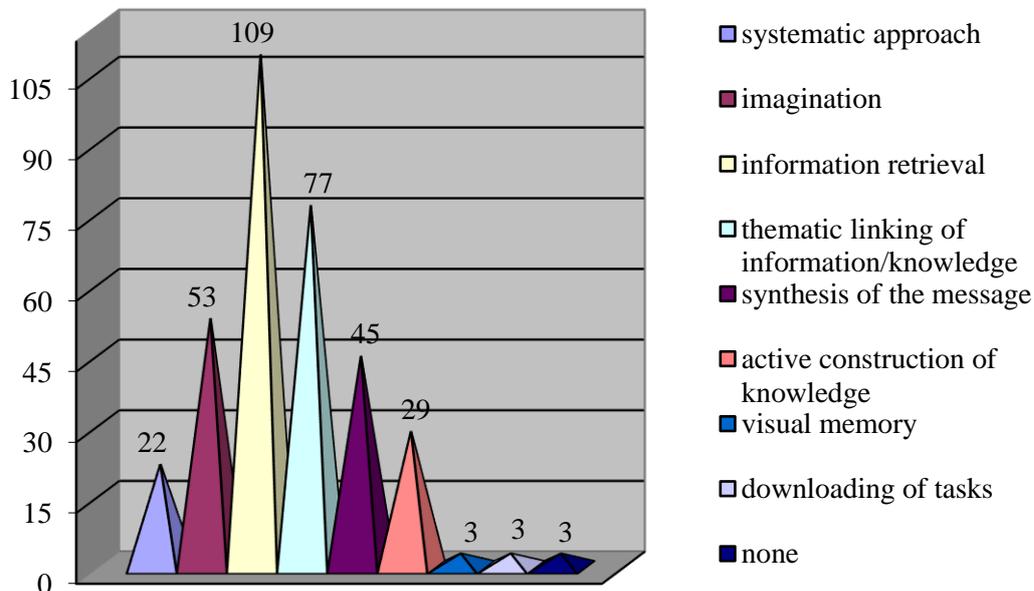
Which skills, according to teachers, do students improve using a computer in the classroom or at home? 22 respondents – systematic approach, 53 – imagination, 109 – information retrieval, 77 – thematic linking of information/knowledge, 45 – synthesis posts,

29 – active construction of knowledge, others – visual memory (3), downloading of tasks (3), none (3). Graph 3.



Graph. 3. Abilities which a student improves using a computer at mathematic lessons
Source: prepared by the author

One person claimed that computer can replace a teacher. 114 respondents answered that it was a supporting tool for mathematics lessons, 87 – learning was more interesting, 46 – students stored the material better, 30 – lessons were not boring, 31 – engage students to seek solutions, 48 – encouraged students to learning. Graph 4.



Graph 4. The role of a computer in teaching mathematics
Source: prepared by the author

It turns out that 48 (40%) persons were able to use mathematics on e-learning platform (before the course). There were lectures (30), quizzes (26), two persons received training on the platform. Only 38 (31,67%) teachers encourage the young people to participate in competitions online, including three persons who stated that students did not use them. 43 claims that there are not enough competitions, 30 that there is a sufficient quantity of competitions, and 42 have never heard about such competitions, three speak about the lack of information on the subject. Nevertheless, young people take part in the competitions such as: Olympic Mathematical Competition of Middle School Students, Mathematics of the Other Dimension, The Internet Adventure with Mathematics, Wroclaw Mathematical Competition, Mathematical Meridian Competition, Logo motion, Geniuslogicus, Beaver, Mat Mix, and Mathematical League Tasks.

It was also an interesting point that teachers make their students aware of the risks related to the use of the Internet and how to use it safely. In this point only three teachers admitted that they did not do it. 83 (69,2%) of respondents claim that students are aware of the risks arising from the use of computers and the Internet. 31 – said no, and 6 – had no opinion. According to 79 of the surveyed, the Internet is a threat, for 24 – it is not a threat, 17 do not have an opinion.

The arguments in favor of the fact that it is not a threat: a good source of information, the possibility of high-speed communications and messaging, a rich knowledge base available on call, support at work and learning. It is difficult not to agree with one of the respondents who pointed out that knowledge (awareness) about the dangers, resulting from exposure of children to these tools, continues to increase and they use the tools in a safe manner. In other words, the controlled use of this medium.

The list of threats given by the respondents is much more extensive: pornography, access to age-inappropriate games (often violent), dependence on these games, dangerous contacts (pedophilia), cyber bullying, theft, piracy, disclosure of personal data, familiarity with dangerous people, aggression, vulgarity, drugs and sects, anonymity, addiction, „the thief of time”, flood of information (information noise), misleading information, existence in the unreal world, closing to the real world, disruption of interpersonal contacts, mindless prescribing solutions of the tasks (lack of independence and creativity), possibility of publishing profanity, poor control of what is on the network (absence of the police) threat/disturbance of child's mental and emotional development, defects of posture, carpal

tunnel syndrome. 55% of respondents perceive the danger of social networking sites, 37% have no opinion on this topic, and only for 11% such contacts are not dangerous.

Summary of the project results

Most teachers who have taken part in the survey are less than 40 years old with the work experience no more than 25 years (106 respondents – 88,33%). It can be said that they are facing many challenges of the 21st century. Despite having access to computer labs (82,5%) only 54,17% of respondents reach for computer technology tools at the mathematics lessons. They also do not like mathematical programs listed on the Internet. Fortunately they do not negate the usefulness of the information technology to conduct mathematics lessons using multimedia techniques. It is surprising that parents are not interested in the use of modern technologies in the classroom mathematics at school. As many as 97 teachers responded that parents did not attach any importance to this question. Do the results illustrate the fact that the parents are unaware or that the cooperation between the two groups is insufficient?

According to the teachers, lessons with the use of computer are more interesting for the students (72,5%); they encourage them to work (40%); assist students with learning difficulties in mathematics (63,4%); visualization of mathematical problems helps students to gain knowledge (91,67%); lessons are not boring. The student develops a lot of skills: systematic approach, information retrieval, thematic linking of information/knowledge, synthesis of messages, active construction of knowledge, visual memory as well as there were statements that downloading of tasks without any real abilities. Teachers definitely cannot be replaced by computers. Graph 4.

The respondents indicate numerous advantages of computers as a tool to support learning. Why, then, of 99 teachers with the access to computer labs only 55 use them rather sporadically in the classroom and do not apply the computer programs that perfectly support the teaching of mathematics? The teachers (68,33%) do not encourage students to participate in mathematical competitions online.

Almost all the respondents make their students aware of the risks related to the use of the Internet and how to use it safely. 83% claim that the students are aware of the threats. Such results are very optimistic. Finally, the teachers perceive very few positive aspects of educational advantages in the Internet.

Teacher of the 21st century

The teacher should have a reliable and didactically accurate working workshop and sufficient knowledge not only substantive, in the given subject, but also ought to know the web to navigate across the ocean of „the Internet knowledge”. He must be a stimulator for the student’s intellectual development. He does not teach but facilitates the learning process and access to appropriate sources, creating organizational structures in which learning takes place. He becomes a guide in the world of information. The teacher is supposed to be a self-conscious director of the performance called „Science”. He should be a highly qualified computer technician who knows his tools. Such features are especially important in the globalised education. The idea of mathematics education should be promoted. New teaching methods help to diversify school programs, enrich them with easily produced mathematical structures. The boring lessons, with time, turn into lively mathematics (J. Kandzia, 2011, p. 26, 46).

The need to equip young people with the necessary key competences and improving educational achievements constitute an essential part of the Integral Guidelines for Economic and Employment Growth. The educational and training systems should be adapted to the requirements of new competences through better identification of occupational needs and the key competences within the Member States’ reform programs. All young people should have sufficient means to develop the key competences to a level that equips them for adult life and which forms a basis for further learning and working life.

Knowledge of mathematics is the ability to understand the messages that are formulated with the use of concepts and tools of mathematics. The positive mathematical attitude is essential, expressed in respect to the truth, the desire to look for reasons, assessing their relevance and validity. Knowledge, skills and attitudes are expressed by the ability to apply the main principles and mathematical processes in real life, tracking and evaluating the sequence of arguments, mathematical reasoning, understanding and mathematical proofs and thus, communication in the language of mathematics. It should be said here about the ability of understanding, judgment, exercising and using mathematical functions in the context of mathematics and outside mathematics. One of the basic conditions of mathematical competence is a thorough and extensive general knowledge, mathematical knowledge as well as technical skills. The ability to ask and answer questions on a given topic within the scope of mathematical means.

Summary

The information society expects that a modern school graduate should have knowledge and skills to apply Information and Communications Technology (ICT). The transfer of knowledge, with the use of new educational methods, will allow students to handle efficiently non-standard situations within the scope of the mathematical sciences. Mathematics will become easier in the daily practical use. The world we live in is increasingly dependent on information technology. This also applies to mathematics. The usage of digital media in science is the topic of discussion led by mathematics educators as well as by the teachers themselves. [Excerpt from article: J. Kandzia, 2013].

I hope that the trained teachers will be more likely to reach for new tools, new methods of teaching mathematics. They will become „attractive” for present and future „customers” of education. Knowledge will be transferred in a manner comprehensible to the generation XD. Let me conclude, the above considerations, by quoting: „[...] If society is changing and the knowledge is changing the teaching has to change as well. Thus, the teacher ought to be replaced by e-teacher, the teacher assisted by a computer and network. The teacher has to train students (although they are supposed to be taught facts and theories), but he should be their guide and helper, teach them how to learn, evaluate the information and opinions, not just hammer facts to their heads. However, he has to realize that he is dealing with a new type of students” (T. Goban-Klas, 2002, p. 45).

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