

**Iwona Piotrowska**

Department of Geography Teaching and Ecological Education  
Faculty of Geographical and Geological Sciences  
Adam Mickiewicz University, Poznań  
ipiotrow@amu.edu.pl

**INFLUENCE OF EDUCATION TRANSFORMATION  
ON IMPROVING KEY COMPETENCE  
IN GEOGRAPHY TEACHING**

**Abstract:** Systemic transformation taking place in Poland for many years now, have included all fields of the economy. It is particularly visible on the level of society education. The implemented reform of education system introduced thorough structural and curricular changes. New subjects were introduced, such as nature, information and communication technologies, which refers to civilizational achievements. A school was entrusted with accomplishing a very important task of getting young people ready to live in a knowledge-based society, because knowledge and skills account today for the greatest treasure of societies. Ambitious tasks were entrusted also to the teachers. Adaptation to development of technology and application of digital devices in teaching subjects was one of these tasks. The aim of this article is to define the influence of education transformation on improving key competence in geography teaching. Presentation of the results of the conducted research concerning level of application of new technologies in schools, diversity of curricula and teachers' approach to new technologies in geography teaching with awareness of very high informatics competence of the contemporary students was a mean to achieve this goal. Also methodical and substantial solutions improving teachers' qualifications are proposed. Significant questions arise: is e-school, development of which has been observed in the recent years, going to raise effectiveness of education? And is a contemporary teacher – follower of constructivism – applying various teaching methods going to facilitate development of particular key competence of 21<sup>st</sup> century?

**Key words:** teachers' education, key competence, creative teacher, digital generation, multimedia in geography teaching

## INTRODUCTION

As a result of systemic transformation taking place at the end of 20<sup>th</sup> century, one can observe dynamic development of knowledge-based economy, as well as society, which uses intensively technological achievements of the contemporary world. Therefore, getting young people ready for life properly by transferring knowledge and developing skills relevant to the stage, which a student graduates, is one of the educational tasks of a school. The acquired knowledge relates to the basic terms, regularities and rights characteristic for a particular science, whereas skills are practical and allow using information in life. In European education programmes it can be read that “teachers are key agents for a change” (Schools for the 21<sup>st</sup> Century, 2007) and, at the same time, they should mediate between rapidly evolving world and the pupils. Such a statement requires constant improvement and development of teacher’s competence, related undoubtedly to his/her willingness for personal growth, continuous knowledge, therein geographical knowledge, update and knowing a student – his potential interests and potential for development (Piotrowska 2010).

Systemic transformation taking place in Poland in the last twenty years resulted in dynamic changes also in computer technology and in information and communication technology, along with introduction of a new school subject – information and communication technology (ICT). Such a situation causes dilemmas: which of the new technologies should be adapted in schools, and first of all – how to teach environmental subject with application of modern technologies? These questions are becoming essential in education system of today, as contemporary student is a student who belongs to so called Digital Generation (Net Generation, Net Genrs), who has different possibilities than his/her colleagues from before 30 years (Don Tapscott 2008). This is a generation of people, who were born between 1982 and 2001, use digital technologies, are used to multimedia and have characteristic style of learning, thinking and communicating, where multitasking and speed dominate. This contemporary Digital Generation accounts for a great challenge for a school and mainly for teachers. Is teacher prepared for these changes? (Piotrowska, in press). Therefore, the aim of this article is to define influence of education transformation on utilisation of new information technologies, computers and the Internet by teachers in a didactic process and improvement of the key competence in geography teaching.

## CHANGE OF CURRIUCULUM VS NEW TECHNOLOGIES

Systemic transformation in geography education is evident in successively implemented reforms of social education system. ‘Podstawy Programowe

kształcenia ogólnego w poszczególnych typach szkół – Curricula for general education for each type of school of 1999' (Official Journal of the Republic of Poland of 15<sup>th</sup> Feb 1999 No. 14, pos. 129), 2001 (Official Journal of the Republic of Poland No. 61, pos. 625) and 2008 (Official Journal of the Republic of Poland: of 15<sup>th</sup> Jan 2009 No. 4, pos. 17), which are documents determining what and how is to be taught in each science, are special ground for comparisons. On the basis of the methods used in the paper, the author conducted research consisting in comparing and contrasting (tab. 1) the above mentioned documents, during which evident differences in wordings concerning new technologies in teaching geography were observed. In comparison to 1999, in the Curriculum of 2008, more precise picture, appreciating importance of application of new technologies in teaching can be found. Evident changes concern the way of defining goals of the general education, skills acquired and improved by a student during learning, as well as requirements, both general and detailed. These last ones are written in a language of education effects, which is a novelty for this document. Such a wording results from the requirements of Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning (Official Journal of the European Communities 2008/C 111/01). The quoted act accounts for more precise definition of what a school is obliged to teach an average student. This attaching much importance to the effects of education is taking place at the moment in European countries' education systems. There is a regulation in the current Curriculum of 2008 to the effect that: "An important challenge for a school on the third (secondary junior school – author's supplement) and the fourth (secondary senior school – author's supplement) stage of education is getting students ready to life in knowledge-based society. Teachers should create conditions for students to acquire skills of searching, arranging and using information from various sources with application of information and communication technologies during courses on different subjects. Achieving the above goals should be supported by well-equipped school library, possessing up-to-date collection both of books and multimedia resources" (Official Journal of the Republic of Poland of 15<sup>th</sup> Jan 2009 No. 4, pos. 17). Therefore, records of effects and achievements concerning geography teaching in primary school, secondary junior school (school stage introduced by the reform of 1999) and secondary senior school are worth further consideration. Table 1. presents selected records found in curricula of 1999, 2001 (when changes were introduced into secondary senior schools) and 2008 related to the new technologies on all education stages, prevailing numeration of achievements and goals of education occurring in the documents.

**Table 1.** New technologies in geography education in the Curricula of 1999, 2001 and 2008

	CURRICULUM <b>1999</b> <i>(OJ of 15<sup>th</sup> Feb 1999 No. 14, pos. 129)</i>	CURRICULUM <b>2008</b> <i>(OJ of 15<sup>th</sup> Jan 2009 No. 4, pos. 17)</i>
School (in general)	Teachers create conditions for students to acquire the following skills: 5) searching, arranging, and using information from various sources and effective utilisation of information technology.	Among the most important skills acquired by a student during general education on the third and fourth education stage one can find: 5) ability of efficient utilisation of modern information and communication technologies.
Nature – Primary school	<b>Achievements</b> 3. Acquiring and integration of knowledge necessary for describing natural phenomena.	<b>Education goals – general requirements</b> V. Observations, measurements and experiments. A student uses various sources of information; applies information and communication technologies.
Geography – Secondary junior school	<b>Achievements</b> 6. Utilisation of possibly various sources of information.	<b>Education goals – general requirements</b> I. A student is able to apply information and communication technologies in order to collect, process and present geographic information. Teaching contents – requirements: 4) a student presents, for example in a form of multimedia presentation ...
Geography – Secondary senior school	Curriculum of 21 <sup>st</sup> May <b>2001</b> <i>(OJ No. 61, pos. 625).</i>  Teachers create conditions for students to acquire the following skills: 5) searching, arranging and using information from various sources, effective utilisation of computers and information technology methods. <b>Achievements</b> 3. Utilisation of various sources of geographic information: (...) The Internet, GIS and other.	<u>Basic level:</u> Teaching contents – requirements: 9) a student explains what changes are taking place in the labour market in regional and global scale, resulting from development of information and communication technologies. <u>Extended level:</u> <b>Education goals – general requirements</b> IV. Acquiring, processing and presenting information on the basis of various sources of geographic information, therein information and communication technologies as well as Geographic Information System (GIS).

Source: Own elaboration on the basis of ordinances: OJ of 15th Feb 1999 No. 14, pos. 129, OJ of 15th Jan 2009 No. 4, pos. 17 and OJ of 21st May 2001, No. 61, pos. 625.

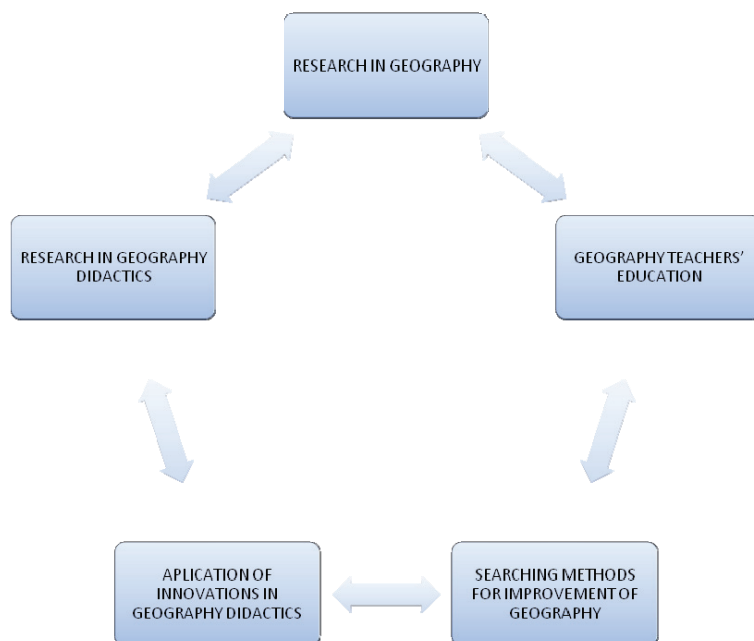
It results from the conducted comparative analysis of the records of education goals and requirements, that during systemic transformation, contents and

requirements related to application of information technologies in schools were significantly extended. In the newest legal modifications (2008) they were presented in an unequivocal and specific way, for example: "A student is able to use (...) information and communication technologies". This means that a teacher has to/should take into account examples of applying information and communication technologies in his work in geography teaching, not only for explaining phenomena and processes but also in a student's work, both this during lessons at school and at home.

Another novelty, however being a logic result of education activity caused by popularisation of computer utilisation at school and organising computer laboratories, is another MNE's (Ministry of National Education) legal regulation concerning possibilities for creating and using electronic textbooks (MNE's ordinance of 8<sup>th</sup> Jun 2009 on accepting textbooks for school use, OJ, No. 89, pos. 730). We can read there: "§ 9.1. Textbook, referred to in § 6–8, can be electronic and can be written on an IT data carrier or in the Internet". This implicates a different dimension of student's work, necessity of methodical modification and speedup of work during lessons (or rather slowdown?). MNE enriches teachers with another tools for carrying out their didactic job, which can be used appropriately, provided that teachers have abilities of using them. Otherwise, innovations in teachers' education are necessary.

#### CONTEMPORARY STUDENT VS INNOVATIONS IN GEOGRAPHY DIDACTICS

As an element of introduction for consideration innovations in geography didactics resulting from application of new technologies, I suggest to look closely to a picture of a contemporary student. Many authors discuss over what a contemporary student is like. Research and observations conducted by Youth Research Centre of Warsaw University has shown that only 19% of the students perceive teacher as an important source of knowledge, whereas majority (77%) seeks information in the Internet (Nowakowski, 2009). Moreover, as Dylak (2009) suggests it is extremely interesting that skills, important for functioning in the digital era, are developed by student in the net, outside the school. In this way, students form their innovativeness, problem solving skills, cooperation, communication and utilisation of the newest information and communication technology. In one word, they develop key competences in the field of knowledge, skills and attitudes. When we look at the list of key competences for lifelong learning which can be found in Education and Training Programme 2010 (MNE, 2006), apart from: "1. Communication in native language; 2. Communication in foreign languages" appear precisely „3. Mathematic competences



**Fig. 1.** Innovations and changes in geography teachers' education; source: Daudel 1990, Piotrowska 2000

and basic scientific and technical competences; 4. Information technologies competences; 5. Ability to learn; 6. Social and citizenship competences; 7. Initiative and entrepreneurship; 8. Culture consciousness and expression". Digital Natives, as Kołodziejczyk (2009, 2010) calls contemporary students, not only listen to different music and watch different movies than their teachers but, first of all, they use different communication tools. Net Generation is used to many impulses and is bored in a traditional classroom, while teachers complain about their lack of mental concentration.

Therefore, it is significant to use various innovations in the process of students' education, which introduced in an appropriate way, influence development of knowledge, qualifications and didactic skills, and as a final effect, they contribute to better education of the students. These assumptions are evident in a model presenting relations between introduction of innovations resulting from systemic transformation and potential changes in teachers training (fig. 1). Thus, it seems necessary to introduce changes into teaching methods initiated by teachers themselves. Teachers are people who should, above all, organise space for students to learn by application of new methods and work tools. Awareness of this is important, because Digital Generation is characterized by high level of technologic competences (this is a generation of people who were

born when majority of digital devices was accessible), communication and social skills (the Generation participates in conversations with their colleagues with application of social services on-line), multitasking (they carry out many tasks at the same time), as well as ability to simultaneous use and produce digital information (Tapscott 2008).

The observed systemic transformation in geography education should influence further teachers' development by utilisation of multimedia technologies, diversification of teaching methods, cooperation with students, focus on life-long learning (LLL) and projecting education programmes, which use Net Geners norms. Tapscott (2008) observes a current paradox consisting in change of paradigm: and so young people are very often teachers in the field of rapidly changing technology. As much as students manage perfectly good surfing the net, they find it difficult to create new knowledge with the information acquired there. And this is a moment, in which teacher's help is necessary.

#### **GEOGRAPHY TEACHERS TOWARDS NEW TECHNOLOGIES IN LIGHT OF THE CONDUCTED SCIENTIFIC RESEARCH**

On the basis of the results of the conducted comparative analysis of legal regulations determining all the structural and curricular changes in education, at the same time taking into account student's potential in the field of information technology competences, a scientific research was conducted in 2010 among teachers of environmental subjects. Issue of new technologies in education, which interests the author, should be referred to by presence and application in schools of computers together with software, multimedia projectors, the Internet as well as interactive boards. Also education platforms, which are more and more often introduced to schools is an example of new technology. *XI Ogólnopolskie Forum Nauczycieli Przedmiotów Przyrodniczych* (11<sup>th</sup> Polish Forum of Environmental Subjects Teachers) organised in September 2010 by Laboratory of Geography Didactics and Ecology Education in Faculty of Geographical and Geological Science of Adam Mickiewicz University in Poznań was an opportunity for conducting the research.

#### **RESEARCH METHODS**

From among diagnostic survey research methods a questionnaire was chosen and conducted on a randomly selected group of 111 teachers of nature in primary schools (25 people), geography in secondary junior schools (14 people) and secondary senior schools (14 people) as well as remaining mathematical

and environmental subjects (32 people) and humanities (26 people) from various places in Poland.

The aim of the research was to: 1) diagnose teachers' approach to the newest technologies, 2) recognise level of computer and multimedia techniques (computer programmes, multimedia presentations, the Internet resources) application in teaching environmental subjects in schools and 3) assessment of purposefulness and usefulness of multimedia application during lessons.

The questionnaire contained the following questions: 1) How often do you use a computer to get ready for didactic classes? 2) How often do you use a computer during lessons at school?, 3. Do you prepare multimedia presentations for your classes yourself? 4) Do you have a possibility for conducting lessons in environmental subject in computer laboratory? 5) Do you see a need for utilising multimedia during your lessons and why? The last, 6<sup>th</sup> question concerned assessment of information and communication technologies application in a didactic work.

## RESEARCH RESULTS

In the selected group dominated teachers working in school over 20 years (fig. 2), which accounted for 50% of the respondents. The teachers from secondary junior schools (almost 30%) and primary schools (almost 20%) accounted for the biggest percentage of the respondents. Teachers were neither classified by place of origin (schools in the cities or in the country) nor by size of a settlement, in which a school was localised.

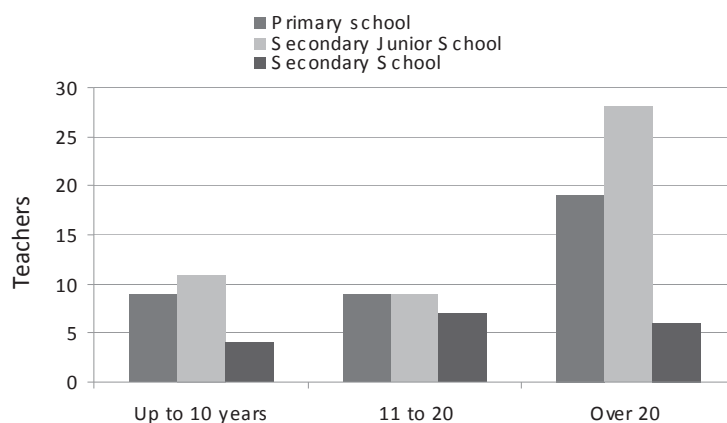


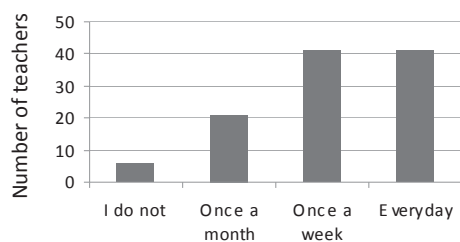
Fig. 2. Education job tenure of teachers; source: own elaboration



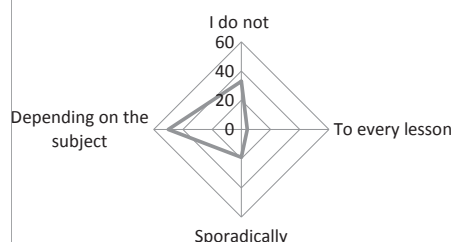
Information/multimedia technologies is probably the greatest challenge for teachers with the longest job tenure, as when they were being educated computers had just started to emerge in Poland. On the basis of the questionnaire it can be said that 95% of schools is equipped with computer laboratories while 67% of the teachers see a need for multimedia application on their lessons.

The below graphs present teachers' answers to the successive questions.

Great majority of the teachers (74%), irrespective of the subject, to the question concerning frequency of computer application in getting ready for a lesson and preparing teaching aids (fig. 3), answered that they use computer for getting ready to the lessons once a week or once a day.



**Fig. 3.** Frequency of computer usage by teachers during getting ready to didactics lessons; source: own elaboration

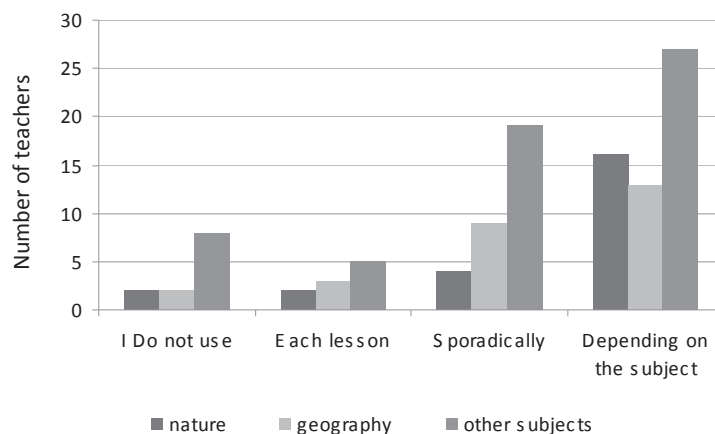


**Fig. 4.** Teachers who individually prepare multimedia presentations to lessons (number of answers); source: own elaboration

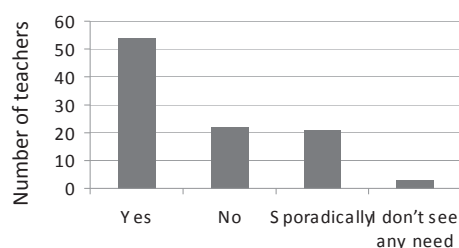
In the subject of preparing multimedia presentations by the teachers (fig. 4), 50% answered that he/she prepares presentations in relation to the subject, part sporadically and a small group for every lesson. 30% of the teachers do not prepare presentations on their own, which can be explained by lack of skills in this matter, lack of time or using ready presentations, elaborated by education publishers.

Declared way of preparing a lesson is not fully reflected in computer utilisation in the course of lesson (fig. 5). A small group works with a computer during lessons, whereas over 50% of teachers use it depending on a subject. For comparison, diversity in relation to subjects was also presented on this graph. Geography and nature teachers (48%) use a computer sporadically or, depending on a subject, for visualisation of the discussed issues, facilitation of carrying out an observation and explanation.

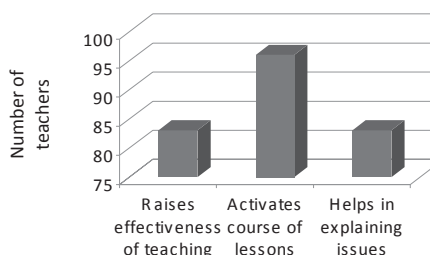
The successive question concerned possibility for conducting a lesson in environmental subject in a computer laboratory (fig. 6), because this is what multimedia education is all about.



**Fig. 5.** Frequency of computer application during the lesson; source: own elaboration



**Fig. 6.** Is there a possibility to conduct an environmental lesson in a computer laboratory; source: own elaboration



**Fig. 7.** Evaluation of usefulness of information and communication technology usage in didactic work; source: own elaboration

Teaching any subject, except for information technology, in a computer laboratory with full accessibility to educational programmes, the Internet and, for example, with connection to interactive board, creates perfect conditions for work, creation, analysis and, first of all, visualisation of phenomena and processes. It refers to the illustrative aspect of education, which is particularly important in geography. Over half of the questioned teachers has the same possibility for conducting lessons in computer laboratory at school (fig. 6).

The last question in the questionnaire considered usefulness and purposefulness of information and communication technology (ICT) application in didactic work. Opinions, which appeared most often, presented in fig. 7, unanimous among teachers regardless of the taught subject show that application of computers, software makes course of lesson more attractive (86% of teachers),

helps to explain discussed issues, processes and phenomena (74%) and rises teaching effectiveness (74%).

What is more, 67% respondents see a need for using multimedia during their lessons. Among the answers given to the question: „do you see a need for using multimedia on your lessons and why?“, the following can be found most often (quotations of teachers' answers from questionnaires):

- multimedia activate students,
- speed up course of lesson and rise concentration,
- facilitate understanding,
- by access to the Internet – quicker collection of information,
- cause deeper emotional engagement of students,
- inspire students to activity,
- enrich lessons,
- develop imagination,
- arouse interest in the subject,
- influence a lot of senses,
- motivate to individual work,
- this is “their way” of effective communication of knowledge,
- increase potential for perception of experiments and simulation of phenomena as well as support other methods,
- more comprehensible lessons,
- students are more willing to participate in such classes
- increase potential for presentation of experiments, simulation of phenomena
- it is necessary to keep abreast of the times,
- encourage to work at home”.

The above quoted opinions prove that teachers are convinced of the role played by information and communication techniques in a contemporary school. Differences, which were observed in the teachers answers concern parts of lessons, in which techniques may be applied; beginning with using ICT during a whole lesson, through its application during particular parts of a lesson only, to, finally, using ICT for summary. There is a significant individualisation in the approach here, but it is considered to be right.

The conducted research proves increase of teachers' awareness of technological changes, which are taking place at the moment. This tendency has been observed for a long time now, although it certainly rose after implementation of successive reforms. Researches conducted earlier, from the middle 80s of 20<sup>th</sup> c. had brought up, at first, issues of computer application as didactic means (Podgórski, 1988), then definition of their influence on understanding geographic terms, skills formation, teaching effectiveness as well as causes for computer application during geography lessons and interests in possibility of using new technologies in education process (Podgórski, 1991). As Podgórski writes

(2007), also teachers' approach to using computers in education process has changed.

This change was observed also during the currently conducted research. In comparison to the previous researches, increase in accessibility of computers was observed in schools, while programme "Interklasa" (Interclass) inspired by Ministry of National Education, caused emergence of computer laboratories in every school in Poland, which can be observed until today. Thus, teachers' answers confirm growing tendency of information technologies application in schools. As majority of teachers uses or sees a need for using computers during geography and nature lessons, whereas part of them seeks ideas for preparing such lessons, teachers' education and trainings in new technologies and multimedia may be very important and helpful.

#### MULTIMEDIA FOR GEOGRAPHY TEACHING

Trainings teaching an appropriate and effective application of multimedia, projects and education portals in geography teaching should be numbered among the above mentioned innovations executed within geography didactics. Innovative projects conducted skilfully during geography lessons may stimulate and motivate students. Modern devices such as computers, multimedia projectors or interactive boards account for the essence in educating contemporary, creative teacher. *Multimedia in Teaching Geography and Nature*, a course proposed within geography education, which has been conducted on Faculty of Geographical and Geological Science UAM in Poznań for a few years (Piotrowska, 2010) is an example of new technologies application. Multimedia should be understood as a general term for means of communication using many forms of transmission. When we talk about multimedia we usually think about combination of a few of the following elements: text, picture (static – graphics/ photograph or motion – movie/animation), sound (music, speech) and additionally, if we talk about multimedia in computers, there is application of links. In such a meaning, multimedia education consists in using rationally and functionally selected simple or combined and technical didactical aids in teachers' didactic work. Multimedia is applied in order to fulfil didactic tasks, activate cognition, individual knowledge acquiring and problem solving.

The proposed subjects include: creation of Power Point presentations, application of the Internet and Google Earth during geography and nature lessons, creation of teaching aids with application of graphic programmes, presentation of potential of selected GIS programmes utilisation in school practice (Piotrowska, 1996) and software supporting GIS as well as application of education portals. Thus, multimedia approach integrates both knowledge in its essence,

methods and information technology. Whereas planning lesson units with application of multimedia makes it possible for a teacher to visualise presented issues and helps students to understand it. Teacher prepared in this way may consciously and creatively use various conquests of technology, portals, education platforms and e-learning, that is a technique using electronic media as a new mean of communication between teachers and students. Contemporary technological challenges of 21<sup>st</sup> century make it necessary to adapt to new conditions of didactic work. Part of the teachers approve of the present situation, some underestimate it, while the remaining ones participate in trainings, as they see an opportunity to arouse students' interest in their subject. Introduction of various innovations to teaching process is a way of adapting to the changing circumstances. Therefore, what advices should be given for the contemporary teachers? The most important are: application of technologies in a classroom (rationally, functionally and optionally); diversification of teaching methods; cooperation with students; focus on lifelong learning and utilisation of curricula.

Policy-makers reiterate that a teacher should be an architect of student's knowledge and should plan teaching process in a virtual visual environment by appropriate adaptation of teaching methods for a given science. Hence, another systemic transformation and the reality forces teachers' adaptation to circumstances in which they work. Thanks to technological inventiveness of the world today, didactic process can be made much more attractive.

#### SUMMARY

Influence of education transformation, driving force behind which were successive school reforms, on improvement of the key competence is evident. Geographers and geography teachers make a great effort so that the applied tools and methods, more and more advanced, bring intended teaching effects, with a special focus on forming the key competences. Introduction of various innovations into geography didactics causes a situation in which a young person takes part in active education, transfer of his/her knowledge and more thorough understanding of the contemporary world. This imposes special tasks on geographers of all the education stages. It stimulates them to further, constant deepening and verifying knowledge, which is, anyway, accordant with the programme of lifelong learning included in Education and Training 2010 Programme. It is a challenge for a university to get teachers ready appropriately for working at school of the 21<sup>st</sup> century with the teenagers of Digital Generation, in the aspects of the main key competence and skills, which are creativity, innovativeness and functioning in diversified, multicultural as well as virtual environment.

## References

- Dylak S., 2009, *Nauczyciel wobec uczniowskiego uwikłania w sieć*. [Teacher vs. student's entanglement in the Internet], <http://www.ckp.edu.pl/konferencja/wyklady.html>
- Kołodziejczyk, W., 2010, *Pokolenie Y*. [Y Generation] [in]: *Uczyć łatwiej* [To teach more easily], Wyd. Szkolne PWN, Warszawa.
- Kołodziejczyk, W. 2009, iMózgi w e-szkole [iBrains in e-school], *Focus*, 9, 2009.
- Tapscott D., 2008, <http://dontapscott.com/books/grown-up-digital>
- Nowakowski Z., 2009, *Nowa edukacja dla pokolenia sieci, czyli e-podręczniki na platformie edukacyjnej* [New education for the Net Generation – e-handbooks on education platform], <http://www.ap.krakow.pl/ktime/ref2009/nowakows.pdf>.
- Piotrowska I., 1996, *Wykorzystanie Geograficznych Systemów Informacyjnych w nauczaniu geografii* [Usage of Geographic Information System in geography teaching], [in]: Jarowiecki J., Piskorz S. (edit), *Różne drogi kształcenia i doksztalcania nauczycieli geografii* [Different ways of educating and schooling geography teachers], Wydawnictwo WSiP, Kraków, pp. 136–143.
- Piotrowska I., 2000, *Geografia a praktyka szkolna w nowym systemie edukacyjnym* [Geography and school practise in new educational system], [in]: *Geografia w reformowanym systemie szkolnictwa. Nowoczesna Szkoła* (Geography in reformed school system. Modern school), 3. Wydawnictwo Naukowe Akademii Pedagogicznej, Kraków, pp. 39–47.
- Piotrowska, I. 2010, *Rola dydaktyki geografii w kształceniu twórczego nauczyciela* [Role of geography didactics in educating a creative teacher], [in]: A. Kwaterra, P. Cieśla (ed.), *Rola i zadania dydaktyk przedmiotowych w kształceniu nauczycieli* [Role and tasks of subjects' didactics in educating a teacher], UP, Kraków, pp.136–144.
- Piotrowska I., (printing), *Współczesne pokolenie cyfrowe wyzwaniem dla szkoły* [Modern Digital Generation as a challenge for schools], Pedagogia, Poznań.
- Podgórski Z., 1988, *Przykład zastosowania mikrokomputerów w nauczaniu geografii* [Case of microcomputers usage in geography teaching] *Geografia w Szkole*, 2, pp. 116–117.
- Podgórski Z., 1991, *Podnoszenie skuteczności nauczania geografii przez zastosowanie mikrokomputerów* [Raising effectiveness of geography teaching through usage of microcomputers], [in]: Falkowski J., Świtalski E. (ed.), *Geografia jako nauka i przedmiot nauczania w Polsce* [Geography as a science and a school subject in Poland], UMK, Toruń, pp. 21–29.
- Podgórski Z., 2007, *Wybrane aspekty badań nad stosowaniem komputerów nauczaniu geografii* [Selected aspects of research over computer usage in teaching geography], *Geografia w Szkole*, No. 2, pp. 31–38.
- Polska na tle innych państw członkowskich UE w realizacji Programu `Edukacja i szkolenie 2010* [Poland vs. other EU members in implementing Education Programme and training 2010], Materiał opracowany przez MEN, Departament Współpracy Międzynarodowej [Paper elaborated by MEN, Department of International Cooperation], 2006, Warszawa.
- Szkoły na miarę XXI wieku. Dokument roboczy Stuzb Komisji, Komisja Wspólnot Europejskich UE* [Schools for the 21<sup>st</sup> century. Commission Staff Working Document, Commission of the European EU], 2007, Bruksela.