THE USE OF INFORMATIONAL TECHNOLOGIES IN GENERAL EDUCATION SCHOOLS IN LITHUANIA

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Abstract

Contemporary school is inconceivable without the integrated interactive learning tools and informational technologies (hereinafter referred to as IT) in the education process. Recently teachers' ability to efficiently use these technologies has become particularly important. However, according to the research, IT integration in the learning process is insufficient. The aim of this research is to analyse the experience of teachers in using IT during lessons. Data demonstrates, the higher IT competence of teachers, the more they are convinced that IT has positive influence on education and can make education process more effective. The research demonstrated, that teachers with shorter length of in-service teaching experience do not fully use IT possibilities in organising education process in schools.

Introduction

Pursuant to the international and national documents, in order to achieve economic growth, long-term competitiveness and greater social cohesion, it is necessary to strengthen the innovative and creative potential of European citizens by enhancing the „specialist training factor" in the so-called knowledge triangle consisting of scientific research, innovation and education (European Commission Communication „Europe 2020"); to create competitive knowledge economy based on the latest technologies and qualified human resources (Lithuanian Innovation Strategy for 2010-2020). Thus, rapidly changing economic, social and political conditions and penetration of new technologies require different, i.e. innovation-driven educational science specialists capable of applying the university knowledge, initiating projects, integrating various methods/ tools and contributing to changes in education. One of the most significant factors of these innovations is teachers' ability to effectively use educational technologies: the framework for action by building new teaching forms and methods; regulation of educational content, design, organisation and performance of education process via the use and coordination of technical and human resources (Bitinas, 2000; Jucevičienė, Brazdeikis, 2003; Ross & Lowther, 2009). A special focus is given to methods (Anderson, Weert, 2002; Dagienė, Kurilovas, 2009, Fredriksson, Gajek, Jedeskog, 2009) applied through ITs and e-learning environment.

European Union (EU) and UNESCO institutions place great importance on integration of IT in the education process and on the teacher IT competences, since successful integration enhances learning process, makes it more attractive, promotes cooperation, authentic learning, motivation of pupils and teachers, and helps to effectively solve problems in the current IT-driven world (The ICT Impact Report, A Review of Studies of ICT Impact on Schools in Europe, 2006). According to the strategic EU documents, promotion of teachers' creativity and innovation through IT is one priority area, therefore focus should be given to teachers' IT qualification (Teaching and Learning for an ICT Revolutionised Society, 2010, Key Data on Learning and Innovation through ICT at School in Europe, 2011).

According to the research, in other countries integration of IT in the learning process is also insufficient; most often schools fail to develop the vision on the effective integration of IT in the education process (Kuskaya-Mumcu, Koçak-Usluel, 2013) and are not able to reach their full potential (Fredriksson, Gajek, Jedeskog, 2009). The main causes are: absence of common policy in the EU Member States, and lack of trust, competence and resources in IT integration (Bingimlas, 2009). Understanding the need for IT usage in education shall go hand in hand with highly qualified human resources and with the innovation-friendly teacher training/qualification development institutions (Teaching and Learning for an ICT Revolutionised Society, 2010).

The research revealed that changes related to integration of IT in education are slow, whereas the impact of IT on teaching highly depends on IT usage in the education process (The ICT Impact Report. A Review of Studies of ICT Impact on Schools in Europe, 2006). Basic ICT skills are insufficient to teach pupils (E-Teacher 2.0 Empowering Teacher´s ICT-Pedagogical Competencies. 2010). Effective IT integration requires fundamental changes in teaching/teaching framework, teaching paradigms/methods and consolidation of new methodologies; thus teachers should have the opportunity to engage in training, to deepen their understanding and mastery of ICT as a tool for innovating teaching approaches[1].

According to the research (Fraillon, Ainley, & etc., 2013), most often teachers use computers outside school or for other purposes and non-use of IT is related to the lack of resources or to the teachers' attitudes (Navickaitė, 2010). Only a small number of teachers use electronic teaching/learning tools (Orintienė, Lazauskienė, 2010). The research revealed that so far there is no major breakthrough in the education process regarding the IT due to the narrow-minded attitude of teachers toward the use of IT in the teaching/learning process;

[1] A Framework to Support Teachers' CPD in the use of ICTs. Public Progress Report, 2007; Punie, Zinnbauer, Cabrera, 2006; Key Data on Learning and Innovation through ICT at School in Europe 2011

besides, the aims of education and practical teachers' activity are still directed toward traditional teaching (Teacher Training on Use of Information and Communication Technology, 2009; Tamošiūnas, 2010; Paulionytė et al. 2010).

According to the data of OECD Teaching and Learning International Survey (TALIS), the major need for further improvements in Lithuania is related to the teaching practice and understanding/adopting relevant methods. Whereas globally the major professional development needs are in the rapidly changing areas due to globalisation, e.g. teachers' ability to use/apply ICT in the education process (Information Technologies in the 21st Century Schools, 2010, Professional Development of Lithuanian Teachers, 2010).

The research revealed that Lithuanian students' level of computer/information literacy is moderate. Although students do have basic skills, they are less successful in accomplishing creative and independent tasks (Fraillon, Ainley, & etc., 2013); besides, students are more likely to use computer at home rather than at school, and the use of the virtual learning environment (especially outside school) is still not common in many countries (Survey of Schools: ICT in Education. Benchmarking Access, Use and Attitudes to Technology in Europe's Schools, 2013). The main factor determining the level of students' IT skills is the teacher capable of organising and managing the IT-based teaching/learning process in a creative manner. However, the survey (Survey of Schools: Information Communication Technology (ICT) in Education. Information about Lithuania) revealed that teachers use IT in teaching/learning on rare occasions. Development of IT competency and possibilities for further development could be specified only after an in-depth situation analysis and the analysis of the current experience in using IT during lessons in Lithuanian general education institutions.

Methodology of Research

The research was based on the methodological (or normative) paradigm of quantitative research for social sciences interpreting social reality as a positivist attitude. The normative model is based on two main ideas: 1) human behaviour is essentially rule-governed; 2) human behaviour should be investigated by the methods of natural science (Kardelis, 2007). In view of this focus is given to the relationship between the theory and the empirical research. Usually quality is determined by quantitative indicators. According to the global science, quantitative analysis is a typical procedure required for an in-depth research (Bitinas, 2006).

Sample of Research

The research analysis includes: the impact of IT on teaching/learning (Punie, Zinnbauer, Cabrera, 2006; Ross & Lowther, 2009); connection between the use of IT tools and teaching methods (Dagienė, Jasutienė, 2007 (a); Dagienė, Jasutienė, 2007 (b); Means, 2010, Kriliuvienė, 2010, Pečiuliauskienė, 2010, Prell, 2011, Brazdeikis, Masaitis, 2011, Gudonienė, 2011), and application of the IT-based educational environment (Brazdeikis, 2010; Jucevičienė, 2013; Žadeikaitė, Gulbinas, 2014). Teacher competence issues are considered by the researchers as one of the key IT usage factors (Anderesen, Weert, 2002; Jucevičienė, 2005; Dagienė, Kurilovas, 2009; Gedvilienė etc., 2010, Jucevičienė, Brazdeikis, 2012), as well as problems related to IT integration into subject teaching (Bingimlas, 2009; Navickaitė, 2010; Orintienė, Lazauskienė, 2010; Tamošiūnas, 2010; Paulionytė et.al, 2010; Lukšėnienė, Žygaitienė, Pošiūnaitė, 2014).

Instrument and Procedures

The instrument of the research is a questionnaire survey for teachers. In order to determine the internal consistency (reliability) of questionnaire scales, Cronbach's alpha coefficient was applied (based on the correlations between variables and evaluating on whether the sample size is adequate (Pukėnas, 2011): questionnaire block on pedagogues' competence in integrating IT into subject teaching - Cronbach's Alfa (α=0.764); questionnaire block on the use of IT during teaching process – Cronbach's o Alfa (α=0.806). According to the obtained results, the indicators selected in the questionnaire define the analysed features; their analysis will determine teachers' attitude toward implementation of IT tools in the education process and their experience in applying these tools in practice

The research involved 605 teachers working in pro-gymnasium (n=277) grades 7-8 and gymnasium (n=328) grades 10-11 of the four largest Lithuanian cities. The sampling was based on a cluster sampling method due to a wide spread of teachers' population. In view of this, teachers have been selected after a random selection of pro-gymnasiums/gymnasiums. This is a representative sampling assuming a 95 percent confidence level and a margin of error of 5 percentage points. The research analysis was done using SPSS 18 (*Statistical Package for Social Sciences*) software package. The methods of dispersive and cross-

correlation analysis and multiple regression have been applied to process the obtained data (Vaitkevičius et al., 2006; Longitudinal data analysis, 2009).

Results of Research

The study science teachers (n=605): teachers of mathematics (25.2 percent), biology (24.9 percent), physics (25.1 percent) and chemistry (24.8 percent). By pedagogical qualification the breakdown of teaching staff was as follows: teachers (24.6 percent), senior teachers (24.5 percent), teachers-supervisors (25 percent) and teachers-experts (26 percent).

The research included qualified and competent teachers: 58.7 percent of respondents reported 10 and more years of pedagogical experience, 27.1 percent – 15-25 years, and 12.2 percent reported having more than 25 years of experience.

The IT (information technology) experience of pedagogies in the learning process is determined by multiple interrelated or interdependent variables. In view of this, correlation analysis was applied, as well as calculation of Spearman's correlation coefficient ($\mathbf{r_s}$). The correlation analysis included teachers' knowledge, abilities, attitude changes and ICT tools most frequently used in subject teaching. Table 1 provides only statistically significant outcomes.

Table 1. Pedagogues' knowledge and ICT tools Spearman correlation coefficient (r_s)

Pedagogues' knowledge, abilities and attitudes	**ICT tools**							
	Personal Computer	Notebook computer (laptop)	Educational computer applications	Electronic calculators	Handheld computers	Video camera	Interactive board	Email
I am aware of the main provisions for integration of ICT in the study subject	**0.506*****	**0.780*****	**0.817*****	**0.937*****	**0.755****	**-0.937*****	**0.879****	**0.754****
I am able to integrate ICT in some topics of the study subject	–	–	–	**0.655*****	**0.348*****	**0.655*****	**-0.357*****	**0.348*****
I am able to integrate ICT in any topic of the study subject	**0.506*****	**0.780*****	**0.817*****	–	–	–	**0.879****	–
I am aware of ICT learning environments appropriate for the study subject	**0.422*****	**-0.525*****	**-0.360*****	**0.341*****	**0.187*****	**0.341*****	**-0.448*****	**0.187*****

I am able to use ICT learning environments in the study subject	**0.506*****	**0.780*****	**0.817*****	**-0.337*****	**0.755*****	**-0.931*****	**0.879*****	**0.755*****
I can create learning environments via ICTs	**-0.443*****	**0.348*****	**0.342*****	**0.480*****	**0.255*****	**0.480*****	–	**0.255*****
I can provide consultations to other teachers on ICT application.	**0.608*****	**0.525*****	**0.568*****	–	**0.572*****	–	**0.749*****	–

$^{*}p<0.05$; $^{**}p<0.0$; $^{***}p<0.001$

Pursuant to the data analysis, the better pedagogues evaluate their knowledge on basic provisions for IT integration in the subject teaching, the more frequently they use personal computer (**r_s=0.506, p<0.0001**), notebook (**r_s=0.780, p<0.0001**) computer, educational computer applications (**r_s=0.817, p<0.0001),** electronic calculators **(r_s=0.937, p<0.0001), handheld computers (r_s=0.755, p<0.001), interactive boards (r_s=0.879, p<0.001) and emails (r_s=0.754, p<0.001)** in subject teaching.

It turned out that pedagogues who are able to efficiently integrate ICTs in separate topics of a subject, most often use electronic calculators and video cameras **(r_s=0.655, p<0.0001**). And vice versa, the better pedagogues evaluate their knowledge on basic provisions for integration of ICT in the study subject and are able to use the available ICT learning environment in subject teaching, the less they use video cameras (respectively **r_s= -0.937, p<0.0001** and **r_s= -0.931, p<0.0001)**. This suggests that the tools like electronic calculators and video cameras are not widely applied and could be used only in teaching separate topics of a subject. A similar tendency is observed also in evaluating other knowledge, abilities and attitudes of pedagogues.

According to the obtained results, the aims of ICT usage during lessons correlate with the pedagogues‘ competence. Four levels of pedagogues’ ICT competence were analysed: (1 Behavioural level of competence, i.e. elementary behaviour according to the requirements of a workplace; 2) Additive level of competence, i.e. behaviour and knowledge interpreted as value added; 3) Integrative level of knowledge, i.e. knowledge integration via creative activity; 4) Holistic competence (Jucevičienė, 2005). The level of pedagogues‘ competence is a derived indicator obtained by calculating and transforming pedagogues‘ knowledge, abilities and skills.

According to the research, the more teachers consider themselves as competent pedagogues, the more they are convinced that ICT facilitates collaborative work of teachers and students **(r_s=0.732, p<0.0001)**. ICTs help to generate a pleasant atmosphere in the

classroom **(r_s=0.610, p<0.0001)**, diversifies learning process and makes learning more attractive **(r_s=0.496, p<0.0001)**.

The research revealed that ICT opportunities during the learning process are related to the pedagogical work experience: usually teachers with an extensive pedagogical work experience are among those who say that the use of ICT impedes learning process due to the poor computer provision in schools **(r_s=0.523, p<0.0001)**. In other words, the pedagogues having a more extensive pedagogical work experience say that the better is computer provision in school the more possibilities they have to apply ICTs in the education process.

It has been noted that respondents with shorter pedagogical experience more positively evaluated ICT as a tool providing for a more effective control of the education process **(r_s= -0.732, p<0.0001)**. This means that lack/absence of pedagogical experience prevents from an adequate evaluation of the situation. In conclusion it could be said that pedagogues having no extensive pedagogical work experience use all ICT opportunities in organising the education process in general education schools, and usually apply ICTs as a control measure.

In order to analyse the experience of ICT usage in general education schools, it is necessary to identify factors having major influence on the formation of pedagogues' attitude. In view of this, a regressive analysis was applied for data analysis. Regression analysis is a statistical process for estimating the relationship among variables and anticipating the meanings of one variable according to changes in other variables. A multiple linear regression model was applied. Dependent variables determining ICT evaluations have been selected (*ICT facilitates collaborative work between teachers and students (promotes cooperation); use of ICT improves atmosphere in the classroom (there is no competition among pupils, they feel safe/protected and less distracted etc.); ICTs allow to better monitor the education process; the use of ICT diversifies the opportunities of learning and makes learning more attractive,* as well as independent variables (*pedagogues' work experience, qualification, subjects taught, ICT competence).* Indicators of suitability of the regression model are presented in Table 2.

Table 2. Assessment of suitability of the multiple regression model

No	Dependent variables: pedagogues' evaluation	R^2	R^2_{α}	ANOVA	Durbin-Watson(d)

1.	ICT facilitates collaborative work between teachers and students (promotes cooperation)	0.692	0.690	p<0.000	d=1.405
2.	The use of ICT improves atmosphere in the classroom (there is no competition between students, they feel safe/protected and less distracted etc.)	0.411	0.407	p<0.000	d=2.162
3.	ICTs allow to better monitor the education process	0.463	0.460	p<0.000	d=2.090
4.	The use of ICT diversifies the opportunities of learning and makes learning more attractive	0.359	0.355	p<0.000	d=1.405

R^2 – determination coefficient indicating on whether the model fits the observed data. High value of the coefficient of determination means model adequacy (the required $R^2 \geq 0.25$. Durbin-Watson (d) criterion indicates that there is no autocorrelation in the mode (d statistics is close to 2).

Below there is an illustration of the statistical values of the dependent variable *"ICT facilitates collaborative work between teachers and pupils"* and independent variables "*pedagogical work experience, pedagogue's qualification, taught subject, pedagogue's ICT competence"* by applying the method of multiple regression analysis (see Table 3).

Table 3. Multiple regression model. ICT evaluations: ICT facilitates collaborative work between teachers and pupils

Dependent variable (Y_1)	**Independent variables**	**Constant**	**Non-standardised coefficients**			**Standardised coefficients**		
			b	**F**	**ANOVA p**	**β**	**t**	**p $H_0: b_j = 0$**
ICT facilitates collaborative work between teachers and students	Pedagogical work experience	-0.813	-0.044	337.435	0.0001	-0.187	-7.839	0.0001
	Pedagogue's qualification		-0.129	337.435	0.0001	-0.311	-13.457	0.0001
	Taught subject		-0.035	337.435	0.0001	-0.085	-3.688	0.0001
	Pedagogue's ICT competence		0.785	337.435	0.0001	0.676	28.759	0.0001

The values of the indicated *b* coefficients are low but significant from the statistical point of view (p<0.001). Coefficients of pedagogical work experience, pedagogue's qualification and a subject taught are negative, therefore the increasing coefficient reduces the estimate of a dependent variable (*ICT facilitates joint work of teachers and pupils*) unless this decrease is outweighed by the coefficient of ICT competence. Pedagogue's qualification has

negative impact on this dependent variable (β= -0.311), whereas positive result is determined by the increasing pedagogues‘ ICT competence (β=0.676).

Such a logical construction of the data analysis is also applied for the analysis of other dependent variables (Table 4).

Table 4. Multiple regression coefficient (*β estimates*) for pedagogues‘ evaluation

No	Dependent variables (Y_i): pedagogues‘ evaluation	Constant	X_1 Pedagogues‘ qualification	X_2 Taught subject	X_3 Pedagogical work experience	X_4 Pedagogues' ICT competence
1.	ICT facilitates collaborative work between teachers and pupils (promotes cooperation)	-0.813	**-0.311** p=0.0001	-0.085 p=0.0001	-0.187 p=0.0001	0.676 p=0.0001
2.	The use of ICT improves atmosphere in the classroom (there is no competition between students, they feel safe/protected and less distracted etc.)	-1.048	-0.015 p=0.630	0.088 p=0.006	-0.169 p=0.0001	0.575 p=0.0001
3.	ICTs allow to better monitor the education process	0.138	-0.306 p=0.0001	0.007 p=0.817	-0.341 p=0.0001	0.393 p=0.0001
4.	The use of ICT diversifies the opportunities of learning and makes learning more attractive	-0.187	0.448 p=0.0001	0.123 p=0.0001	0.269 p=0.0001	0.267 p=0.0001

The provided standardised estimates of β coefficient with respect to all statements demonstrate that pedagogical work experience has negative impact on pedagogues‘ evaluation regarding the following statements: *ICT facilitates collaborative work between teachers and pupils* (β= -0.187); the use of *ICT improves atmosphere in the classroom* (β= -0.169); *ICTs allow to better monitor education process* (β= -0.341). According to the research, pedagogues‘ qualification (β= 0.448) has positive impact on pedagogues‘ evaluation (*The use of ICT diversifies the opportunities of learning and make learning more attractive).*

Regression equation was determined by using the non-standardised coefficient estimates (b) allowing to identify which variables have major weight in forming pedagogues‘ views on the use of ICT during the learning process. Below there is the equation of the fourth dependent variable *the use of ICT diversifies the opportunities of learning and makes learning more attractive.*

$$\mathbf{Y} = -0.187 + 0.448 \cdot x_1 + 0.123 \cdot x_2 + 0.269 \cdot x_3 + 0.267 \cdot x_4$$

It has been noted that *pedagogue‘s qualification* has major impact on the formation of pedagogues’ attitudes (β= 0.448).

In applying the dispersion analysis (ANOVA) major differences have been determined between the pedagogues of different subjects (mathematics, physics, etc.) and time allocated for ICT integration (F=1.668; p=0.173). In view of this, the analysis was

pursued by applying the Scheffe criterion ($p<0.01$). It was established that statistically the major difference was in the time allocated by the teachers of biology and mathematics in integrating ICT tools in teaching subjects during the recent three months. On average teachers of mathematics allocated about 50 percent of their time for integration of ICT tools (teachers of biology – about 30 percent).

Conclusions

The aims of ICT usage during lessons precisely correlate with the pedagogues‘ ICT competence. Teachers mastering ICT skills realise that ICT usage for educational reasons has positive impact on education and can increase effectiveness of the process; this determines diversity of ICT usage goals.

Pedagogues‘ work experience correlates with the ICT usage during the teaching/learning process: pedagogues with longer work experience have more experience in ICT usage and see more possibilities for ICT usage in the teaching/learning process. Teachers having short pedagogical work experience relate the use of ICT during lessons to the improvement of organisational lesson elements (atmosphere, control).

Pedagogues‘ opinion about the use of ICT during the learning process is mainly determined by their qualification, work experience and ICT competence.

References

1. A Framework to Support Teachers’ CPD in the use of ICTs. Public Progress Report (2007) Retrieved 21/02/2014, from http://eacea.ec.europa.eu/llp/projects/public_parts/documents/ict/pr_ict_etq.pdf
2. Anderson, J. & van Weert, T. (Eds).(2002). Information and Communication Technology in Education: A Curriculum for Schools and Programme of Teacher Development. Paris: UNESCO. Retrieved 25/08/2014, from http://unesdoc.unesco.org/images/0012/001295/129538e.pdf
3. Bingimlas, K., A. (2009) Barriers to the Successful Integration of ICT in Teaching and Learning Environments: *a Review of the Literature. Eurasia Journal of Mathematics, Science and Technology Education*. 5(3), 235-245.
4. Bitinas, B. (2000). *Ugdymo filosofija.* Vilnius: Enciklopedija.
5. Bitinas, B. (2006). *Edukologinis tyrimas: sistema ir procesas*. Vilnius: Kronta.
6. Brazdeikis, V. (2010) Švietimo informacinių sistemų integracija// E. Švietimas: mokslas, studijos ir verslas : konferencijos pranešimų medžiaga, Kaunas: Technologija. Retrieved

21/02/2014, from http://www.lvu.lt/cms/files/liedm/resources/3931_e_svietimas_pranesimu_medziaga.pdf

7. Brazdeikis, V.; Masaitis, M. (2011) Kompiuterinės mokymo priemonės edukacinėse ir mokymosi aplinkose XV kompiuterininkų konferencijos mokslo darbai. 33 – 45. Retrieved 21/02/2014, from http://eia.libis.lt/viesas/Leidiniai/XV_kompiuterininku_konferencijos_mokslo_darbai/KODI2011-md-2-leidimas.pdf
8. Dagienė, V., & Kurilovas, E. (2009) Informacinių ir komunikacinių technologijų diegimo švietime patirties Lietuvoje ir užsienio šalyse lyginamoji analizė. *Pedagogika, 95, 112-119.*
9. Dagienė, V., Jasutienė, E. (2007a). Skaitmeniniai aplankai ir tinklaraščiai vertinant IKT kompetenciją. *Informacijos mokslai, 37-42.*
10. Dagienė, V., Jasutienė, E. (2007b). Informacinės technologijos matematikai vizualizuoti ir tyrinėti. *Informacijos mokslai, 76-88.*
11. E-Teacher 2.0 Empowering Teacher´s ICT-Pedagogical Competencies. (2010) Europos komisijos finansuotas projektas. LLP-LdV-ToI-2010/DK-1010. Retrieved 17/09/2014, from www.adam-europe.eu/prj/6574/project_6574_en.pdf
12. Fredriksson, U., Gajek, E., Jedeskog, G. (2009) Ways to use ICTin schools to optimize the impact on teaching and learning. *Acta Didactica Napocensia. 2 (4), 21-32.*
13. Fraillon, J., Ainley, J. & etc. (2013) Preparing for Life in a Digital Age the IEA International Computer and Information Literacy Study International Report. Retrieved 21/02/2014, from http://research.acer.edu.au/cgi/viewcontent.cgi?article=1009&context=ict_literacy
14. Europos Komisijos komunikatas "2020 m. Europa. Pažangaus, tvaraus ir integracinio augimo strategija. KOM (2010) 2020.
15. Gedvilienė, G., Laužackas, R., Tūtlys, V. (2010). *Mokytojų kvalifikacijos tobulinimo poreikiai. mokslo studija*. Kaunas.
16. Gudonienė, D. (2011) Naujų IKT metodų taikymas Lietuvos mokyklose// XV kompiuterininkų konferencijos mokslo darbai. 86 – 97. Retrieved 21/02/2014, from http://eia.libis.lt/viesas/Leidiniai/XV_kompiuterininku_konferencijos_mokslo_darbai/KODI2011-md-2-leidimas.pdf
17. Indrašienė, V., Penkauskienė, D., Suboč, V., Matonytė, A. Kritinio mąstymo ugdymo principų integravimas į Lietuvos bendrojo ugdymo sistemą (2010). Retrieved 20/12/2014, from: http://www.sdcentras.lt/pr_ctp/tyrimas.pdf
18. Informacinės technologijos XXI amžiaus mokyklose (2012). *Švietimo problemos analizė. Nr. 7 (47).*
19. Jucevičienė, P. (2005). Pedagogų rengimas IKT DIEGIMO Lietuvos švietime aspektu. Mokslinis tyrimas. Retrieved 15/01/2014, from http://www.itc.smm.lt/wp-content/uploads/2009/11/Pedagogu-rengimo-IKT-diegimo-Lietuvos-svietime-asp.pdf
20. Jucevičienė, P., Brazdeikis ,V. (2003). Pedagogo IKT kompetencijos dinamiškos struktūros pagrindimas. *Socialiniai mokslai.2 (39).*
21. Jucevičienė,P., Brazdeikis V. (2012) The effectiveness of ICT competence evaluation strategies. Research papers. *Societal Innovation for Global Growth vol. 1*, 367-375. Retrieved 01/08/2015, from: http://socin.mruni.eu/wp-content/uploads/2012/12/B_2012-12-26.pdf

22. Jucevičienė. P. (2013). *Požiūris į ugdymą - edukacinės ir mokymosi aplinkos santykio konceptualusis pagrindas// Leonas Jovaiša: nuo pedagogikos edukologijos link: mokslo studija*. Vilnius: Vilniaus universiteto leidykla.
23. Kardelis, K. (2007). *Mokslinių tyrimų metodologija ir metodai.* Šiauliai: Lucilijus.
24. Key Data on Learning and Innovation through ICT at School in Europe (2011). Europos komisijos dokumentas. Retrieved 12/06/2014, from http://eacea.ec.europa.eu/education/eurydice/documents/key data series/129EN.pdf
25. Kuskaya-Mumcu, F., Koçak-Usluel, Y., (2013) Teachers' Perceptions Related to Levels of ICT Implementation, *Procedia – Social and Behavioral Sciences, 83, 729 – 733.*
26. Lietuvos inovacijų 2010 – 2020 m. strategija. Retrieved 8/11/2014, from http://www.ukmin.lt/lt/strategija/ino_strategija/2010-2020_ino_strategija.pdf
27. Lietuvos mokytojų profesinis tobulėjimas, (2010). Retrieved 11/08/2014, from http://www.smm.lt/svietimo_bukle/docs/pr_analize/sv_problema_5.pdf
28. Longitudinal data analysis, 2009. Boca Raton (Fla.); London; New York (N.Y.) : CRC Press : Taylor & Francis Group.
29. Lukšėnienė, A., Žygaitienė, B., Pošiūnaitė, K. (2014) IT priemonių taikymo ypatumai per technologijų pamokas. *Pedagogika, 113, Nr. 1, 148–158.*
30. Means, B., (2010). Technology and Education Change: Focus on Student Learning. *Journal of Research on Technology in Education. 42(3). 285-307.* Retrieved 15/01/2015, from http://www.sri.com/work/publications/technology-and-education-change-focus-student-learning.
31. Mokyklų tyrimas: informacinės ir komunikacinės technologijos (IKT) švietime. Informacija apie Lietuvą. (2012). Retrieved 21/02/2014, from http://www.draugiskasinternetas.lt/repository/dokumentai/ataskaitos/MOKYKLU_TYRIMAS_IKT_svietime_Informacija_apie_Lietuva_2012.pdf
32. Navickaitė, J. (2010). Informacinės technologijos XXI amžiaus mokykloje. *Švietimo problemos analizė, 7 (47), 1-8.*
33. Orintienė, G.; Lazauskienė, N. (2010). Projekto "Pagrindinio ugdymo pirmojo koncentro (5-8 kl.) mokinių esminių kompetencijų ugdymas" veiksmingumo tyrimo ataskaita. Retrieved 17/11/2014, from http://mokomes5-8.pedagogika.lt/index.php?option=com_content&view=article&id=3:112-projekto-veiksmingumo-tyrimas&catid=5:projekto-veiklos&Itemid=21
34. Paulionytė, J.; Grabauskienė, V.; Žemgulienė, A.; Schoroškienė, V.; Makarskaitė-Petkevičienė, R. (2010). IKT ir inovatyvių mokymo(-si) metodų taikymo pradiniame ir specialiajame ugdyme pasiūla, taikymo praktika ir perspektyvos Lietuvoje ir užsienyje. Retrieved 20/12/2014, from http://www.inovacijos_upc.smm.lt/pirmasis-mokslinis-ikt-ir-inovatyviu-mokymo-si-metodu-taikymo-ir-diegimo-svietime-bukles-tyrimas
35. Pečiuliauskienė, P. (2010). Edukacines inovacijas bendrojo lavinimo mokykloje lemiantys veiksniai: mokytojų novatorių požiūris. *Pedagogika, 100, 57-63.*
36. Pedagogų rengimas informacinių ir komunikacinių technologijų taikymo aspektu. (2008). Retrieved 10/12/2014, from: http://www.ipc.lt/wp-content/uploads/2009/11/pedagogu-tyrimo-ataskaita.pdf
37. Prell, (2011) Social Network Analysis: History, Theory and Methodology. SA GE Publications.
38. Pukėnas, P. (2011*). Kokybinių duomenų analizė SPSS programa*. Kaunas: LKKA.

39. Punie, Y., Zinnbauer, D., & Cabrera, M. (2006). A review of the Impact of ICT on Learning. Working paper prepared for DG EAC. Institute for Prospective Technological Studies (IPTS), JRC, European Commission. Retrieved 20/12/2014, from http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1746
40. Ross, S.M. & Lowther, D.L. (2009) Efeectively using technology in education. Better Evidence- Based Education, 2(1), 20-21.
41. Survey of Schools: ICT in Education : Benchmarking Access, Use and Attitudes to Technology in Europe's Schools (2013) Retrieved 21/02/2014, from https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/KK-31-13-401-EN-N.pdf
42. Tamošiūnas, T. (2010). Lietuvos bendrojo lavinimo mokyklos mokytojų ir specialiųjų pedagogų nuomonė apie IKT ir inovatyvių mokymo(-si) metodų taikymą pradinėse klasėse. Retrieved 18/12/2014, from : http://www.inovacijos_upc.smm.lt/pirmasis-mokslinis-ikt-ir-inovatyviu-mokymo-si-metodu-taikymo-ir-diegimo-svietime-bukles-tyrimas
43. Teaching and learning for an ICT revolutionised society. (2010). European Commission, European Research Area. Retrieved 17/06/2014, from http://www.foresight-platform.eu/wp-content/uploads/2011/04/EFP-Brief-No.-178_ICT-in-Education.pdf
44. The ICT Impact Report A review of studies of ICT impact on schools in Europe. (2006). Europos komisija; UNESCO 2008b. ICT Competency Standards for Teachers: Competency Standard Modules. Retrieved 17/06/2014, from http://unesdoc.unesco.org/images/0015/001562/156207e.pdf
45. Unesco ICT competency framework for teachers, (2011). Retrieved 20/10/2014, from http://unesdoc.unesco.org/images/0021/002134/213475e.pdf
46. Vaitkevičius, R., Saudargienė,A. (2006). *Statistika su SPSS psichologiniuose tyrimuose*. Kaunas: VDU leidykla.
47. Žadeikaitė, L., Gulbinas, R. (2014). Socialinio pedagogo IKT įrankiais praturtinamos edukacinės aplinkos prieinamumas, svarba ir taikymas. *Socialinis Ugdymas, (37)1, 134–145.*