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Use of GeoGebra in Primary Math Education in Lithuania: An Exploratory Study from Teachers' Perspective

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Abstract. With the advance of information and communications technologies, new teaching tools are becoming more pervasive. These tools can be utilized in a variety of ways to improve and enhance math teaching. Considering the integration of technology in teaching mathematics, it is clear that the replacement of board and chalk with digital presentation material does not cover all the aspects of the mathematic subjects. One of the important prerequisites for quality of integration technology into mathematics teaching is the teacher's personality, i.e. knowledge, willingness and desire to improve his/her lessons bringing mathematics closer to the present generations of pupils.

GeoGebra as a dynamic mathematics software allows users to explore multiple representations of mathematics concepts. The paper deals with the problem of deployment of GeoGebra in Lithuanian's primary math education and the main purpose of this study is to investigate reasons/factors affecting teachers' decision to utilize GeoGebra and learning objects prepared by it in their teaching process. With a view to evaluate GeoGebra's suitability to primary education an expert opinion poll was conducted and results of that exploratory study are presented.

Keywords: primary education, mathematics, GeoGebra, ICT, teaching and learning.

1. Introduction

Mathematics is often perceived as a difficult subject that among the students. As a result, mathematics teachers are experiencing enormous challenges in the way they teach. Expectations from today's students require a math instruction that goes beyond what was needed by students in the past. This is a significant challenge to mathematics teachers who are experiencing enormous changes not only in the mathematics content they teach, but also in the way they teach.

Information and communications technologies (ICT) have become essential tools for teaching and learning mathematics. ICT tools can also provide students with opportunities to explore different representations of mathematical concepts and allow them in making connections both theory and practice. However, most mathematics teachers have not learned mathematics using technology tools. The importance of preparing teachers to teach mathematics using appropriate technology has highlighted many research studies (Drijvers *et al.*, 2010; Niess, 2005; Voogt *et al.*, 2013). Studies about integrating technology in teaching mathematics described technology, pedagogy, and content knowledge as a type of teachers' knowledge needed for teachers to understand how to use technology effectively to teach specific subject matter. The basic components of technological pedagogical content knowledge are content, technology, and pedagogy (Mishra and Koehler, 2006). In recent years, the need for introducing information and communication technology into the teaching process has posed one of the unavoidable changes in the educational system. Considering the integration of technology in teaching mathematics, it is clear that the replacement of board and chalk with digital presentation material does not cover all the aspects that technology and mathematics can improve when working hand in hand. One of the important prerequisites for quality integration of technology in teaching mathematics is the teacher's personality, i.e. his/her knowledge, willingness and desire to improve his lessons bringing mathematics closer to the present generations of pupils.

GeoGebra is open source software with rapidly growing worldwide popularity. It allows educators to create interactive learning environment to foster experimental and discovery learning for students while visually interacting with mat geometry, algebra, and calculus, graphing and statistics. It is a powerful teaching tool for Math teachers. It belongs to a group of dynamic geometry software that supports constructions with points, lines, and all conic sections (Diković, 2009). One of the most powerful and widely recognized didactical components of GeoGebra is visualization (Kadunz, 1998). Although some authors have recognized advantages and disadvantages of the software (Bulut and Neslihan, 2011; Hugener *et al.*, 2009; Reisa, 2010; Summak *et al.*, 2010), therefore deployment of it depends on many reasons and factors that affect teachers decision to utilize GeoGebra and learning objects prepared by it in their teaching process. There is a need to make teachers proficient in the use of technology in the classroom to improve the quality of math education. However, knowledge of the technology does not guarantee proper use of the technology in the classroom. The question of what teachers need to know and factors/reasons that effect to integrate technology into their teaching has received a great deal of attention in the last decade. Mishra and Koehler (2006) have introduced the term 'Technological Pedagogical Content Knowledge' in order to describe a framework for the teacher's knowledge necessary to integrate technology in the classroom. Knowledge of technology cannot be isolated from the content, and good mathematics teaching requires an understanding on how technology is related to the pedagogy and mathematics (Hughes, 2005).

The main purpose of this study is to examine the reasons/factors affecting teachers' decision to utilize GeoGebra and particularly learning objects prepared by using GeoGebra in their teaching process. With a view to evaluate GeoGebra's suitability for primary education, an expert opinion poll was conducted and results of that exploratory study are presented. According to Karolčík *et al*. (2013), there are a lot of criteria to evaluate educational technology, but some of the criteria are more important than others. Based on presented a set of criteria in this study an influence of the use of GeoGebra software in primary education is presented.

2. Related Research

The use of dynamic software in geometry, where the visualization and manipulation of objects play an essential role, has been well-studied with middle school and high school students and teachers. Moreover several studies have been conducted with secondary school mathematics teachers over the past decade which clearly identified that using dynamic geometry promoted investigation and supported consolidation (Joglar Prieto *et al.,* 2013). In general, the main reason for the integration of dynamic geometry systems into the teaching of mathematics is creation of an experimental, interactive and dynamic environment conducive to active learning (Hanc *et al.,* 2011).

GeoGebra is a free algebra, geometry and calculus software developed at the University of Cambridge Education Institute although an initiator was a lecturer Markus Hohenwarter from Johannes Kepler University of Linz in Austria. This software which was received a number of awards such as EASA 2002 (European Academic Software Award), Learnie Award 2003 (Austrian Educational Software Award), German Educational Media Award Trophées du Libre 2005, has been used by several countries in their education systems (Reisa, 2010). From 2010, Lithuania is actively involved in "The Nordic&Baltic GeoGebra Network" which is collaboration between teachers, teacher educators and researchers in mathematics education (there were five conferences organized, one of them in Vilnius, Lithuania) with the aim of sharing materials and exchanging experiences concerning the use of ICT in the teaching of mathematics (including also particularities of primary math education) with emphasis on the GeoGebra software. In comparison to others dynamic geometry software GeoGebra has several advantages: first of all, it is free, next there is the support of many languages and online lessons are available in these languages. Another very important thing is that this tool can be installed in different kind of computers with different operating systems, e.g. Windows, Mac OS, Ubuntu, it already has mass installation on multiple computers and works on mobile technologies, i.e. tablet PCs. It is very important because usage of mobile technology promotes collaboration, since it stimulates face-to-face social interaction between learners that is really important in modern teaching and learning process. Since in GeoGebra different views (algebra, graphics, spreadsheet, Computer Algebra System) are combined and are mathematically connected and work in perfect harmony, it makes GeoGebra so strong, complex and unique program that now it has very important impacts on pedagogy in math and science teaching (Hanc *et al.,* 2011).

According to Tomić (2013), there are four aspects that mathematical software (including GeoGebra) can offer to the process of mathematics teaching and learning:

1. **Multiple display options** – the availability of different ways of displaying mathematical content, e.g. symbolic to graphic. Demonstration and visualisation and clarity have always been very important for understanding mathematical ideas during the process of learning and problem solving. Also dynamic and visual tools allow mathematics to be explored in a shared space by connecting and bridging the gap between school mathematics and problem solving ‘in the real world’.
2. **Experimental work** – the possibility of students using experimentation in order to gain new knowledge, ideas and problem solving approaches.
3. **Elementarisation of mathematical methods**, that is, computers allow the use of elementary methods which have been abandoned due to the complex calculations. For example, GeoGebra as a construction tool has all the abilities demanded from a suitable drawing/designing software, which is very important for teaching constructive geometry.
4. **Connectivity** – opening new opportunities for shared knowledge construction and for learner autonomy over their mathematical work and GeoGebra can be used by teachers as a cooperation, communication and representation tool by preparing teaching materials.

There are several ways to use GeoGebra for teaching and learning, mainly for demonstration, exploration and modeling, creation and experimental work. According to Bu *et al.* (2012), first, “looking from students’ perspective, students can be engaged in mathematical modeling, problem exploration, and open-ended questioning”. Second, “GeoGebra enhances the learning environment with its multiple representations, computational utilities, documentation tools, and web-friendly features, which extend the scope of teaching and learning beyond the walls of the classroom”. The need for “evaluation of educational software is important so that teachers can make an appropriate choice of the software which reflects their educational principles and which is appropriate to the teaching and learning context” (Lê and Lê, 2007). There are different approaches how to evaluate educational technology “including analytic, expert, empirical and experimental procedures” (Preece, 1993), and “there is growing number of evaluative criteria and checklist” (Lê and Lê, 2007), although educational software evaluation criteria are not clearly defined and elaborated in the literature. It is clear that there is no simple way to compare methods; there are too many criteria, and too many variables that might be relevant (MacFarlane *et al.,* 2005).

Recently, educational institutions and decision makers pay close attention to development of the primary education in Lithuania. For instance, several projects were implemented by The Center of Education Development at the national level[1,2]. During these projects innovative methodologies were presented and practiced in order to engage students, to facilitate their learning, to promote creativity, collaborative learning institutions have been looking for ICT suitable ICT tools for primary education. In order to achieve aforementioned aims several tools were proposed for primary math learning and one of them was GeoGebra. According to the goals of mathematical courses in

[1] http://www.upc.smm.lt/projektai/modelis/
[2] http://www.upc.smm.lt/projektai/tobulinimas/apie.php

primary education in Lithuania can be found in the Educational Plan and Programme (Programme, 2008) issued by the Ministry of Education and Science of the Republic of Lithuania. On the ground of this document, with the use of computers in classrooms, the following goals appear in the foreground: 1) focus on application, modeling, authenticity and problem solving; 2) emphasis on the presentation aspects and interpretation in mathematics; 3) focus on the appropriate concept formulation; 4) focus on ability to learn mathematics; 5) interdisciplinarity. Although in GeoGebra, as a tool, there are five different perspectives, therefore in primary education mostly can be used only three because of both educational plan and programme of mathematics in primary education and complexity of GeoGebra:

- *Algebra and Graphics* (Numbers and calculations, Algebra, Measurements).
- *Elementary Geometry* (Geometry, Numbers and calculations, Measurements).
- *Tables and Graphics* (Numbers and calculations, Algebra, Measurements, Statistics).

Tackling with the problem of deployment of GeoGebra in Lithuanian's primary math education in next section the methodology of investigation of reasons/factors affecting teachers decision to utilise GeoGebra and learning objects prepared by it in their teaching process is presented.

3. Research Methodology

In this study the main aim is to investigate key variables affecting teachers' decision to utilise GeoGebra and learning objects prepared by it in their teaching process. Within this research authors not intend to provide conclusive evidence, but try to provide a better understanding of the problem. In order to understand which factors play the most important role to primary school teachers to use GeoGebra in class activities, an exploratory research method was conducted.

Exploratory research "tends to tackle new problems on which little or no previous research has been done" (Brown, 2006). This paper investigates use of GeoGebra as a tool for primary math education from teachers' perspective. Moreover, it has to be noted that "exploratory research is the initial research, which forms the basis of more conclusive research. It can even help in determining the research design, sampling methodology and data collection method" (Singh, 2007). An exploratory study has been implemented in 4 steps:

1. Analysis of evaluation criteria for evaluating GeoGebra's suitability for primary education.
2. Adaptation of the Analytical Hierarchy Process (AHP) as expert evaluation method for GeoGebra evaluation.
3. Conduction of expert opinion poll in order to examine the reasons/factors affecting teachers' decision to utilize GeoGebra in their teaching process.
4. Analysis of the obtained data.

Next two sections are devoted to describe each step in more detail.

3.1. *Analysis of Evaluation Criteria*

"Most criteria used to evaluate educational software reflect strongly the principles of teaching and learning adopted by evaluators" (Lê and Lê , 2007) and in the literature one can find huge amount of different sets of criteria to evaluate the educational technology (Bokhove and Drijvers, 2010; Karolčík *et al.*, 2013; MacFarlane *et al.,* 2005; Plaza *et al.,* 2009).

According to Karolčík *et al.* (2013), there are a lot of criteria to evaluate educational technology, but some of the criteria are more important than others and authors presented a set of criteria that influence the use of particular software. The evaluation criteria proposed by Karolčík *et al.* (2013) was analyzed in this study further to construct a simplified hierarchical system of the criteria.

Kurilovas and Dagienė (2010) proposed that all evaluation criteria can be grouped into three different sets:

- A set of technological criteria.
- A set of pedagogical criteria.
- A set of intellectual property rights (IPR) criteria.

All evaluation criteria proposed in aforementioned study results were grouped into three groups and are presented in Table 1.

Table 1

Scheme of evaluation criteria for evaluation of GeoGebra's suitability to primary education

Perspectives	Criteria
1. Technological	1. Animations, pictures, multimedia elements
	2. Clarity/simplicity/user friendly
	3. Clearness with illustrative examples
	4. Compatibility/universality for all OS
	5. Graphical processing/design variety
	6. Possibility to access the software through the internet
	7. Possibility to create the simple outputs
	8. Simple and quick installation
	9. Lithuanian language
	10. Update options
2. Pedagogical	11. Contains a number of tasks for practicing
	12. Contains the interactive tasks
	13. Enables further work with information
	14. Consistent preparation for practicing/verifying of knowledge
	15. Intersubject relations/interconnection
	16. Intuitiveness
	17. Meets a learning objective/meaningfulness
	18. Motivational/attractive
	19. Suitability for students considering their age/various difficulty levels
	20. Interactivity
3. IPR	21. Free/open
	22. Shareware/financial affordability

3.2. *Adaptation of the Analytical Hierarchy Process (AHP) as Expert Evaluation Method for GeoGebra Evaluation.*

In order to investigate reasons/factors affecting teachers decision to utilise GeoGebra and learning objects prepared by it in their teaching process the adaptation of the Analytical Hierarchy Process (AHP) as expert evaluation method was chosen and is presented in short.

The AHP was developed by Saaty (1980) and has been identified as an important approach to multi-criteria decision-making problems of choice and prioritization. The AHP procedures are applicable to individual and group decision settings and AHP separates complex decision problems into elements within a simplified hierarchical system. This method was broadly applied for software and other factors evaluation in education (Dorado *et al.,* 2014; Lu *et al.,* 2013; Omar *et al.,* 2011; Tsinidou *et al.,* 2010). This method allows us to determine the weights (significances) of hierarchically non-structured or particular hierarchical level criteria in respect of those belonging to a higher level. The purpose of the AHP enquiry in this paper is gain criteria and subcriteria weights described in Section 3.1. AHP procedures to gain the weights of the criteria are described as follows:

Step 1: Pairwise-compare the relative importance of factors and obtain a $n \times n$ pairwise comparison matrix, n means the number of criteria. In case of this study, there are three matrices of different size: 2×2, 3×3, 10×10.

Step 2: Check the logical judgment consistency using the consistency index ($C.I.$) and consistency ratio ($C.R.$). The $C.I.$ value is defined as $C.I. = (\lambda_{\max} - n) / (n - 1)$, and the $\lambda_{\max}$ is the largest eigenvalue of the pairwise comparison matrix. The $C.R.$ value is defined as $C.R. = C.I. / R.I.$, where $R.I.$ is random index. The $R.I.$ value is decided by the value of n. In general, the values of $C.I.$ and $C.R.$ should be less than 0.1 or reasonably consistent. In this case, in order to calculate final result the average of all evaluations results was taken and presented in section 4.1.

Step 3: Use the normalized eigenvector of the largest eigenvalue ($\lambda_{\max}$) as the factor weights.

The application of the proposed method is presented below in Fig. 1 and consists of application of AHP in two consistent stages as follows:

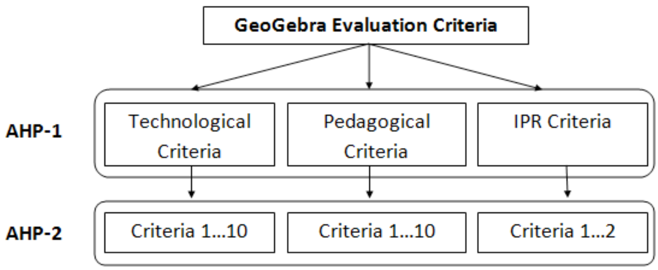

Fig. 1. Scheme of evaluation method applied for evaluation of GeoGebra's suitability to primary education.

1. Establishment of comparative weights of three different groups of GeoGebra use criteria as different perspectives (i.e., technological, pedagogical and IPR). First, experts were asked to evaluate each perspective.
2. Establishment of comparative weights of all criteria in each group.

With a view to evaluate GeoGebra's suitability to primary education an expert opinion poll was conducted. According to Oppermann (1994) and Oppermann and Reiterer (1997) expert evaluation methods draw up expert knowledge to make judgments about the suitability of the product for specific end-users and tasks.

Since the expert evaluation method depends on the skill, the following competence requirements for their selection were defined:

1. No less than 10 year-experience in the field of primary education and use ICT for education in practice (ICT leaders at national level).
2. Participation in at least 3 international educational project in relation to ICT in primary education during last five years.
3. To have teacher expert qualification according to the Regulations of the Appraisal of Teachers which specifies teacher' qualification categories.

An online questionnaire (Fig. 2) was prepared, based on proposed method below and comprising all criteria given in Table 1.

Five experts from different regions of Lithuania were invited to express their evaluation of GeoGebra's suitability for primary math education according to the AHP approach.

After evaluators filled in an online questionnaire results were shifted into MS Excel. In Excel all calculations were performed according to AHP procedures and automated calculations were programmed in the Excel (Fig. 3). All results obtained were reasonably consistent, i.e. $C.R.$ was less than 0.1.

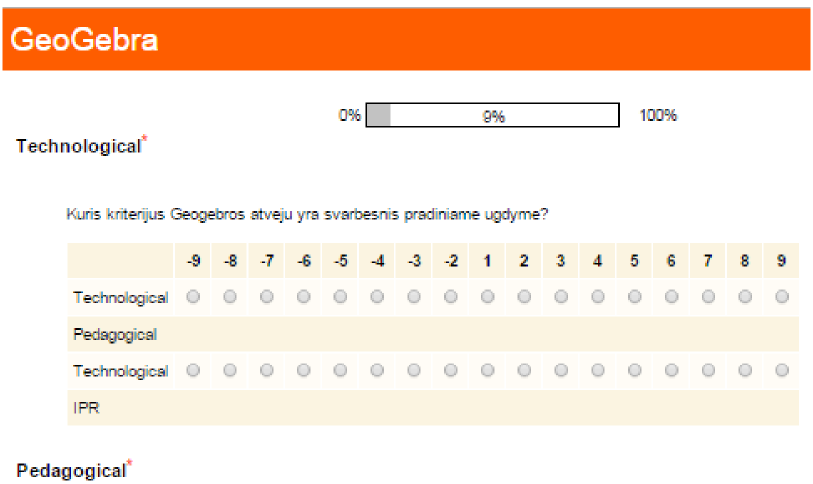

Fig. 2. An online questionnaire for primary school teachers to evaluate GeoGebra's suitability to primary education on the base of provided criteria.

	T1	P1	I1
T1	1.0	0.3	0.3
P1	3.3	1.0	1.0
I1	4.0	1.0	1.0
	8.3	**2.3**	**2.3**

	b1	b2	b3	sum
b1	0.1	0.1	0.1	0.4
b2	0.4	0.4	0.4	1.279227053
b3	0.5	0.4	0.4	1.359227053
	1.0	1.0	1.0	3

X
12.1%
42.6%
45.3%
100.0%

Lmax	3.004455
CI	0.002228
RI	0.52
CR	0.00

Fig. 3. An example of AHP method application for calculating weights of each criteria.

4. Results of An Exploratory Study from Teachers Perspective

Based on a review of the literature and expert questionnaire survey, this study presents GeoGebra's suitability for primary education evaluation criteria and weights that include two hierarchies. The first hierarchy includes three evaluation perspectives; the second is comprised of 22 evaluation criteria. The conclusions are shown below in Table 2.

There were five experts satisfying aforementioned three criteria for experts chosen (section 3.2). They examined all criteria according to the AHP approach in order to find out main factors that may affect teachers' decision to utilise GeoGebra and learning objects prepared by it in their teaching process. Next findings of evaluation are presented and discussed.

Table 2

Evaluation perspectives and criteria for evaluation of GeoGebra's suitability to primary education

First hierarchy evaluation	Second hierarchy evaluation	Normalized weights	Sequence
T1 Technological 0.121	T20 Animations, pictures, multimedia elements	0.073	5
	T21 Clarity/simplicity/user friendly	0.177	2
	T22 Clearness with illustrative examples	0.066	8
	T23 Compatibility/universality for all OS	0.058	10
	T24 Graphical processing/design variety	0.072	7
	T25 Possibility to access the software through the internet	0.074	4
	T26 Possibility to create the simple outputs	0.153	3
	T27 Simple and quick installation	0.072	6
	T28 Language	0.196	1
	T29 Update options	0.061	9
P1 Pedagogical 0.426	P20 Contains a number of tasks for practicing	0.095	5
	P21 Contains the interactive tasks	0.107	3
	P22 Enables further work with information	0.074	8
	P23 Consistent preparation for practicing/verifying of knowledge	0.068	10
	P24 Intersubject relations/interconnection	0.089	7
	P25 Intuitiveness	0.073	9
	P26 Meets a learning objective/meaningfulness	0.175	1
	P27 Motivational/attractive	0.094	6
	P28 Suitability for students considering their age/various difficulty levels	0.129	2
	P29 Interactivity	0.097	4
I1 IPR, 0.453	I21 Free/open	0.875	1
	I22 Shareware/financial affordability	0.125	2

4.1. *Evaluation of Criteria and Weights in the First Hierarchy*

According to the chosen structure of criteria there are three perspectives in the first hierarchy.

The order of relative weights (from high to low) is as follows (Fig. 4):

- Intellectual property rights (IPR) (45.3%).
- Pedagogical perspective (42.6%).
- Technological perspective (12.1%).

$\lambda_{\max} = 3.0$, $C.I. = 0.002$, $C.R. = 0.00$, $R.I. = 0.52$

Analyzing the results, in the first hierarchy of evaluation criteria, it can be seen that pedagogical and IPR are very important criteria for primary education teachers, i.e. they prefer free of charge tools.

A pedagogical criterion is directly related to teachers' work, and they expect any tool to be high quality from this perspective. Willingness to utilize learning objects created using GeoGebra strongly depends on how they are created and also are related to the teachers' level of expertise in their specialization, like math.

Another, even more important perspective is IPR. In practice, Lithuanian primary school teachers are looking for ICT tools and learning objects they can afford, because of little financial support from the government.

Therefore, technological aspects of the ICT tool for primary school teachers seem to be not so much important. The reason could be the lack of digital competencies of primary school teachers, and they think that this perspective is not so important comparing with other two perspectives.

4.2. *Evaluation of Criteria and Weights in the Second Hierarchy*

In the second hierarchy, each perspective includes different criteria.

The first group of criteria of technological perspective consists of ten criteria and their weights (from high to low) are as follows (Fig. 5):

- Animations, pictures, multimedia elements (7.3%).
- Clarity/simplicity/user friendly (17.7%).
- Clearness with illustrative examples (6.6%).
- Compatibility/universality for all OS (5.8%).
- Graphical processing/design variety (7.2%).
- Possibility to access the software through the internet (7.4%).
- Possibility to create the simple outputs (15.3%).
- Simple and quick installation (7.2%).
- Language (19.6%).

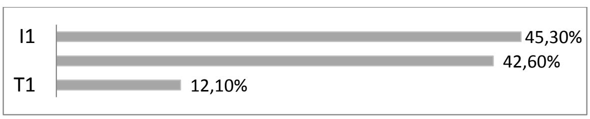

Fig. 4. Weights of criteria groups among technological (T1), pedagogical (P1) and IPR (I1) criteria.

- Update options (6.1%).

$\lambda_{\max} = 10.8$, $C.I. = 0.08$, $C.R. = 0.06$, $R.I. = 1.4$

The most important criteria are T28 language, T28 clarity/simplicity/user friendly and T26 possibility to create the simple outputs. A language criterion is very crucial for Lithuanian primary school teacher, because of the lack of competences in foreigner languages. The situation goes better, but still there is problem to use non Lithuanian ICT tools. As it is known, that GeoGebra is localized and is provided for teachers in Lithuanian, it is very big advantage for Lithuanian teachers. The following two the most important criteria show that by experts' opinion it is very important to save time by working with a tool. At least important criteria for primary school teachers seem to be compatibility/universality for all OS. Although learning designers emphasize the importance of compatibility of any tool, for Lithuanian experts at this moment seems to be at least important criteria. All left criteria seem to be of the same importance.

The second group of criteria belongs to pedagogical perspective and it comprises ten criteria which weights (from high to low) are as follows (Fig. 6):

- Contains a number of tasks for practicing (9.5%).
- Contains the interactive tasks (10.7%).

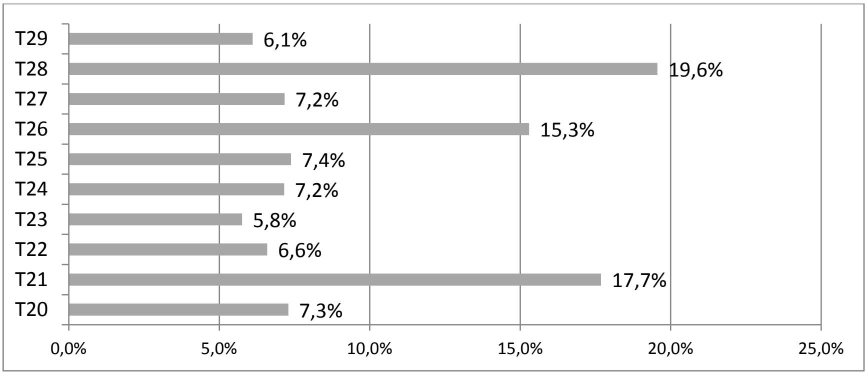

Fig. 5. Weights of criteria in technological criteria group T1.

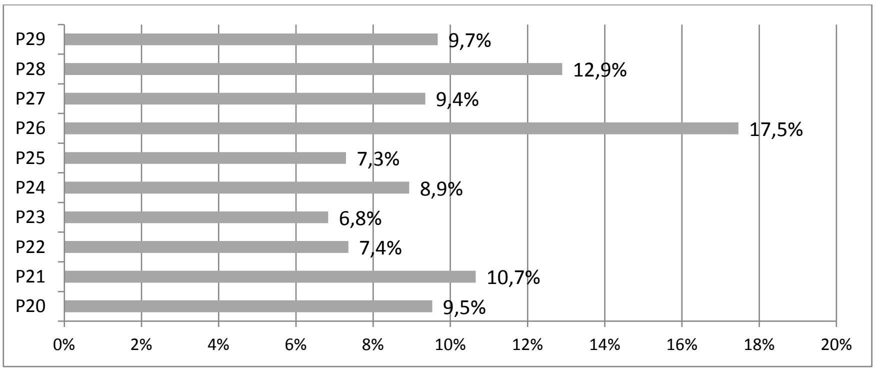

Fig. 6. Weights of criteria in pedagogical criteria group P1.

- Enables further work with information (7.4%).
- Consistent preparation for practicing/verifying of knowledge (6.8%).
- Intersubject relations/interconnection (8.9%).
- Intuitiveness (7.3%).
- Meets a learning objective/meaningfulness (17.5%).
- Motivational/attractive (9.4%).
- Suitability for students considering their age/various difficulty levels (12.9%).
- Interactivity (9.7%).

λ_{max}= 10.6, *C.I.* = 0.06, *C.R.* = 0.05, *R.I.* = 1.4

The most important criteria among these criteria is to meet a learning objective/meaningfulness. This result indicates that experts expect teachers to have sufficient knowledge of learning objectives, their efforts to recognize meaningfulness of learning objects and be responsible to make a decision to use ICT (in this case GeoGebra) to integrate ICT into practice in order to enhance students' learning outcomes.

Other two less important criteria seems to be "suitability for students considering their age/various difficulty levels" and "contains the interactive tasks". These criteria are strongly related to classroom management and student guidance by preparing and giving different learning activities for pupils.

According to experts' opinion, primary school teachers are competent enough to manage math related classroom activities on their own. Furthermore, they do not expect benefit from this kind of technology, i.e. GeoGebra.

The least important criteria are consistent preparation for practicing/verifying of knowledge, intuitiveness and enables further work with information.

This result could be interpreted as experts are not enough familiar with a tool and not sure how to master it in order to prepare for practicing/verifying of knowledge and enable further work with information using it.

The third group of criteria of IPR perspective is the smallest one and consists only of two criteria and their weights (from high to low) are as follows (Fig. 7):

- Free/open (87.5%).
- Shareware/financial (12.5%).

λ_{max} = 2, *R.I.* = 0

According to the results which presented in Fig. 7, IPR are very important criteria for primary education teachers, i.e. they prefer free of charge tools (it shows the importance of criteria "free/open").

This is because of the lack of financial support from the government for educational tools to primary education. Therefore teachers are looking for ICT tools which are free or they can afford.

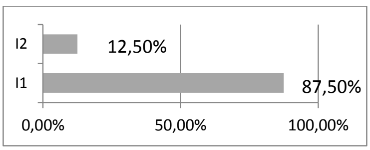

Fig. 7. Weights of criteria in IPR criteria group I1.

5. Conclusions

Through the widespread use of ICT the teaching-learning process has increasingly been complicated. Finding the best ways of integrating technology into classroom practices is one of the challenges the teachers face. Integrating technology into mathematics teaching and learning is a slow and complex progress. Even though, teachers have access to computers and appropriate software is available both in schools and at home, technology is rarely integrated substantially into everyday teaching. Therefore, it is important to know about the factors affecting the adoption of using technology i.e. GeoGebra into mathematics instruction.

The purpose of educational software is to support teaching and learning process. In order to have efficient teaching and learning first problem of teacher attitudes to ICT tool should be recognized. This study was set to deal with the problem of GeoGebra use in primary math education analyzing it form teachers perspective. In order to examine the reasons/factors affecting teachers' decision to utilize GeoGebra an expert opinion poll was conducted. Based on a review of the literature and expert questionnaire survey, this study presents GeoGebra's suitability for primary education evaluation criteria and weights that include two hierarchies. The first hierarchy includes three evaluation perspectives; the second is comprised of 22 evaluation criteria. There were five experts satisfying aforementioned three criteria for experts chosen. They evaluated each criteria according to the AHP approach, which has been identified as an important approach to multi-criteria decision-making problems of choice and prioritization. According to weights derived by the AHP, central factors, which are more important and will affect GeoGebra's suitability to primary school, could be found.

Analyzing the results of the exploratory study showed that in the first hierarchy of evaluation criteria pedagogical and IPR are very important criteria for primary education teachers, i.e. they prefer free of charge tools. Pedagogical criteria are directly related to teachers' work, and they expect any tool to be high quality from this perspective. Looking at the results of evaluation of criteria and weights in the second hierarchy, they demonstrate that language criteria is very crucial for Lithuanian primary school teacher, because of the lack of competences in foreigner languages. Two others most important criteria (clarity/simplicity/ user friendly and possibility to create the simple outputs) show that by expert's opinion it is very important to save time by working with a tool. Evaluation of pedagogical criteria reveals that experts expect teachers to have sufficient knowledge of learning objectives, their efforts to recognize meaningfulness of learning objects and be responsible to make a decision to use ICT (in this case GeoGebra) to integrate ICT into practice in order to enhance students' learning outcomes. Other two less important criteria seems to be "suitability for students considering their age/various difficulty levels" and "contains the interactive tasks". These criteria are strongly related to classroom management and student guidance by preparing and giving different learning activities for pupils. The least important criteria are consistent preparation for practicing/verifying of knowledge, intuitiveness and enables further work with information.

Results demonstrate that the main factors influencing GeoGebra use in primary education are: and Lithuanian language meets a learning objective/meaningfulness, suitability for students considering their age/various difficulty levels, contains the interactive tasks. A case study performed shows that teachers are not ready to use GeoGebra as a tool for creating, but they are enthusiast to apply qualitative learning objects prepared by it.

The basic restriction of the research is that it is an experimental study performed over a small period of time. The study occurred in a particular time and under particular circumstances. The results could have been more reliable and contingent across the Lithuanian teacher-population. Although, these findings cannot be generalized to the overall population.

Based on the outcomes of investigating the factors affecting primary math teachers' opinions to facilitate GeoGebra in their teaching, further research examining the factors that affect primary educations teachers GeoGebra use in mathematics might include a more diverse set of teachers with higher number of expert poll. Moreover, it would be useful to conduct further study ın the future about primary mathematics teachers' opinions and reflections regarding to implement GeoGebra in their teaching process. More investigation needed to assess the level of GeoGebra's effective integration into primary school mathematics as well as its potential impact on instructional methods.

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Matematikos mokymo programos „Geogebra“ taikymas lietuvos pradiniame ugdyme: žvalgomasis mokytojų nuomonės tyrimas

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Informacinių ir komunikacinių technologijų pasiūla lemia naujų mokymui ir mokymuisi skirtų priemonių plėtrą. Pastarosios gali būti įvairiai taikomos siekiant pagerinti ir praturtinti matematikos mokymo procesą. Nagrinėjant technologijų integravimą į matematikos mokymą, akivaizdu, kad ilgamečių priemonių, tokių kaip lenta ir kreida, pakeitimas skaitmeniniu turiniu neapima visų matematikos mokymo ypatumų. Vienas iš svarbiausių veiksnių, lemiančių kokybišką technologijų integravimą į matematikos mokymą, yra mokytojo asmenybė: jo žinios, siekimas ir noras kurti pamokas, kuriose matematika būtų glaudžiai siejama su šiuolaikinių mokinių poreikiais.

„Geogebra“ yra dinaminė matematikos mokymui ir mokymuisi skirta priemonė, įgalinanti naudotojus tyrinėti įvairiai pristatomus matematinius konceptus. Straipsnyje nagrinėjama programos „Geogebra“ taikymo Lietuvos pradinio ugdymo mokyklose problema, žvelgiant į ją iš mokytojų perspektyvos. Pagrindinis straipsnio tikslas – išnagrinėti veiksnius, lemiančius matematikos mokymo priemonės „Geogebra“ ir ja parengtų mokomųjų objektų taikymo pradiniame ugdyme galimybes. Siekiant ištirti programos „Geogebra“ tinkamumą pradiniam ugdymui buvo atliktas žvalgomasis, mokytojų ekspertų apklausa grįstas, tyrimas. Straipsnyje aprašomi gauti rezultatai ir pateikiamos bendros išvados.