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FOREWORD

Dear Colleagues, dear Readers!

Let me introduce you the new issue of our scientific journal Acta Technologica Dubnicae. After publishing three successful issues of the journal last year, we decided to do so this year as well. The Editorial Board of the journal is really pleased by the increasing interest in our journal both in Slovakia and abroad. Our authors and their high quality papers, the thorough peer-reviewing process and also De Gruyter Open, which monitors the journal and gives us feedback on our strengths but also weaknesses that we then try to eliminate, have contributed to the increasing quality to a great extent. At the beginning of this year, De Gruyter Open informed us that Acta Technologica Dubnicae is being indexed by the following 18 services: Baidu Scholar, Celdes, CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, DOAJ, EBSCO Discovery Service, ERIH PLUS (European Reference Index for the Humanities and Social Sciences), Google Scholar, J-Gate Naviga (Softweco), Primo Central (ExLibris), ReadCube, ResearchGate, Summon (Serials Solutions/ProQuest), TDOne (TDNet), WorldCat (OCLC), CEJSH (The Central European Journal of Social Sciences and Humanities), and Microsoft Academic Search. It is a great success and an encouragement for us to continue in our work and to pay special attention to the quality of the journal. After a long discussion, the Editorial Board decided to modify the sections of the journal. Studies, scholarly articles an information about the life anniversaries of recognized professionals will remain.

After a high quality peer-reviewing process and the required authors' corrections, I am glad to introduce you the content of this issue consisting of eight papers by recognized professionals paying attention to various scientific fields, but all of them accentuate the educational aspect of the issue.

Elżbieta Napora, a Polish author, in her scientific study entitled "Parentification and Grandparents' Support from the Perspective of Grandchildren from Families of Various Structures" studies and verifies the relationship between a retrospective evaluation of the experienced social support given by grandparents and the material status of the family with the quality of life of the grown-up grandchildren in families of different structures. The formulated expectations have been verified with the Social Support Scale (SSS), Student's Life Satisfaction Scale (SLSS) and an individual personal survey. The author gathered interesting data, but probably expected.

The first paper in the section of articles written by Zuzana Geršicová from Slovakia is entitled – "Class Teachers – Their Thinking and Reasoning in the Context of Creating a Favourable Classroom Social Climate by Means of the Methods of Personal and Social Education". It focuses on class teachers and their ability to create a favourable classroom social climate by means of personal and social education. The results of the research carried out indicate that teachers have a very high opinion regarding their ability to create a favourable classroom social climate, which can be considered a positive finding.

Among the submitted scholarly articles, the Editorial Board of Acta Technologica Dubnicae has selected a paper by Czech authors Dana Dobrovská and Pavel Andres entitled "Engineering Pedagogy Students Attitudes on Teaching Quality". The aim of the current survey was to make the outcomes of an analysis of mature-age student essays available to engineering teachers and faculty management under the title "What makes a good engineering teacher". Results of this survey are compared with a similar one conducted in the Czech Republic 8 years ago.

A specific field "Development of Key Competencies in Integrated Teaching Workplaces" is dealt with by Daniel Kučerka from the Czech university environment. He focuses on practical teaching in the turning workshop at secondary schools. The development of competencies is based on the learning objectives of the subject 'Technology of Turning' in practical education. It is a highly topical issue as there is a lack of young professionals in this profession within the European Union and the need for their training is urgent.

Gabriela Petrová and Nina Kozárová, two authors from Constantine the Philosopher University in Nitra, Slovakia, in their article "Structuring the Curriculum", deal with the opportunities of structuring the curriculum. On the theoretical level, they discuss the content of education, the process of knowledge selection and organization, bring suggestions for increasing the quality of textbooks. The society supports education at every age and searches for the possible answers to the question "How to provide students with an effective educational process?", but the content of education and textbooks seem not to be ready to react to these changing conditions.

Jana Škrabánková, a Czech author again, by means of a pilot experiment using the eye tracking method, gathered research data based on monitoring the participating primary school children's eye movements in the context of their mathematical and logical intelligence. She entitled her article describing a modern experiment "Practical Use of the Eye Camera in Pedagogical Research (Processing of Selected Data Using the Eye Tracking Method)".

A group of five Slovak authors Jozef Drga, Martin Bulko, Karol Petrík, Mária Csatáryová and Stanislav Šimkovič from various workplaces focused on the topic of "Visual Observations as Exercises in Physics." They state that visual meteor observations are a fun and interesting approach to astronomy and to scientific research in general. They can be used for laboratory or practical exercises in physics at secondary schools and universities and the students can collect and analyse the acquired data by themselves. It could be an undoubtedly exciting and motivating form of education for the young generation.

As a part of the section of information, we bring Erich Petlák's paper written in the occasion of an important life anniversary of Professor Gabriela Petrová. The whole Editorial Board of Acta Technologica Dubnicae is sending their warm congratulations to her.

I wish that everyone would find an interesting article, information or a new, inspiring thought in this issue of the journal.

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Viola Tamášová
Editor

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STUDIES

Parentification and Grandparents' Support from the Perspective of Grandchildren from Families of Various Structures[1]

Elżbieta Napora[*]

Abstract: The purpose of this study was to determine the strength of the relationship between a retrospective evaluation of the experienced social support given by grandparents and the material status of the family with the quality of life of the grown-up grandchildren in families of different structures. The formulated expectations have been verified with the Social Support Scale (SSS), Student's Life Satisfaction Scale (SLSS) and an individual personal survey. The obtained results show that in families of single mothers, the emotional and informative support offered by grandparents was a significant factor improving the quality of the life of the grandchildren. In a complete family, however, the significant forms of support from grandparents were esteem support and its other forms, except for informative support. Moreover, the material wealth of the original family was shown to be an important predictor of the evaluation of the quality of life of the grandchildren; it was judged more negatively by adolescent children of single mothers.
Key words: grandparents-grandchildren relationships, single mother families, quality of life of teenagers.

1 Introduction

Unfavourable conditions for the development of children and adolescents which are of a threat for their health and development (Borucka & Ostaszewski, 2008)

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[*]   Elżbieta Napora, Institute of Philosophy, Sociology and Psychology, University Jan Dlugosz in Częstochova, Poland; e.napora@ajd.czest.pl

can lead to behavioral disorders. Protective factors, which prevent these disorders, can work against them.

Research shows that the help of the loved ones can be a protective factor. For a grandchild the feeling of emotional closeness with grandparents reduces the influence of a lowered maternal mood (Ruiz & Silverstein, 2007). What can be of an example is a family in which a mother suffers from depression but its negative results are neutralized by good relations of a child with grandparents. It leads to lower probability of depression in the adult life of an offspring (Napora, Kozerska, & Schneider, 2014). The bond between a grandchild with grandparents is an important additional protective factor apart from these which result from the existence of a social support chain, the outside family support as well as possessing high intelligence or the feeling of one's own value.

2 Parentification and social support provided by grandparents

Parentification of grandparents is a factor which protects a single mother family against the consequences of the difficulties connected with lonely motherhood (Napora et al., 2014). It can be a synonym of an unconditioned feeling, support and help. Hooper (2007) emphasizes that parentification takes place when there is a shift or change of roles. It can apply to a situation when a child plays a role of a parent, taking responsibility for the material and/ or emotional situation of other family members (as in: Schier, 2010). Other authors such as Chase define parentification as "a change of roles – functional, emotional or both in which a child sacrifices his own needs: the need of attention, security and gaining support in development in order to adjust and care about instrumental or emotional needs of a parent" (as in: Pasternak & Schier, 2014).

The term of grandparents' parentification has not been used in literature so far. It applies to the relation between a child's parents and a child's grandparents and also to the relations between a grandchild and grandparents. Thus, by the term of parentification of grandparents one understands the expectation of an adult child family and support given by grandparents which is necessary for their proper functioning. However, analogically to a child's parentification, a shift of roles appears (Napora, Kozerska, & Schneider, 2012). Grandparents are included in the parenthood sub-system and they play a role of a parent to a grandchild. They can also give support to one of the parents of a grandchild as it is given by a spouse. For example, in a single mother family parentification of grandparents is a situation in which they give support to a child and a mother in the scope it is realized by a father in full families. In conditions, such as death of grandchildren's father or dissolution of children's marriage, parentification of grandparents can be a positive phenomenon for both the grandparents

themselves and for the other family members (Napora et al., 2014; Schneider, Napora, & Kozerska, 2012). That is why, it is a protective factor and helps to recompense the negative consequences of the family members, which result from difficult life situations.

Parentification of grandparents manifests in, for example, giving support which in psychology is understood as an interaction undertaken by one or a few parties in a problem or difficult situation. What occurs in the process of interaction is not only the exchange of information but also emotional and instrumental exchange as well as exchange of tangible goods (Sęk, 1997). The exchange brings the participants of interaction closer to solve the problem and it serves a positive psychological function (Walęcka-Matyja, 2013). What is important for the effectiveness of social exchange is the correlation between the kind of support given and the needs of the receiver. Support is also about enhancing an individual in a stressful, decisive situation in which, without the support of others, he will not be able to overcome the difficulty (Sęk, 2001).

Lack of support, with the subjective feeling of loneliness, decreases both mental and physical resistance of a human being (Sęk, 1986). The effects of research show that among various components of social network, people give more meaning to emotional support than to current, specific help (Ball, 1983; Nowakowski, 2015).

So far what has been noticed was the factor of meaning and quality support from parents for the growing up child as a condition for his development. The quality of supporting social bonds is important for the mental development of adolescents who need help in the process of getting to know one another, in taking decisions and making choices. An individual who obtains high social support from the loved ones, can be characterized by the faith in the existence of social order, in the authority regulating legal, moral and social standards, in faith of the existence of values, in the reliability of friendship, and in faith that thanks to one's own behaviour, one can achieve a lot (compare Kmiecik-Baran, 2000). Early support of teenagers by grandparents positively correlates with their positive adjustment to life in further development stages and lack of mental disorders (Garmezy, Masten, & Tellegen, 1984). Furthermore, these people deal much better in difficult situations (Jaworowska-Obój & Skuza, 1986).

It has been proved that support of grandparents depends on the family needs (Baydar & Brooks-Gunn, 1998; Hank & Buber, 2009). The authors focusing on the research of a single mother family showed that a family characterized by a higher need, gets more support from grandparents than a full family. An unmarried mother, who needs additional support and who takes care of a child alone, gets more support than a married mother (Jendrek, 1993). It goes together

with an observation that parents give more support to children who have additional difficulties. Bornat, Dimmock, Jones and Peace (1999) observed that in case of divorce, which is a traumatic situation, a strong bond between a divorcing mother and a grandmother appears. The grandmother's support is a defensive factor in the time of a crisis (Bornat et al., 1999). This research allows to draw a conclusion that the hypothesis saying that help and support of grandparents can play an important function in the mental and social functioning of adolescents is a right one (Schneider et al., 2012).

Grandparents disburden a single-mother from her core duties (Dex & Ward, 2015), support her emotionally (Bornat et al, 1999) as well as her child (Bridges, Roe, Dunn, & O'Connor, 2007). They tend to be willing to react when family problems appear, especially in case of health problems, teenage pregnancy, prison, and addiction to drugs, divorce, death of a family member (Pruchno, 1995). Thanks to grandparents' engagement in a family support, the family functions remain stable.

Research concerning the relation between the obtained social support or lack of it and the symptoms of depression among adolescents revealed considerable dependencies. The analysis of results obtained from 821 adolescents showed that a low level of social support from the parent's site is prospectively linked with depression symptoms. This suggests that family environment is an inseparable source of support in comparison with the support from the peers (Khatib, Bhui, & Stansfeld, 2013).

Research conducted in Poland on a group of more than 500 researched adolescents by means of a Social Support Scale revealed that in a single mother family every kind of support: informational, instrumental, evaluating, emotional given both by a grandmother and a grandfather from the mother's side, is more favorably assessed by granddaughters than grandsons. In two-parent families it is the granddaughters who are more satisfied with the informational, evaluating and emotional support of a maternal grandmother and only informational support of a paternal grandmother (Napora, 2015).

Despite crucial positive effects resulting from support and help of grandparents for the functioning of a full family and a single mother family, this issue is not systematically analyzed, remaining still a neglected aspect of research. Therefore, the research has been undertaken, which conformed to domestic and international initiatives allowing us to diagnose various aspects of life quality that are recommended by the EU and concern intergenerational family support. The results of the collected data are part of a bigger interregional and interdisciplinary project realized in cooperation with the Faculty of Pedagogy of Jan Dlugosz University in Częstochowa, National Measurement Laboratory in

New South Wales, Australia and the Faculty of Pedagogy of Marie Curie-Sklodowska University (Napora, Kozerska, & Miszczak, 2014; Kozerska, Miszczak, & Napora, 2015). Little research on the topic of the meaning of grandparents' engagement in the functioning of a family, not only the single mother's one, led to analysis which allowed to compare the relations which occur between the social support of grandparents and the life quality of grandchildren. The obtained results will serve to enrich the explanations connected with the issues concerning family functioning and they will allow us to take a viewpoint on the argument which says that grandparents' support plays an important role in the mental and social functioning of adolescents.

Earlier analysis concerning the evaluation of relations in terms of closeness and frequency showed that higher average results for the evaluation of a relation with a maternal grandfather (from the mother's side), expressed by grandchildren from a single mother family show a steady, high activity and attachment to this grandfather. Taking into consideration the analogical assessments concerning the relations with a maternal grandmother, what can be observed is that similar motivation accompanies her efforts as well. These results make us conclude that in a single mother family maternal grandparents are significantly more parentified than the paternal ones (Napora, 2016).

The aim of the research was to capture the strength of bonds between a retrospective evaluation of the social support experienced from the grandparents' side and the quality of grandchildren's life as well as to illustrate life quality of adolescents in terms of a family's material status. What was measured was the social support level whose source are the maternal and paternal grandparents, assessed by grandchildren. The research problems were formed in two questions. The first one: is there a connection between a social support of grandparents in the grandchildren's retrospective assessment and the life quality and if so, is this connection statistically significant? The second question: what are the other factors connected with a family which can explain the adolescents' life quality? The effects allowed us to comment on the hypotheses:
H1: What can be definitely more frequently observed is the meaningful relation between social support of grandparents and the life quality of grandchildren in a single mother family than in a full family. In this hypothesis it is expected that grandchildren assess the relations with a grandmother better – what has been earlier mentioned – that is why, what was expected was the more favourable evaluation of a social support from her side and the connection of this support with life quality of adolescents (Sęk, 1986), especially in single mother families.
H2: Regardless of the family structure, life quality of grandchildren will significantly depend on the evaluation of a family's material status. This expectation is proved by the research presumption (Cudak, Kowolik, & Pindera, 1999) and report analysis in which it is emphasized that a crucial parameter for

the family's life quality are the material conditions of a family (Bieńkuńska, Piasecki, Verger, & Lebrere, 2013).

3 Research Methods

3. 1 Research sample
The research was conducted on a sample of students from the Częstochowa sub-region. It was carried out from January 2013 to May 2013 and at the beginning of 2014, with the approval of students who were informed about the possibility of pausing while fulfilling the questionnaires without any consequences. 206 people took part in the research. During the statistical analysis 10 questionnaires were not taken into account; they were rejected due to omitting some statements or owning to the fact that the students came from single father families.

Table 1

Structure of the researched adolescents

No.	Features		Descriptive statistics		
1.	Age		M		23.91
			SD		6.86
2.	Sex				
	Woman		132		67.36%
	Man		62		32.64%
3.	Family structure				
	full		130		66.33%
	single mother		66		33.67%
4.	Material status				
	unsatisfying		57		29.08%
	satisfying		138		70.92%
5.	Place of living				
	village		68		34.7%
	small city		69		35.2%
	big city		59		30.1%
6.	Parents' education	vocational	secondary	high	
	Mother's n (%)	68(34.9)	90(45.9)	38(19.2)	
	Father's n (%)	104(55)	68(34.9)	20(10.1)	

The average age of the researched was 23.91, among the people women dominated (n = 132, 67.34%). The biggest number of participants came from

small cities (n = 69, 35.2%) and from full families (n = 130, 66.32%). The well-being of a family was evaluated on a satisfactory level by 70.4% (n = 138) of the researched sample. The research was carried out according to the table of meetings and it was organized after the arrangement with both the university authorities and students.

3.2 Measurement
The tools which are the basis for the analysis and conclusions are scales and questionnaires. The Social Support Scale (SSS) in the adaptation of Kmiecik-Baran (2000) was used to measure social support. This scale is divided into 4 parts which consist of questions to which a researched person refers in a 4-degree scale evaluating in a retrospective manner the degree of genuineness of the particular statements to him. The psychometric qualities of the scale are satisfying, reliability of SSS is approximate to unity (tests with a factor 0.75 are considered reliable). SSS includes statements which refer to four categories of support: informational, instrumental, evaluating and emotional. 4 statements for each kind (3 positive statements and 1 negative one). The students participating in the research were asked to assess, by means of a few-degree scale, the extent to which a given statement refers to him, 3 – 'yes' – a statement very strongly fulfilled with this kind of support; 2 – 'rather yes' – a statement strongly fulfilled with a given sort of support; 1 – 'rather no' – a statement weakly fulfilled with a given sort of support, 0 – 'no, does not apply' - a statement which is not fulfilled with a given sort of support at all. Additionally, one can measure the general level of social support.

Huebner Scale SLSS (Student's Life Satisfaction Scale) served to assess life quality. It is a tool used, for example, in research concerning life satisfaction of secondary school pupils (Oblacińska & Woynarowska, 2006), life quality of adolescents (Napora et. al., 2014; Napora, 2016), life quality of seniors (Szornak, Kurhalyuk, Tkachenko, & Pałaczyńska, 2010). The scale consists of seven statements concerning aspects of general life quality, that is: evaluation of style, life satisfaction, and interpersonal satisfaction. By means of a 6-degree scale the researched evaluated the extent to which each statement refers to his life until now (0 – 'I definitely do not agree', 1 – 'I do not agree', 2 – 'rather no', 3 – 'difficult to say', 4 – 'rather yes', 5 – 'I definitely agree').

By contrast, by means of a questionnaire, socio-demographic data were collected. That is: age, sex, place of living, family structure, level of parents' education, material status of a family.

Tools were selected by a research team which consisted of a few family researchers from disciplines such as psychology, pedagogy, human development and sociology who came from the following institutions Jan Dlugosz University

in Częstochowa, National Measurement Laboratory in New South Wales, Australia and Marie Curie-Sklodowska University in Lublin. The team met for seminars in order to discuss the scope and strategy of conducting research, train the pollsters and continue consulting if any doubts during the whole process of data collection appeared. The aim of the created interdisciplinary team was to combine research environment, disciplines and experience of the researchers.

4   Results

In order to verify the hypothesis non-parametric methods were used. To make the comparisons between two groups U Mann-Whitney test was applied. To analyze the relations between variables, coefficient of Spearman range correlations as well as chi-squared test were used.

4.1. Social support and life quality of grandchildren

The scales allowed us to collect the evaluations submitted by the participants of the study concerning social support from the grandparents' side and referring to the assessment of life quality. What was checked was the relation between the evaluation of social support and life quality. The basis for the division of the researched into two groups was the criteria of family structure background. The obtained coefficient of Spearman rang correlation (R) is included in tables 2 and 3.

Table 2

Connection of R-Spearman between support of maternal grandparents and grandchildren's life quality

Social support	Family structure	Maternal grandparents					
		Grandmother			Grandfather		
		R	t(N-2)	p	R	t(N-2)	p
Informational	Full	0.151	1.607	0.110	0.108	1.058	0.292
	Single mother	-0.012	-0.092	0.926	0.061	0.449	0.655
Instrumental	Full	0.111	1.174	0.242	0.075	0.747	0.456
	Single mother	-0.150	-1.159	0.251	0.041	0.304	0.762
Evaluating	Full	0.081	0.856	0.393	0.114	1.133	0.259
	Single mother	-0.193	-1.515	0.135	-0.009	-0.070	0.944
Emotional	Full	0.133	1.417	0.159	0.103	1.032	0.304
	Single mother	-0.013	-0.105	0.916	0.038	0.280	0.779
General	Full	0.118	1.250	0.213	0.096	0.934	0.352
	Single mother	-0.042	-0.321	0.748	0.079	0.576	0.567

Both in full families and single mother families, no crucial relation between grandchildren's life quality and maternal grandparents' social support was observed. The subjective grandparents' social support experienced by grandchildren is crucially connected with life quality of adolescents. This suggests that maternal grandparents are similarly evaluated by the rich ones in terms of the social support given. What surprises, however, is the direction of the occurring dependencies. In a single mother family a small statistically not important negative relation between every kind of social support of a grandmother, evaluative support of maternal grandfather and the life quality of grandchildren occurred.

Table 3

Connection of R-Spearman between support of paternal grandparents and grandchildren's life quality

Social support	Family structure	Paternal grandparents					
		Grandmother			Grandfather		
		R	t(N-2)	*p*	R	t(N-2)	*p*
Informational	Full	0.071	0.754	0.451	0.057	0.528	0.598
	Single mother	0.104	0.790	0.432	0.240	1.737	0.088
Instrumental	Full	0.147	1.568	0.119	0.178	1.644	0.103
	Single mother	0.078	0.587	0.559	0.188	1.344	0.184
Evaluating	Full	0.206	2.228	0.027	0.257	2.394	0.018
	Single mother	-0.021	-0.160	0.873	0.119	0.840	0.404
Emotional	Full	0.218	2.355	0.020	0.217	2.020	0.046
	Single mother	0.128	0.967	0.337	0.247	1.789	0.079
General	Full	0.178	1.898	0.060	0.198	1.822	0.072
	Single mother	0.086	0.650	0.517	0.255	1.852	0.069

A significant positive relation was obtained between life quality of grandchildren from a full family and evaluating support of a grandmother (R = 0.206; p < 0.027) as well as emotional (R = 0.218; p < 0.02) and general support (R = 0.178; p < 0.06). What was also observed was the important connection between grandchildren's life quality and the evaluating support expressed by a grandfather (R = 0.257; p < 0.018) as well as emotional (R = 0.217; p < 0.046) and general support (R = 0.198; p < 0.072). The obtained results allow us to assume that what is the most important for the subjective evaluation of grandchildren's life quality from a full family is the evaluating, emotional and general support of both grandmother and grandfather from the father's side.

Yet in a single mother family positive crucial connections on the level of statistical tendencies were revealed. The dependencies occur between the informational support given by a grandfather (R = 0.24; p < 0.088), the emotional one (R = 0.247; p < 0.079), the general one (R = 0.255; p < 0.069) and life quality of grandchildren. Grandmother's support is without any meaning for the evaluation of life quality by grandchildren. The results allow us to assume that what is the most important for the subjective evaluation of life quality of grandchildren from a single mother family is the informational, emotional and general support but only from the father's side.

4.2 Life quality and the material status of a family
The intra-group analysis (see Table 4 and Table 5) and the intergroup analysis (Table 6) carried out on the researched from various structures allowed to capture the difference in the evaluation of life quality in terms of material status of a family.[2]

Table 4

Descriptive statistics together with the relevance test for the life quality of grandchildren from single mother families

Variable (N = 66)	M	Me	Min.	Max.	Lower Quartile	Upper Quartile	SD	z	p
Satisfactory (n = 37)	25.43	26	10.00	34.00	22.00	29.00	5,78		
								2,749	0,005
Unsatisfactory (n = 29)	21.32	22	9.00	32.00	17.00	25.00	5,64		

A strong dependency between the assessment of life quality and a family material status was observed. Grandchildren from a single mother family, more satisfied with the material family status assessed their life quality better (z = 2.749; p = 0.005) than those who were dissatisfied with it.

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[2] The people with the mark of good and very good were included in the category of people evaluating the material level of family as the satisfying one. People with the mark satisfactory and unsatisfactory were included in the category of people who asses the material level as the unsatisfying one

Table 5

Descriptive statistics together with the relevance test for the life quality of grandchildren from full families

Variable (N = 129)	M	Me	Min.	Max.	Lower Quartile	Upper Quartile	SD	z	p
Satisfactory (n = 101)	26.17	27	11.00	35.00	23.00	30.00	5.19		
Unsatisfactory (n = 28)	23.07	25	9.00	30.00	19.50	27.00	5.36	2.641	0.008

What was also observed was the strong dependency between the assessments of life quality and material status of a family. Grandparents from full families being more satisfied with their material status evaluated their life quality much better (z = 2.641; p = 0.008) than the unsatisfied ones.

Table 6

Descriptive statistics together with relevance test for the differences in adolescents' life quality in terms of a family structure

Family material status	Family structure				Total
	single mother		full		
	n	%	n	%	
Unsatisfactory	29	43,94	28	21,71	57
Satisfactory	37	56,06	101	78,29	138
Total	66	100,00	129	100,00	195
Value χ^2		10,142			
DF		1			
p		0,001			

In single mother families there is a significantly higher percentage of adolescents who evaluate their material status as the unsatisfactory one. The obtained result proved to be statistically significant (χ^2 = 10.142; DF = 1; p = 0.001). The result suggests that a bit lower material status in a single mother family could influence the lower life quality.

5 Discussion and conclusions

The aim of the elaboration was to take a position on two research problems. The first problem is whether there is a connection between the social support of grandparents and life quality in the retrospective evaluation of grandchildren, and if so, is this connection statistically significant? In the light of the obtained results, one can say that no relevant dependencies for the maternal grandparents, both in a single mother family as well as the full family, were observed (Table 2). According to the possessed knowledge from other research on social support, it was expected that the result could be less favourable for the grandchildren from full families. Thereby, the formed expectation that support from maternal grandparents will more crucially connect with the life quality of grandchildren in a single mother family than in a full family (H1), was not proved with the collected empirical material. It can be assumed that grandparents could aim their social support at their children and not directly at grandchildren and hence, social support did not have an important influence on their life quality.

However, the obtained results allow to claim that for the evaluation of life quality of grandchildren in single mother families what proved to be of importance was the emotional ($p = 0.079$), informational ($p = 0.088$) and general support ($p = 0.069$) of only a paternal grandfather (Table 3). Yet in a full family a few significant positive connections between the social support of paternal grandparents and the life quality of grandchildren were obtained. The results showed significant connections between evaluating support ($p = 0.027$), emotional ($p = 0.02$) and a general one ($p = 0.06$) of a paternal grandmother and grandfather (respectively: $p = 0.018$; $p = 0.046$; $p = 0.072$) and the grandchildren's life quality. The results do not confirm the earlier results obtained from a group of grandchildren from Lublin and Śląsk Voivodeships in which there was a meaningful relation between the evaluating support of a maternal grandfather in a single mother family and crucial relations between every sort of support of maternal grandparents in a full family (Napora et. al., 2014, p. 168).

Both emotional and evaluating support is the kind of psychological help, which strengthens the feeling of value among adolescents and reveals positive attitude of adults towards them. Generally, both forms of support are about sending verbal and non-verbal messages which ensure closeness. These messages occur most commonly and they are mostly awaited. Informational (cognitive) support comes down to the exchange in the process of information interaction which fosters a better understanding of a situation and a problem. It is about giving advice and information which can help in solving problems. It is important to pass feedback information about the efficiency of the undertaken actions. Social support expressed by grandmothers in emotional and evaluating scope is mainly

expressed in the aspect of a sex stereotype. According to it, women are more aimed at building social bonds and they are more emotionally open (Cavanaugh, 1997). It is contradicted by the obtained results for the connections between evaluation of social support and life quality of grandchildren from a single mother family (table 3), in which the social support given shows a negative relation with life quality of grandchildren. Yet close emotional bond of a parental grandfather with grandchildren, their informational, emotional and general support shows a meaningful connection with their life quality. As researchers suggest, it can be a consequence of allegiance relation which was created between them (Tyszkowa, 1991).

Therefore, a conclusion can be formulated that there are no significant relations between social support by maternal grandparents and the quality of life of grandchildren both in two-parent and in single-mother families. The evaluations of social support provided by grandparents that the grandchildren submitted during the study are similar to each other. This conclusion does not apply to the evaluation of social support of a paternal grandfather, which clearly shows the connection between the life qualities of grandchildren regardless of family structure. This suggests that if a parental grandfather engages in help and support of grandchildren, especially in a single mother family, he will thereby contribute to the better life satisfaction. He can act like a shield for grandchildren experiencing changes in a family structure. The conclusion contradicts the observations that grandchildren usually have better relations with maternal grandparents rather than the paternal ones (Hodgson, 1992). What is more, paternal grandmothers influence life quality of grandchildren but only in a full family.

The obtained results allow us to think that adolescents who come from full families evaluate grandparents' support better than the adolescents who come from single mother families. In full families more results which were statistically significant for the relation between the social support evaluation of grandparents and life quality of grandchildren were obtained. These results suggest that if there is involvement from the distant family members (of a grandmother and grandfather), the mental well-being of children's upbringing improves as well. The results show that there are differences in the evaluation of grandmother's and grandfather's support caused by the distinctness of family structures – in full families relations with grandparents happen quite harmoniously and they are highly assessed by grandchildren, yet in single mother families if the intensification of contacts with a parental grandfather appears, then life quality of grandchildren clearly increases. It can suggest that higher engagement, especially of a grandfather in paternal line, results in the increased mental well-being of grandparents in these types of families. This statement should refer to the observations described in literature where grandparents give their advice

concerning learning, work and finance. The obvious expectations would be a counterbalanced influence of grandparents – both from the maternal and paternal line – which would without doubt contribute to the better fulfillment of grandchildren's needs and which would find the reflection in adolescents' evaluation on the topic of their life quality until now.

Answering the second question, of what factors connected with family additionally allow us to describe the quality of life of grandchildren, it can be said, on the basis of intergroup analysis, that life quality of grandchildren is significantly connected with the material status of a family (table 4 and 5), regardless of the family structure. Adolescents unsatisfied with the economic well-being of their family evaluated their life quality low. Moreover, in single mother families a higher percentage of adolescents evaluating the material family status as the unsatisfying (43.94%) in comparison with the researched people from full families (21.71%) was observed. The obtained result for the inter-group comparison is statistically significant ($p = 0.001$) (Table 6) and it suggests that what could influence the lower life quality in a single mother family is the fact of a bit lower material status.

Effects prove that low material status of a family is constantly seen by adolescents and it can lead to deprivation of mental needs: affiliation, meaningless, recognition in the eyes of others and it additionally solidifies passive and aggressive attitude in interpersonal relations (Siwek, 2010). As a result, it can lead to lowering the meaning and withdrawal from the engagement in social life (Buhs and Ladd, 2001). Worse material family situation can result in social exclusion of adolescents.

To conclude, the obtained results indicate:
1. Similarity in experiencing social support of maternal grandfathers by grandchildren, regardless of the family structure of dwelling in Częstochowa sub-region.
2. More crucial relations between the social support (evaluating, emotional, general) of paternal grandmother and grandfather and life quality of grandchildren in full families.
3. The surprising result for the positive low connection between social support (informational, emotional and general) of a paternal grandfather and life quality of grandchildren in a full family.
4. Unsatisfied adolescents due to the material status, regardless of family structure, evaluate their life quality considerably worse. What is more, in comparison with adolescents from full families, a twice higher percentage of adolescents from single mother families were unsatisfied with their material status.

The results allow us to assume that the most important for the subjective evaluation of life quality of grandchildren from a single mother family is the informational, emotional and general support only of a paternal grandfather. In a full family evaluating, emotional and general support both of a paternal grandmother and grandfather is positively connected with the life quality of adolescents.

To conclude, the visible and experienced social support of parental grandparents fosters life satisfaction of adolescents who come from Częstochowa sub-region. Furthermore, results suggest that a lower material status influences lower life quality in a single mother family. With the higher material status of a family, higher life satisfaction of adolescents can be observed.

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ARTICLES

Class Teachers – Their Thinking and Reasoning in the Context of Creating a Favourable Classroom Social Climate by Means of the Methods of Personal and Social Education

Zuzana Geršicová[*]

Abstract: The paper deals with class teachers' thinking and reasoning processes and the possibilities of influencing teachers' ability to create a favourable classroom social climate. This paper describes personal and social education as one of the means and methods of such influencing. The results of the research carried out indicate that teachers have a very high opinion regarding their ability to create a favourable classroom social climate. The issues of personal and social education in the work of a class teacher are the topic of the project KEGA 002DTI-4/2013 being solved by a team of professionals at Dubnica Institute of Technology in Dubnica nad Váhom.
Key words: class teacher, personal and social education, favourable classroom social climate, perceived self-efficacy.

1 Introduction

Today's youth enter their lives equipped with rich theoretical knowledge but they are not prepared for the most important thing they need in their everyday lives. Young people are not able to communicate effectively, to cope with conflicts nor to solve them.

They cannot cope with everyday problems, are not skilled to organize their lives, time, gifts and talents, dreams nor desires. They do not know how to deal with their inclusion into the system of social roles in life. One of the possible ways of improving this situation is personal and social education in schools leading to the development of personal, individual prerequisites of people for living with

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[*]   Zuzana Geršicová, Dubnica Institute of Technology in Dubnica nad Váhom, Dubnica nad Váhom, Slovakia; gersicova@dti.sk

themselves and other people in the current social context, to the development of social (interactional, relations) skills for living with other people and to the development of ethical prerequisites for living in the society and in this world as such (Gymerská, Kožuch, & Záškvarová, 2009, p. 7). And here it is necessary to emphasize the need for professional educational work on the side of teachers, especially class teachers, who play the specificational and integrational role within educational programs. The educational encyclopaedia (Pedagogický slovník, 1985, p. 458) defines a class teacher as a teacher authorized by the director of the school to a school class both form educational and administrative aspects. The personal qualities, job description and professional self-efficacy of a class teacher can be summed up as follows: gets and gathers information about pupils and processes them as a part of complex assessment, monitors their school success and behaviour in the class, supervises pupil's school attendance, perceives them in the context of their family environment. From the above follows that class teachers, besides knowledge from pedagogy and psychology, need a huge amount of creativity, ideas, exercises and methods for developing young people's values and, at the same time, for creating a positive classroom social climate.

2   Class teachers and sessions with the class teacher

Class teachers lead their pupils throughout the whole process of schooling starting from primary and ending at secondary schools. They are the first contact persons in case of questions, unclarities and problems. Class teachers are responsible for the activities of a school class, organize its working routine, and work with class documentation. They must ensure the equality in relationships in the school class as well as equally good learning conditions for all its members. They help students with completing all their duties and, at the same time, supervise them. They are responsible for the discipline and following the school rules but the rights of pupils must not be restricted neither by their school mates nor their teachers. From the above, it is clear that being a class teacher is not an easy thing. The expectations on the side of the school management, pupils, pupils' parents and their colleagues are high. Based on our personal experience, we have tried to formulate the most important tasks in the work of a class teacher and divided them into five basic fields:

- Coordination of the educational work in the classroom, cooperation with parents, legal representatives, representatives of various organizations and institutions;
- Creation of hygienically appropriate conditions for education;
- Preservation of security and of pupils' health;
- Working with pedagogical documentation;
- Creation of a favourable classroom social climate.

The specifics of class teachers' work at various levels of education should not be forgotten about. There are some differences between the status of class teachers in primary and lower secondary schools. Especially the differences in the amount of time spent with their pupils is visible. In case of primary school teachers, class teachers spend the whole school day with their class, while lower secondary school teachers who only teach their subject in the class (which can be 2-5 lessons per week depending on the number of lessons in the timetable) and meet their pupils only during their regular group sessions with the class teacher. It can have a negative impact on the creation of a closer relationship between teachers and their pupils. Of course, it is important to take into account the specifics of younger school-age children, their greater openness, responsiveness and their willingness to follow the set rules. With pupils of older school-age, rebelliousness, denying authority and attempts to fulfil their need for personal self-realization appear.

In the school environment, class teachers can get to know their pupils better during the regular group sessions with the class teacher. Sessions with the class teacher provide space for the class teachers' direct educational impact on pupils and for increasing the quality of communication with their legal representatives. The goal of the sessions with the class teacher is solving educational problems and activities of the particular class. The precondition for doing so, according to Hlásna (2005, 2008, 2011), is having information about the existing social relationships in the class.

According to the Decree of the Ministry of Education of the Slovak Republic No. 320/2008 Coll. on Primary School as amended by the Decree No. 224/2011 Coll., regular group sessions with the class teacher in which students and teachers discuss general class and school matters are included in school timetables. The length of a group session with the class teacher is 45 minutes (one teaching period) and is not included in the total number of pupil's lessons nor in the teachers' class time per week. Class teachers can decide about the form and the content of the session based on their own needs and the requirements of the school management. By this decision, teachers were given freedom but, at the same time, the question of the content of the sessions with the class teacher has arisen.

3 The current state of the issues of teachers' personal and social education in Slovakia

Preparedness for everyday life is not only a sum of general knowledge that opens young people the path to further studies, but it represents help in the sphere of life orientation and adequate reactions in various life situations. If we take a deeper look, we, for sure, find out that the acquisition of life competencies

is underestimated in comparison with knowledge competencies in the Slovak school system. Personal and social education was implemented in the British curriculum for children aged 5 to 16 in 2003. It includes the field of relationships and communities on both local and global levels, sexual education, moral education, environmental education and spiritual education. In the Czech Republic, personal and social education has been mandatory in the curriculum of every primary school since 2007. It is included in the national curriculum for primary education as a cross-cutting theme. Individual parts of every cross-cutting theme are mandatory and it is up to the school where and how pupils get in touch with them during their school attendance. It can be a part of the educational subjects, projects, courses and various activities. It is usually realized by means of experiential learning. Personal and social education is focused on personality development, development of social skills and moral values. In the Slovak Republic, new state educational programs on all school levels based on the international classification ISCED were introduced by the Act No. 245/2008 Coll. on Education (the school act). Personal and social education is included in all levels of education starting from ISCED 0 and ending at ISCED 3 as a compulsory cross-cutting theme. Cross-cutting themes deal with topical issues, they serve as a guideline for prevention and solution of problems, and, at the same time, help to deepen basic knowledge with an emphasis on its application. They should contribute to broadening students' minds, help to acquire certain attitudes, values, help in decision making. They interconnect various fields of knowledge, contribute to the complexity of students' education, they have a positive impact on the process of the development and improvement of pupils' key competencies. They can be taught within school subjects, but also in the form of courses or as individual elective subjects (Act No. 245/2008 Coll. on Education). The cross-cutting theme Personal and Social Development develops the human potential of pupils, prepares them for a full and responsible life. It means not only academic development of pupils, but also the development of personal and social skills that support the academic development.

The aim is to:
- Develop pupils' self-reflection, self-knowledge, self-respect and self-confidence; and taking responsibility for their actions, personal life, self-education; to teach pupils how to apply their rights but also to respect the opinions, needs and rights of others.
- Support the prevention of social-pathological phenomena by its content.
- Help students develop and maintain personal integrity.
- Develop high quality interpersonal relationships.
- Develop the social skills necessary for life and cooperation (according to Štátny pedagogický ústav, 2012).

Within this cross-cutting theme, also human rights education as well as family education are applied (Tamášová, 2006, p. 13). The theme crosses all the fields of education and responds to the current needs of pupils. It is necessary to use suitable activities, model situations, discussions, games and other interactive methods with all the themes.

4 Project

Personal and Social Education as a Part of Class Teachers' Lifelong Learning is a project being solved by pedagogues from the Dubnica Institute of Technology in Dubnica nad Váhom (project leader: Z. Geršicová). The main purpose of the project is to react on the need for a broader implementation of personal and social education realized by class teachers into primary and secondary schools and to make their job easier by means of handbooks on how to manage group sessions with the class teacher and teacher-parent meetings. The team of investigators aims to achieve this by working out and testing methodological handbooks in practice and their subsequent corrections, after which handbooks will be introduced into practice.

Based on the above stated, it is evident that personal and social education should be introduced to our schools. This type of education is included in the project in the part of testing methodological handbooks in practice. It is not a research project but an application project focusing on the practical skills of class teachers in the field of personal and social education as well as methodological support by fulfilling its goals in practice. The project has the potential of further development and application in other research tasks that can follow after testing and introducing the methodological handbooks into practice. One of the possible solutions is the project of continuous education for class teachers in the form of socio-educational training which can help teachers to learn more about the individual methods and techniques of personal and social education and their realization with a group of pupils. A better knowledge of the class offers the teachers the opportunity to evaluate the relationships in the classroom and the classroom climate better.

5 Favourable social climate

Several authors have defined the notion of school climate. For the purposes of our paper, we have chosen three of them.

According to Průcha, Walterová and Mareš (1995), it is the long term socio-emotional state characterized by attitudes, relationships, and pupils' emotional responses to various classroom situations.

Gavora (1999) defines classroom climate as the extent to which a pupil is satisfied in the class, whether the pupils have good relationships in the class, what is the level of competition between them and what is the degree of class cohesion.

According to Mareš (1998), as for its content, the notion of classroom climate includes the established procedures, perception, experiencing, evaluation and reactions by all the participants (the teacher, all the pupils in the class, groups of pupils within the particular class, and individual pupils) to what has happened, is happening or will happen in the future in the classroom. He accentuates that the perception and interpretation of the climate by the participants themselves, i.e. the subjective aspects of school climate and not what the climate objectively is like, is accentuated. The reason is clear: for reflection, taking positions, action and the evaluation of such actions, the subjective view of the participants on the school class is important.

The common feature of all the definitions is the emotional side of the mutual relationships in the classroom and their subjective evaluation by individuals participating in the creation of classroom social climate. Their view on their ability to objectively change the current social climate is subjective as well.

These statements lead us to conclude that the success of a teacher's work with a school class and in the classroom is influenced by:
- The teacher's and pupils' positive approach to what is happening in the classroom;
- efficiency of mutual communication;
- knowledge of the social-psychological phenomena of the school class;
- their diagnostics by means of appropriate methods using a suitable diagnostic tool;
- collecting the results and formulating findings;
- suggestion of suitable methods and interventions;
- realization of these interventions and evaluation of the results.

One of the task of class teachers, as mentioned above, is to create a positive classroom social climate. We understand this notion as minimization of fear and jitters on the side of pupils, motivation to learning, and creation of optimal conditions for developing personal relationships. The positiveness of classroom social climate is, in our understanding, divided into five dimensions - a high degree of satisfaction and cohesion of pupils in a school class on one hand and a minimum of conflicts, low degree of competition between pupils and adequacy of requirements on pupils on other hand. The personal development of pupils should be accentuated and their assessment should be more complex. A positive classroom social climate is not created only by a positive approach of teachers to

pupils but also by their participation in the life around them and tutoring them, encouraging and supporting them in mutual help.

A positive social climate is determined by mutual trust between the class teacher and pupils; participation of pupils in decision making; evaluation, motivation and encouragement on the side of the teacher and the schoolmates; and decency and fairness as for the participation in class life. It makes a difference whether the social climate is objectively favourable or only perceived so by its participant. In the next part of the paper, we focus on gaining information regarding the perception of the professional self-efficacy of teachers in the process of creating a positive classroom social climate.

6   Professional self-efficacy as perceived by pupils

Class teachers have their own ways of class management (based on their personal qualities). It is reflected in the behaviour of pupils, social climate and their actions in the classroom. For this reason, we focused on the perception of self-efficacy in relation to the process of creation of a positive social climate by a class teacher. According to the general definition of perceived self-efficacy, it is a characteristic feature which has an influence on success or failure in every human activity. One thing is to have all the predispositions for the completion of a particular task but to believe that we can solve the tasks is another one. Self-efficacy is a part of the socio-cognitive theory by Albert Bandura. Bandura (1997) defines self-efficacy as an individual's beliefs regarding their capacity to organize and execute behaviour successfully in order to achieve one's goals.

Individuals with a high degree of perceived self-efficacy are more independent, resilient and they see themselves more positively. They set themselves more demanding goals, are more persistent in endeavour and give up in case of failure less frequently. The quality of their performances is increasing and they feel contentment. They are sure of their abilities in a particular field, they trust themselves, they perceive difficult tasks and overcoming obstacles as challenges. They take responsibility for their behaviour and manage their lives with an ease.

Individuals with a low degree of perceived self-efficacy are psychically vulnerable, have problems with handling stressful situations and often have a tendency to depression. Their self-confidence is low, they do not trust their own abilities. They run away from solving problems, feel incompetent to deal with them and easily give up. Their feeling of helplessness brings them to self-pity and to the effort to show themselves and the others how a problem or task cannot be solved without any real argument. Failure is perceived as a lack of own abilities. Their belief that they do not have power over their own lives and are

not capable to manage them is very strong. They lack decisiveness, are easy to influence and to manipulate with.

"Perceived self-efficacy is an important regulatory factor of many activities. We consider it an extremely important characteristic feature of a teacher. In this context, we discuss *perceived professional self-efficacy*. Self-image is a very strong regulatory factor of personality, that is why we deal with the beliefs of teachers, not their opinions." (Gavora, 2011, p. 90) In the teaching practice, perceived self-efficacy is defined as teachers' beliefs concerning their own capacity to influence pupils' results, increase motivation, to improve the quality of performance and the perceived personal self-efficacy of students. Teachers' perceived professional self-efficacy is a serious issue connected with teachers' characteristics that have an impact on their thinking and reflection, decision making, planning and managing all the classroom activities.

Such features of perceived self-efficacy as described above can be observed with teachers, too. Gavora (2009) says that we can distinguish between two spheres of the impact related to teachers' perceived professional self-efficacy. One of them is the impact on the assessment of own capacity to influence pupils' development and the other one is the evaluation of the possibilities to change the educational process and to overcome some less favourable external factors (family environment, low abilities of the pupil). Both factors are evaluated by teachers separately. The relationship between these factors has been researched on, e.g. by Tschannen-Morgan and Hoy (2001), and Gavora (2009, 2011).

Teachers with a high perceived professional self-efficacy can organize the educational process better, plan activities on a higher level, they are enthusiastic and diligent. They are resistant to the pressure of the environment and are not afraid of solving problems. They pay more attention to weaker students. They are more open to new ideas, not afraid to experiment with innovative methods of work (problem solving, students' individual projects, group work). Persistence is showed in cases when the educational process does not progress according to the planned steps and in time that teachers dedicate to pupils by searching for appropriate solutions. According to our opinion, it has a strong impact on the classroom social climate.

7 Questionnaire research – "What am I able to do for the creation of a favourable classroom social climate?"

In the last decades, observations and examination of the classroom social climate have come to the fore. For class teachers, it is very important to be familiar with the situation in the class and be able to progressively respond to the current situation. Our research brings information about teachers' evaluation of own

capacity to participate in creating a positive classroom social climate. A more detailed description of the process of construction and the structure of the questionnaire can be found in the scholarly article by Geršicová (2012a).

Research sample
The research sample consisted of 106 class teachers from primary schools who completed the questionnaire in two regions of Slovakia. One of them was a primary school in Trnava and the other one a primary school in Levice district. The research sample was selected based on the researchers' possibilities and the willingness of the school management and teachers to participate in the research. All the teachers were informed that the gathered data would be used exclusively for the purposes of our research. Based on the demographic data included in the questionnaire, the structure of the research sample is showed in Table 1. In the final evaluation, demographic data related to teachers' qualifications to teach at the particular school level, the number of school classes, and the number of students in one school class are not included in the analysis. We have decided to do so as no statistical significance was found between such smaller groups of respondents during the process of data processing.

Table 1

Composition of the research sample

Variables		n	%
Gender	Female	94	88.7
	Male	12	11.3
School level	Primary	38	35.8
	Lower secondary	60	56.6
	Missing data	8	7.5

Source: Author

Data analysis
The higher score one achieves in our questionnaire, the higher one's perceived self-efficacy is. The questionnaire contains six-level scales. Their median is 3.5.

The arithmetic mean of the whole research sample reaches the value 5.04, which highly exceeds the median and is very close to the statement "I am always able". Based on this finding, we must assume that teachers trust themselves as for their skill to create a positive classroom social climate. It is clear that it is the

teachers' subjective evaluation, not the objective reality regarding their professional self-efficacy. A teacher's real level of self-efficacy can be observed when solving conflicts and problem situations in the class and establishing a creative working environment. In the process of creating a positive climate, teachers' trust in themselves is very important. It would be interesting to confront our findings with the evaluation of classroom social climate by pupils. One of the options is to make an interview with the pupils of the class teachers, focusing on the real skills of the particular class teacher in the process of creating a positive classroom climate. The questionnaire method could be used for an inquiry on the evaluation of the classroom social climate and the obtained results could be compared with the results of our questionnaire focusing on teachers' perceived self-efficacy in relation to their capacity to create a favourable classroom climate. Based on our experiences, we can state that the results of the comparison between class teachers and their pupils concerning their evaluation of the classroom social climate would not be very positive for teachers. A research with the same research problem showed that teachers often overrate or underrate the individual dimensions of the classroom social climate compared with students.

The lowest achieved score was 3.04 in item 29 "To have favourite students, who inform me about what is going on in the class." We presume that the teachers expressed their opinions in this item from the moral point of view. We believe that its formulation probably evokes a negative experience with talebearing and betrayal in the class for the most of the participants. Teachers, probably for this reason, consider having such a student in their class to be a failure. Our presumption is supported by the following findings.

The highest achieved score was 5.57, it was achieved in item 9 - "Try to be fair with all the pupils and not to treat them differently." The achieved scores in this item are the proof of the teachers' attempt to give the same attention to all the pupils in the class and not to treat them differently. The moral value of this statement, which can be summed up in one word: "justice" or "equality", is in the perception of teachers, and, in fact, in the perception of the majority of people, built on the hierarchy of moral values and is very high. Therefore, we think that such a high level of perceived self-efficacy of teachers in managing a class is influenced by this fact. In support of our statement, we can mention another finding – the achieved score in item 20 - "To be fair when solving conflicts between pupils." If we compare the gathered data, we find out that it is the second highest achieved score.

Differences between male and female teachers

Based on the demographic data, the differences between female and male teachers were compared and the findings are worth to mention. The findings show that female teachers achieved higher scores than male teachers, what we had not presumed (Table 2). It means that women rated their perceived professional self-efficacy to create a positive school social climate higher than men. This result showed statistically significant on the level of 5%. It is necessary to add that the sample contained only 10 male teachers which is a very small number to make more complex conclusions from this finding.

The results of a similar, but a more complex research on Slovak primary school teachers' perceived professional self-efficacy undertaken by Gavora (2011) by means of the OSTES questionnaire show that, similarly to our research, women achieved higher scores than men. In this case, the results were not statistically significant.

Table 2

Questionnaire results according to gender

	n	AP	SD	Statistical significance
Women	84	5.09	0.54	$p < 0.50$
Men	10	4.70	0.56	

Source: Author

Results according to the school level

The results of the comparison based on the school level at which the participating teachers work, are interesting, too. They are shown in Table 3. Slightly higher scores were achieved by primary school teachers. If the sizes of the subsamples of respondents are compared, we must admit that the sample of primary school teachers was a bit smaller that the sample of lower secondary school teachers. The statistical significance on the level of 1% proves a more developed perceived self-efficacy for the creation of a positive classroom social climate with the primary school teachers. We already presumed the probability of this finding in the theoretical basis where we mentioned the differences in and the possibilities of class teachers' work at primary and lower secondary schools in favour of primary school teachers.

Gavora's (2011) research realized by means of OSTES questionnaire did not show any statistical significance when teachers of primary and lower secondary levels were compared. It is declared in the research, that the teachers of both

levels had a sufficiently developed level of perceived self-efficacy. The sample of primary school teachers was very small.

Table 3

Results according to the school level

	n	AP	SD	Statistical significance
Primary level	35	5.30	0.52	p < 0.10
Lower secondary level	52	4.92	0.53	

Source: Author

A high score in the overall average rating of perceived professional self-efficacy in the process of the creation of a favourable social climate which is very close to the scale statement "I am always able" leads us to the conclusion that the teachers included in our research sample probably evaluated themselves more positively than the reality shows. This statement is supported by the results of our earlier research, in which the classroom climate was evaluated more positively by teachers than by pupils (Geršicová & Hlásna, 2013).

8 Conclusion

As mentioned above, to have certain predispositions is one thing but to believe that we are able to use them to the full extent is another one. Our actions depend to a great degree on our belief that we really can act that way. As it applies in everyday human life, in the teaching practice it applies twice as much. Those teachers who perceive their own self-efficacy as high, usually become successful at work. Teachers participating in our research perceive their professional self-efficacy in the process of creating a positive classroom social climate as relatively high. It is a positive statement but one should not forget that it is their subje+ctive evaluation which varies from reality. It would be interesting to confront the obtained data with the opinions of the participating teachers' pupils. A direct observation of the class teachers' work during the regular group sessions with the class teacher or their actions when dealing with various situations with their pupils, is another option. According to our opinion, observation of the process of personal and social education during the group sessions with the class teacher would have a significant impact on the perception and evaluation of their own competencies in the process of managing classroom life. We believe that only then their real professionality would be manifested.

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Engineering Pedagogy Students Attitudes on Teaching Quality

Dana Dobrovská – Pavel Andres[*]

Abstract: The aim of the current survey was to make the outcomes of an analysis of mature-age student essays available in a convenient form to those who might be interested – engineering teachers and faculty management. Results of this survey are compared with a similar one conducted 8 years ago. Students presumed high expertise of their teachers, but also underlined importance of the real-world engineering examples.
Key words: teaching quality, essay analysis, qualitative methodology, teacher expertise, human/ didactic qualities.

1   Introduction

The higher education teacher's personality is a deciding factor of the quality of the educational process (Biggs, 2003; Mareš, 2013; Holeček, 2014). Experts in various sciences, such as theory of education, educational psychology, philosophy and sociology of instruction have tried to analyze this issue. Different approaches have been used: deduction - when scientists described an "ideal" teacher, induction - when students evaluated their teachers, or when psychological tests backed the illustration of real qualities of teachers. Sometimes, a combination of both approaches seemed appropriate (Koetsier et al., 1996).

Other authors offer lists of personality attributes - principles of effective teaching in higher education. Ramsden (2003) suggested 6 key principles:

- interest and explanation;
- respect for students and student learning;
- appropriate assessment and feedback;
- clear goals and intellectual challenge;
- independence, control (by students over their own learning) and

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[*] Dana Dobrovská, Masaryk Institute of Advanced Studies, Czech Technical University in Prague, Czech Republic; dana.dobrovska@cvut.cz
Pavel Andres, Masaryk Institute of Advanced Studies, Czech Technical University in Prague, Czech Republic; pavel.andres@cvut.cz

engagement;
- learning from students.

Other lists of desirable qualities of HE teachers are available from public bodies involved in professional recognition and accreditation. The UK Higher Education Academy (2010) defined these qualities partly in terms of core knowledge. Applicants via the individual entry route were expected to demonstrate knowledge of:
- the subject material that they will be teaching;
- appropriate methods for teaching and learning in the subject area and at the level of the academic programme;
- models of how students learn, both generically and in their subject;
- the use of learning technologies appropriate to the context in which they teach;
- methods for monitoring and evaluating their own teaching;
- the implication of quality assurance for practice.

2   Survey I (2007)

Some research activities on technical teacher personality were already undertaken at the Czech Technical University in Prague in past (Dobrovská, 1995; Šafránková, 2005). Other information on teaching quality has been regularly available to teachers from regular student questionnaire reports.

The aim of older survey was to make the outcomes of a students´ essay analysis available to engineering lecturers and faculty management. Methodologically, we had found our inspiration in essay analyses as performed by Davies (2006) who had used this methodology at the University of Coventry.

Although the form of student essay has not had such a long tradition at Czech universities compared to the English speaking countries, we decided to replace regular student questionnaires. We knew students disliked to fill in questionnaires for research purposes, sometimes for unclear reasons.

This year, we decided to conduct similar survey and to make result comparison. We assumed moderate result differences due to the lapse of time and different respondents (differences in age and study experience).

Our research sample - students of the Master engineering programme (84 students, age 22 - 26, 1/3 from these were female) submitted their opinions and experience in a 500-1000 word essay "What makes a good engineering teacher." Perhaps as a result of word association, the word teacher in the title seems to have led the essay writers to concentrate on the role of lecturers and some more

forms of class, generally a practical class, laboratory class, project tutor, etc. However, the students referred to the relationship between the teacher and the students´ own learning.

The main attributes of a good engineering teacher were derived after 3 phases of qualitative evaluation (as performed by Davies). In the first phase all relevant semantic formations in essays were registered and assorted (substantives, adjectives and verbs). In the second phase synonyms were set aside and all the attributes were included in 3 categories:
-   expertise of teachers;
-   human qualities of teachers;
-   didactic and presentation qualities of teachers.

In the last phase, quantification of answers and final classification of data was completed.

2.1   Expertise

A major agreement of students referred to expertise. A good engineering teacher has depth of knowledge and command of the study material, he/she keeps proper knowledge up-to-date and uses real-world engineering examples backed up by practical experience. One student wrote: "…it is all too easy to spot a teacher who has spent his whole life in education and merely conveys the bones of the subject matter without the flesh that real life would provide." The importance given to real-world examples and practical experience was significant because some professional engineering institutions are currently expressing concern over the declining numbers of new engineering lecturers with practical experience, caused by the pressure to appoint staff on the basis of research record. Surprisingly, students also mentioned a technical university teacher should have a good general education.

2.2   Human qualities

The student list of human qualities was rather long, even after a considerable semantic reduction: a teacher should be friendly, open-minded, communicative, tolerant, available and enthusiastic (the last component makes a teacher impressive and charismatic). Students criticized a teacher who only presents slides, without any interest in the audience, he/she should possess awareness and responsiveness to students´ needs and should interact with students as individuals and in class. The teacher should also be human, objective, fair-minded and honest. Among conative characteristics exactness, conscientiousness, patience, orderliness, responsibility and consistency were often mentioned. Most of the students who referred to these attributes did so in the context of seeking help with the subject. The teacher should be young in

spirit and should be able to admit errors. His/her appearance should be tidy (!). Students also appreciated a sense of humour.

2.3   Didactic and presentation qualities

The students suggested a good engineering teacher should give sophisticated presentations. He/she should be a good speaker and speak with clarity, lectures should be well structured. Teachers should have a good knowledge of literary language (critique of poor Czech grammar, vocabulary and low semantic sensitivity is frequent…"some CTU teachers should be sent to an obligatory 2 semester course of the Czech language…"

If he/she can persuade an audience that the material is worthwhile and important then the listeners may well be inspired to improve the world around themselves with innovative and inspirational solutions. This needs for an excellent knack, for example and analogy, a feel for how the concept looks to a student who does not yet understand it and an instinct for how well the audience understood the last sentence spoken. A method of explanation that was instantly successful last year may only confuse this year´s batch. These are clearly important and difficult skills. A good teacher is a great motivational tool for students; he/she should be creative and master a variety of adequate methods.

The students did not only describe the desirable qualities of good engineering teachers, but they were also thinking back on good teachers they met during their secondary school studies. "Good teachers are always fondly remembered and consequently the solid foundation that the students build with the help of the teacher is something that lasts for life". Another consideration… "a good teacher is one whose classes I am able to recall in years to come, not only when it comes to exams…"

3 Survey II (2015)

Similar methodology was used in a group of mature-age students (62 students, age 30-46, 1/4 female, students of Bachelor programme "practical classes teaching"). Again, 3 phases of evaluation were used: all relevant semantic formations in essays were assorted, synonyms were set aside and all the attributes were included in 3 categories: expertise of teachers, human qualities of teachers and didactic qualities of teachers.

3.1   Expertise

Similarly to previous survey, students expected good teachers to master their subject and give positive messages to students which are essential for motivation. "The most important quality an engineering lecturer can have is to be genuinely interested in the subject that they teach." "Enthusiasm is

contagious and it encourages the student into further study of the subject, which in turn makes subsequent topics easier to understand" ... "the teacher is a knowing guide to the wanderer."

A teacher is able to impart technical knowledge and to foster the development of technical skills and should be able to manage rapidly growing knowledge base.
A well organized and suitably prepared lecturer is one likely to make a good impression on several respondents. "Preparation is vital to gain student confidence in their knowledge and the information they provide – no one likes to wait for a lecturer to work out his own slides."

3.2   Human qualities
Again, the student list of human qualities was rather long, even after a considerable semantic reduction. Two qualities which were mentioned in most essays were teaching enthusiasm and caring attitude toward students. The need for caring attitude was perceived as essential as many mature-age students were afraid of possible study failure due to long time lapse from high school study. Other qualities were similar to the ones which were described in previous research.

3.3   Didactic and presentation qualities
Text-books, notes and handouts provided by the lecturer rated very highly in the entrants' list of priorities, some favouring the fill in the gaps kind as a way of ensuring attendance at lectures, but all in agreement that clarity and quality are of the utmost importance.

Communication skills were also of vital importance to our essayists. The standards expected by them were high (and rightly so), as they did not just consider lecturing to be a one-way street. Interacting with the class or audience participation was cited in 25% of the essays as crucial to the success of the learning experience. A similar number of essays cited clarity of course structure as key to a lecturer's success.

4   Comparison - Survey I and Survey II
It was not considered appropriate to give precise percentages based on a low number of essays, and so the level of agreement was expressed as:
-   *strong agreement* - referred to in virtually all the essays;
-   *good agreement* - referred to in more than half essays;
-   *some agreement* - referred in several essays.

The specification of the attributes:

Strong agreement – virtually all the essays referred to these characteristics: that a good engineering lecturer: is enthusiastic, gives clear, well-structured presentations, uses real-world engineering examples backed up by industrial experience.

Good agreement – the following characteristics were clearly identified in more than half of the shortlisted essays: a good lecturer has a genuine interest in students as individuals and as members of an audience (is friendly, approachable and patient; is audience-aware and responds to feedback), strongly encourages learning, has depth of knowledge and command of the material, uses visual material and demonstrations effectively.

Some agreement – In addition to these characteristics, several essays indicated that a good engineering lecturer is good at simplifying difficult concepts and is well organized and reliable.

4   Conclusions

Similar results were received in the survey I and the survey II after essay analyses of two cohorts of students - despite of the lapse of time and differences in age and study experience. Students presumed high expertise of their teachers, but also underlined importance of the real-world engineering examples. Enthusiasm and ability to motivate were perceived as essential. In the second survey, the mature-age students indicated teacher support at the utmost importance.

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Development of Key Competencies in Integrated Teaching Workplaces

Daniel Kučerka

Abstract: This article deals with the determination and definition of competencies of pupils and their development in an integrated didactic work place. The article focuses on the practical teaching in the turning workshop at secondary school. The development of competencies is based on the learning objectives for the subject "Technology of Turning" in the practical teaching. The general learning objectives are further specified in sub-objectives, in which the various competencies the student should acquire and develop are defined.
Key words: key competencies, integrated teaching workplace, turning.

1 Introduction

Integrated didactic departments ensure the development of skills and experiences based on the theoretical knowledge of pupils as acquired during theoretical teaching. In general employers already require qualified professionals with practical workplace experience at the time of recruitment. Those schools that are able to establish practical training programmes in companies give their students an advantage on the labour market. Such programmes provide students with experience under full operating conditions, and under the guidance of practitioners. There are companies that have built multi-functional integrated workplaces, in a similar vein to a school workshop, directly within their company. The us competencies the students acquire can therefore easily be put into practice because the company prepares them accordingly and usually creates jobs for the competent students. The qualified graduate, when they start working full time, therefore knows the working conditions and the requirements of their employer. The reverse is also true, the employer knows the core competencies of their employee.

[] Daniel Kučerka, The Institute of Technology and Business in České Budějovice, Czech Republic; kucerka@mail.vstecb.cz

2 Key competencies

Competence is the ability to activate and apply the internalisation system of knowledge, skills, vocational, personal and social skills, values, attitudes, as well as other personal qualities, which are specifically configured (level of intensity, the ratio of the components, method of grouping, hierarchy). Competencies may be activated or manifest themselves in different contexts through the activities that a person undertakes in real life.

According to Hrmo and Turek (2003), competence is a behaviour (action or a set of actions) that is characterized by excellent performance in any field of activity. Key competencies are the most important competencies of a set of competencies. They are those competencies that are suitable for addressing a wide range of mostly unforeseen problems that allow an individual to successfully cope with rapid changes in their work, personal and/or social life.

By studying and learning at secondary vocational schools. we want to achieve the formation of expertise relating to key competencies and professional competencies. These competencies are influenced by skills, experience, knowledge, attitudes and orientations in the branch.

Key competencies represent a summary of knowledge, skills, abilities, attitudes and values important for the development of each member of society. The selection of key competencies is based on the values generally accepted in the society and generally connected ideas about the fact which of the competencies contribute to individual's education, happy and successful life, to strengthen the functions of civil society (Veteška & Tureckiová, 2008).

According to Hrmo and Turek (2003) the competence has the following characteristics:
- it has the activity character,
- it is the quite complex,
- it has the processual character,
- it is dynamic and developed on a various level,
- it is a prerequisite for the development of a person in a particular activity,
- it is the result of formal and informal education.

Experts agree that the key competencies should be acquired by all the pupils during their compulsory education. Whether it is formal or non-formal education, their development is needed throughout their life. To ensure that there is effective acquisition of key competencies, there is especially needed the fundamental change in the content and teaching methods and strategies towards

the participative, interactive, experiential learning, which is based on experience and is linked with life.

Competence has the certain behavior, manifested by certain characteristics. These characteristics reflect specific action, but also behaviour, knowledge, skills, motives and performance of an entity in a particular activity. This comes from the combination of characteristics of Hrmo and Turek (2003) and tab. 1 of Veteška (2010).

According to the above mentioned, the competence is defined firstly by a certain standard. This standard assumes a level of mastering the required performance. The performance is determined by a set of performance criteria. By these criteria, it is possible to measure and evaluate the required competencies for example in integrated teaching workplaces. The pupil in every year of his/her study must have certain knowledge, skills, habits and routines. Considering the practical training of the second year the pupil for example by machining on a lathe must handle operations such as alignment of the front part, removing material using the average of the components, grooving, drilling, etc. The third year student is required to handle threading, turning conical parts, turning the copier and so on.
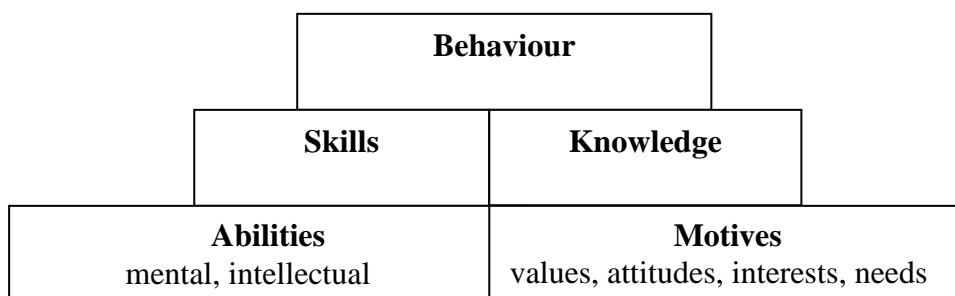
Behaviour	
Skills	**Knowledge**
Abilities mental, intellectual	**Motives** values, attitudes, interests, needs

Figure 1. Content of competence (Veteška, 2010).

Veteška (2010) according to Figure 2 provides a graphical representation of key competencies and relationships among qualifications, competencies and education.
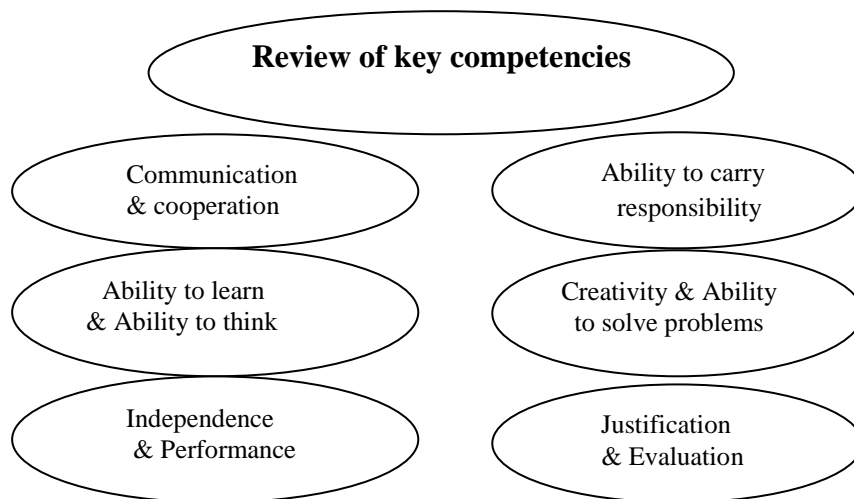
Figure 2. Review of key competencies (Veteška 2010).

Discussion about the need to establish key competencies into the national educational programme and school curriculum, strategic documents, as well as the common use of the term within the European Union is closed. Nobody doubts about the necessity of introducing this terminology.

The development of key competencies is related not only to the education in the primary sense, but also in the lifelong learning, continuing education and retraining.

3 Integrated teaching departments

Integrated teaching facilities form a part of Engineering Education. Engineering Education is the interdisciplinary discipline that transforms the knowledge of pedagogy and psychology into technical sciences. Its purpose is to increase the effectiveness of didactic education of engineers involved in the formation and training of future professionals. The role of integrated teaching working places is to bring theory into practice. It means that the student (pupil) during his education has the opportunity to test his theoretical knowledge in practice. For these reasons, such teaching accumulates within more hours.

To develop the integrated working places, it is necessary to take into account the principles such as the light intensity, noise intensity, heat intensity, paint of rooms. In these working places should be taken into consideration the volume of the room for a person in terms of the health protection principles and ergonomics. In terms of equipment it is required to ensure so that people should

work on didactic machines with the valid revision and these machines should have the right (safe) instruments, tools and accessories.

Integrated learning workplace is understood as a set of suitable formulated didactic material resources required for the enquired type mainly of training classrooms (Hrmo, Kučerka, & Krištofiaková, 2014).

The integrated teaching departments include: language classrooms (laboratories), video centre, computer and multimedia classroom, classroom associated with the study room, specialized classrooms for programming of machine tools, etc.

In my opinion, it is possible to divide the integrated teaching departments in the following groups:
- school workshops at secondary schools
- special departments for gifted pupils
- special integrated workplaces for disabled students
- laboratories,
- special classrooms of vocational subjects.

School workshops of secondary schools can be divided into:
- workshop of manual machining,
- workshop of machining and
- workshops of CNC machines.

Machining workshops consist of workshops of lathes (Figure 3), milling machines (Figure 4), grinders, drill machines or some machines for finishing operations.

Figure 3. Turning workshop.

Figure 4. Milling workshop.

Turning workshop consists of various types of lathes. The basic type is the lathe SV 18 R, which is usually in every workshop. From a didactic point of view these are the teaching tools that are the real teaching aids where the pupils learn to work. They acquire the knowledge from the teaching theory and use them in practice and gain experience, skills and habits. These are actually the key competencies.

4 Development of key competencies in integrated teaching departments – machining workshops

The development of pupils´ key competencies in an integrated teaching workplace affects the lesson planning a teacher is acquired to do. This process is an extremely important component of planning competencies and teaching abilities. Teacher with his/her experience and interest in his/her job is able in his/her preparation for the the lesson during his/her planning process answer many important questions. First of all, he/she has to find answers to questions:

- What do I want to achieve during the lessons but also in all thematic units?
- What do I want the students to know?
- What skills the students should have?
- What are the cross-curricular relations in the topic?
- What information do I choose and how can I continue the already acquired knowledge of students?
- What homework or project will I give to them?

The answer to these questions for the teacher is his/her plan. In this plan there are the answers for the achievement of learning objectives through the content, methods and material and immaterial resources.

Learning objectives can be organized into a hierarchy according to the concreteness or abstractness of general objectives, targets and specific objectives. As the example we can mention the teaching objectives of the subject Practical training - thematic unit Turning.

General objective of the unit:
To master basic concepts, methods and practical activities in turning.
Interim Destination of the thematic unit Turning

- to know basic concepts and the geometry of the cutting tool (turning knife),
- to know basic types of machining on a lathe (turning of cylindrical surfaces, align of the front parting, grooving etc.),
- to understand the nature and acquire the basic skills turnings.

Specific objectives of the thematic unit Turning:
- to define and explain the essence of cultivation.
- to name and draw the basic angles of cutting tools (lathe knives)
- to appoint the types of turning blades and describe their geometry,
- to appoint the types lathe
- to list some of the lathe,
- to learn to control lathes,
- to be able to perform a desired lathe operation.

Mastering the individual goals during the practical training on the lathe are the own key competencies of the student. The acquired habits, skills, experience and attitudes are important for his professional experience, or they form the basis for dealing with CNC lathes.

5   Conclusion

Students, through their studies at secondary school, are seeking to acquire the necessary key competencies and professional competencies to qualify in their field. These competencies are influenced by skills, experience, knowledge, abilities and attitudes that are oriented to this branch.

Required competencies are formed in pupils by a range of professionals (secondary school teachers) in the theoretical and practical teaching from different specializations . Students in addition to vocational subjects also have a general educational subjects which are the support subjects of future specialist.

In integrated teaching workplaces the students gain their practical experience and skills. Their development is dependent on the preparation, it affects the planning of a lesson by the teacher. This process is an extremely important component of planning skills and teaching skills. Equally important component is the use and inclusion of appropriate teaching resources to teaching which include the teaching machines, equipment, tools and the accessories.

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Structuring the Curriculum

*Gabriela Petrová – Nina Kozárová**

Abstract: In the proposed paper, we deal with the opportunities of structuring the curriculum. On the theoretical level, we discuss the content of education, the process of knowledge selection and organization, suggestions for increasing the quality of textbooks.
Key words: structuring the curriculum, mental representation, cognitive modification, interference, curriculum, curricular content.

1 Introduction

The right for education is included in the international documents of every democratic country. The society supports education at every age and searches for the possible answers to the question "How to provide students with an effective educational process?" Various intervention programmes, a number of research, and modification of the cognitive conditions of education appear in ordinary schools more and more frequently. The content of education and textbooks seem not to be ready to react to these changing conditions.

2 Educational content

According to Kosíková (2011), based on the humanistic principle, we approach education with an accent on the necessity to increase the autonomy of schools. The curricular reform, which promotes teachers' and schools' participation in the process of curriculum creation, draws on the increased autonomy of schools. Teachers should also adopt the method of active teaching and learning which requires not only a creative teacher but also a creative student. The involvement of teachers in the curricular content selection and creation process can promote and help to increase the quality of interactions and bring a deeper feedback between teachers and students.

The educational content given in curricular documents must correspond with the content of textbooks, for this reason, the curriculum determines the structure of textbooks to some extent. We find it necessary to clarify the notion of

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* Gabriela Petrová, Faculty of Education, Constantine The Philosopher University in Nitra, Nitra, Slovakia; gpetrova@ukf.sk
Nina Kozárová, Faculty of Education, Constantine The Philosopher University in Nitra, Nitra, Slovakia; nina.kozarova@ukf.sk

curriculum from the point of view of several authors. Švec (2002) understands curriculum as a kind of an educational plan worked out in agreement with the national performance standards.

Turek (2008) understands curriculum on three levels, as the formal curriculum (realized in the course of the educational process); informal curriculum (after school activities); and hidden curriculum (social interactions of students in the class).

Skalková (2007) considers curricular documents an umbrella concept for various methodical and didactic tools for teachers, curricular plans, didactic tests for students, the curriculum, educational standards, and textbooks. School curricular documents form a part of school development plans.

Voices for a curricular reform have been calling for quite a long time. Professionals criticize the method of imparting ready knowledge to students, but also a too extensive curriculum, encyclopaedism, superficial knowledge and, last but not least, students' passivity. Professionals accentuate the necessity of developing cross-curricular relationships, increasing students' activity and of providing them with systematically organized knowledge. "The structure of a curriculum is based on the educational fields and the content areas and particular school subjects are derived from them. In the process of school curriculum creation, the educational aim and goals, the selection of curricular content and the cross-cutting themes form a mandatory part of the curriculum. The process of curricular content selection and creation based on the general educational program is influenced by the expected results." (Kosíková, 2011, pp. 73-76).

Škoda and Doulík (2011, pp. 157-168) state, that the pace of the mankind's progress is tremendous in many fields and one of them is science. "So it is necessary to specify the educational content in such a way that it forms a certain representative selection of scientific (but, of course, also technical, artistic, cultural, etc.) knowledge on the level of the learning individuals by means of didactic analysis." Didactic encyclopaedism is a discussed issue in many educational journals. With the development of technology, science and human knowledge, the requirement to acquire knowledge from every field of science has become unreal. An abnormal amount of information leads towards a too extensive curricular content and students' personality development is suppressed by memorizing huge amounts of information that students often only reproduce without understanding. The teacher devotes all his teaching time to the presentation of information and students often only passively participate. "Curricular content based on specific competencies is a special type of curricular content selection, the aim of which is developing competencies for practicing a certain profession. Such a selection of curricular content is practiced in

specialized, qualification, requalification or lifelong education." (Škoda & Doulík, 2011, p. 161)

The mentioned authors offer a view on the formulation of what students should master. Educational content is formulated based on a didactic analysis, then didactic transformation follows, which means that it is transformed into a curriculum. The result of the process of didactic reconstruction is then a reconstructed structure of the curricular content. Such a reconstructed structure should be simpler than the original scientific idea. It is adapted and modified in order to become comprehensible for students of a particular age and cognitive level.

3   Curricular content selection and organization

A lot of scientists from the fields of pedagogy and psychology, but also some representatives of other scientific disciplines, deal with the question "What kind of knowledge and to what extent should students acquire?". The question of the possibilities of structuring knowledge into such a format which helps students remains unanswered. Not only the amount of information plays a role but their organization is important, too. Several recognized foreign authors, e.g. Chang (2007), Pazzaglia and Moé (2013), Kovac and Bertoncelj (2008), Chung, Cheak, Lee, and Baker (2012), have focused on this issue.

Professionals consider developmental psychology, especially the age specifics and competencies of students which influence mastering of a topic, to be one of the most important aspects in the process of selection as well as organization of the curricular content. It is necessary to realize that the learning capacity of students has its boundaries and limits that change with their development. We must not forget about the preservation and development of students' physical and mental health, therefore, it is crucial to select the most important information among the huge arsenal of human knowledge.

Petlák (1997, p. 45) says, "We understand the concept of curricular content as a certain set of information and activities which students should master in the course of the educational process and the process of learning which should be reflected in their knowledge, competencies, skills and habits."

Understanding the internal structure of the curricular content is necessary when analysing it from the didactic aspect. Information that teachers mediate to students should always be connected to the aims of education. The process of curricular content selection corresponds with a broad spectral didactic analysis. It is necessary to analyse students' previous knowledge as it is the starting point for working with a topic. An organization of the curricular content based on its

structuring can help students to understand the basic terminology and the relationships between concepts, phenomena, or objects. In order not to learn the curricular content only in isolation from internal and external contexts, but as an integrated system, it is necessary to mediate information to students about the cross-curricular relationships. An analysis of cross-curricular relationships can be realized horizontally (relationships to other subjects in the particular grade of study), or vertically (building on the knowledge from previous school grades).

Kosíková (2011) describes the individual psychodidactic aspects of curricular content selection and organization. Among them are: taking into account the age and individual specifics of students, transformation of the language of the scientific field into the language of the school subject and the language of students, organization of the educational content in the curriculum, the psychological principles of students' learning processes, and the development of students' competencies.

The theory of basic knowledge was elaborated already in the 50s and the 60s of the 20th century by O. Chlup. The theory is based on the criticism of a too extensive curricular content. According to the author, basic knowledge is something that every student has to learn. The curricular content should be sufficiently fixed and practiced at school and the teacher should not start a new topic before all the students have learned the basic knowledge.

An illogical overloading of students by unimportant knowledge is criticized by Skalková (2007), who does not agree with the excessive intellectualisation of musical, aesthetic and physical education. She favours the theory of exemplary education, the aim of which is the selection of the so called core knowledge representing whole fields of knowledge.

Synthetic (integrated) school subjects try to eliminate a subjects' isolation and to support using cross-curricular relationships by providing a more complex knowledge. In our conditions, such school subjects are not included in the national curriculum but in countries such as Japan, Sweden, Germany or Norway have been used for many years. Many teachers find the transformation of scientific knowledge into a curricular content in a suitable form taking into consideration the age of students and cognitive differences the most difficult thing. As stated by Klimentová (2011), transformation is realized on the basis of a didactic analysis of the curricular content based on defining the particular elements of the curricular content, use of cross-curricular relationships, the sequence and the hierarchy of the elements of the curricular content, organization of the curricular content into thematic fields, and taking into account the logical order of the curricular content in thematic units.

We understand didactic analysis as penetration of teachers into the subject matter. Only if they understand the educational content they can lead students towards mastering the topic.

A different view on the curricular content on the didactic level is offered by the group of authors Švec, Filová and Šimoník (2002). According to them, the elements of every subject must form a structure by their organization. It requires conceptual analysis, operational analysis and the analysis of the curricular content from the aspect of cross-curricular relationships (continuity of the curricular content).

Some pluralism can be seen in the field of curricular content selection in various theoretical concepts. Professionals keep asking the question whether school curricula really represent modern education which is necessary both for individuals and the society. A dynamic approach to education, which attempts to overcome the static approach, presumes that big leaps in science and technology negate the amount of knowledge which individuals should acquire in the course of their studies.

4 Textbooks

A textbook should not be considered a routine school supply, but a complex construct which should help the learning subject. It would be a mistake to approach textbooks as only some sets of texts which represent general knowledge from a particular thematic field or a field of science.

In the 60s and the 70s we can observe the beginning of empirical research on the functioning and the characteristics of textbooks. Behind this trend, we can find especially psychodidactics, psycholinguistics, psychology of learning and, last but not least, cognitive psychology. An in-depth analysis of this educational medium is unavoidable. It is not enough to judge whether a textbook is suitable for a particular school grade, but also if it is scientifically correct.

Besides traditional textbooks for a particular school subject also other sets of didactic texts (practice books, collections of exercises, collections of reading, workbooks) are used.

Authors see the function of textbooks from many aspects. Most of them contain some common features, e.g. catching students' attention when learning from textbooks, unifying various sources of scientific knowledge, putting information into logical order, helping in the process of knowledge acquisition, revision of the learnt curricular content, and transformation of scientific texts.

A textbook should correspond to the curriculum, be aesthetically pleasing, scientifically correct, linguistically accurate, thematically organized, should use cross-curricular relationships and last but not least, provide space for the development of cognitive skills. At present, the situation regarding textbooks is changing, prevention of overloading students from qualitative and quantitative points of view is emphasized. Unlike the textbooks from the past which were written by researchers and the amount of terminology and facts was accentuated in the process of their creation, modern textbooks are created with an emphasis on creativity development and cognitive processes. Also the creation of several textbooks for one subject is promoted, so teachers can choose the textbook which they want to work with.

"A complex understanding of a textbook presumes that it is not only the bearer of education, but also an instrument of students' learning management based on their own active work." (Skalková, 2007, p. 103).

The deductive approach to the presentation of a topic has been replaced in textbooks by the inductive approach. It is the inductive approach which formulates the final themes that students learn.

In the process of textbook creation, their authors should not forget about the axiological aspect and to emphasize the ethical aspect of the topic in the selected curricular content. At present, teachers can choose from a large spectre of didactic means and tools in order to improve the educational process and to achieve students' activity in the lesson.

Beneš (2009) discusses textbooks as literary unit from two aspects - from the internal and the external aspect. The external aspect focuses on the public space in which a textbook can be found and the structure of a textbook as a didactic text is analysed by the internal aspect. The author finds modern textbooks structurally complicated, combining iconic texts with verbal forms. He focuses on the construction of the information unit of the text, particularly on the sentence. The optimal length of a sentence for elementary school pupils is eight words and it is twelve words for secondary school students. We must not forget to mention the quality of verbal texts as they are the instruments of the complex cultivation of an individual. We agree with the author who considers textbooks to be multifunctional.

We agree with Nogová (2009, p. 27) according to which "In the system of educational media, textbooks should be prioritized to all the other types as they are significantly connected to the curriculum and intentionally focused on the development of key competencies and, at the same time, fulfil its functions, e.g. interpretational, motivational, evaluation function, etc."

It is necessary to realize that the current generation of teenagers uses a different language and learns in a way differing from the previous generations. They download music, send text messages, their skill to work with hypertexts is developed, they visit libraries by means of their own computer. For a more efficient use of textbooks, not only the informational function is important for students, but also the examples in textbooks which motivate students to work with other resources.

5 Suggestions for increasing the quality of the textbook creation process

Already J. A. Komenský highlighted the irreplaceable importance of visual elements in the educational process. It is generally known that the more senses people use the better they can remember information. In modern textbooks, we consider visual elements a matter of course, as they often form a big part of the main components of textbooks. In textbooks, the following visual elements are used: tables, pictograms, schemes, geometric shapes, graphs, photographs, plans, drafts, drawings, paintings, and maps. Some authors of modern textbooks pay more attention to visual elements than the text itself.

As stated by Škoda and Doulík (2011, pp. 76-77), various types of fonts, colours of the text are used and also graphical elements such as bubbles or frames are included in the text of modern textbooks. According to the authors, such an innovation of textbooks has a double purpose:

1. it removes demotivating monolith text;
2. text differentiation indicates the importance of the elements of the curricular content or keywords.

The authors refuse the new trend of curricular content 'in brief' as it is not enough if students learn only the so-called main idea at the end of the thematic unit because they can get the wrong impression that they understand the curricular content. In reality, they are not able to analyse the relationships or relations between concepts.

Kováčik (2009) states that modern textbooks should reflect the changes in the curriculum and be updated continuously. According to the author, professionals should create hypertext materials and integrated textbooks, didactic programmes in such a way that gifted students as well as students achieving poor results were given the opportunity to study successfully.

Integrated textbooks offer an unlimited number of alternatives for both teachers and students, they uncover cross-curricular relationships and interdependences.

Hypertext textbooks as a modern element of education are preferred by authors because they are freely accessible on the Internet or through DVD. They contain the core text and supplementary texts for weaker students, which introduce the curricular content from a different point of view.

It is not possible to increase the quality of textbooks without having sufficient information about them. The list of textbook evaluation criteria is general, clear and comprehensible. For example, it includes ensuring gender equality in textbooks, psychodidactic requirements in relation to the book cover and the weight of the textbook, the motivational function, problematic content, taking into account the cross-curricular relationships and the principle of age-appropriateness. In the criteria, graphic organization of textbooks, an aesthetic use of space, suitable illustrations corresponding to the text in order to form conceptually appropriate units are not forgotten about. Other criteria are related to social correctness, correctness of information from verified reliable sources, and updating data in textbooks.

Some students can work with textbooks absolutely spontaneously and naturally. They are capable to systematically work with texts and to actively process them. They underline important relations, write formulae and schemes in colour and use frames for the main thoughts of the curriculum content.

Some students might not be capable to work with texts alone. Reading with comprehension has been much discussed among teachers, professionals, pedagogues, psychologists, parents and also the students themselves. Monitoring and the written form of the school leaving exams are based on testing whether students can read with comprehension. Not that much attention is paid to the question whether students are able to learn from texts or textbooks. In most cases, students only memorize the written text without comprehension and they do not study it. Learning individuals cannot even find the main idea of a text, paragraph, or a chapter. They are not able to distinguish between cause and effect, facts and opinions nor to form their own opinions on the content of what they have to remember. They do not use dictionaries, encyclopaedias nor tables for learning. They do not highlight such structural elements as concepts or theories, facts or principles that could make their learning easier. Taking notes from text is another way how to promote effective learning from textbooks. For some students it is hard to remember definitions or formulae, others do not like long texts without any graphic organization. When trying to remember the curricular content, motivation is important, but it must be adequate in order to avoid fear.

6   Possibilities of structuring the curricular content

At school, students do not learn how to structure the curricular content alone. It is the textbooks which should help them to create a certain structure for the particular curricular content. It allows students an easier orientation in topics, to internalize knowledge and to remember it for a longer period of time.

We can learn the curricular content in a shorter time if we divide the text into smaller parts according to their importance, meaning, or mutual relationships. The more information we have in our brain, the better it is structured, the better we can deal with demanding situations, solve problems and link new information to old.

Curricular content is usually organized on three levels. We can distinguish between linear organization, where the curricular content is dealt with only once; cyclic organization, where the curricular content is organized in certain cycles; and spiral organization, when the curricular content is put in order hierarchically. The structure of the curricular content can be presented in the non-linear form, e.g. graphs, networks, diagrams, matrixes or the linear form, e.g. presentations, printed and written text.

Under the notion of structuring the curriculum we understand the division of a unit (block of curricular content) into smaller parts taking into account the individual's own cognitive system. We distinguish between traditional and modern structuring of the curricular content. According to Mareš (2001), working out an orientation outline, structuring the main concepts of the theme (progress in small steps), a schematic conspectus (students get worksheets before the lesson and fill them in during the teacher's presentation of the topic) belong to the oldest traditional theories of structuring the curriculum.

Table 1

Comparison of three types of conceptual structures (Mareš, 2011, pp. 217- 218)

Comparative aspect	Scientific conceptual structure of the field	Conceptual structure of the particular school subject	Students' conceptual structure of the curricular content of a particular school subject
Creation of a conceptual structure	Scientists, teams of scientists	Scientists, didacticians of a particular school subject	Students themselves

Source of data for the creation of a conceptual structure	Observation, scientific experiment, scientific theory	Scientific knowledge, educational experiment, pedagogical experiment, didactic theories and the educational experience of teachers	Teachers, textbooks, schoolmates, parents, everyday experience
Recipients of the conceptual structure	The scientific community	Teachers, students, parents	Students themselves, their teachers
Processes and procedures used with conceptual structures	Scientific monographs, research studies	Scholarly articles, curriculum, training and workshops for teachers	School education, self-education, gaining life experience
Purpose of the conceptual structure	To formulate scientific theories and to verify their validity	To select, organize and process information into the form of curricular content, to mediate it to students and to lead students towards understanding it	To understand the structure and to learn how to use it
Validity of the conceptual structure	Worldwide, for the whole scientific community	Usually for the given country	For students as individuals as well as for groups of students
Stability of the conceptual structure in time	Relatively low, the scientific structure is being modified	Relatively high, educational reforms, changes of the curriculum	Varies: some students continuously modify their conceptual structure; others are not open to changes

Time orientation of the conceptual structure	Present and above all the future	The past, present and the future	The past, present and the future are unclear
Character of the conceptual structure	Objective	Mostly objective	Subjective

Structured networks can be worked out on the basis of linear organization of the curricular content. One of the examples is the so called deeper processing which relies on reading with comprehension and presumes that a deeper processing of information leaves a deeper memory trace. Another possibility of linear organization of curricular content is its reorganization which assumes that if students organize the curricular content by themselves, they will learn it more easily. For processing information, with learning materials that students are familiar with, the so called top-to-bottom method is used, the bottom-to-top model is used with more difficult learning materials. As for non-linear, abstract representation of the curricular content, spatial learning strategies in the form of graphs, matrixes, schemes and diagrams are used.

Networks are created based on the rules and possibilities of visualizing concepts. They help students to understand the relationships between concepts and the hierarchy of these relationships. Schemes are created very similarly to networks. The next type of abstract representation of the curricular content is the recurrent graphic organization based on the theory of meaningful learning. If the original cognitive structure is well-organized, new knowledge can be built on the original structure.

Under the umbrella term of conceptual maps, we can find a variety of techniques and methods of graphical display. Throughout the process of structuring, we organize the curricular content logically and according to the hierarchy of concepts.

While our educational system and the textbooks are oriented on knowing facts, generalization (the result of human learning) is forgotten about. Students possess a lot of information that they have to memorize but they are not able to match information and to work with them, they are not capable of using what they have learnt. Generalisation is not presented in textbooks, it seems that authors assume that generalization of concepts and facts should be explained to students by their teachers, or students should simply be able to understand them by themselves.

7 Conclusion

During the educational process, many teachers try to make learning easier for their students by means of ready notes which they narrate and writing the most important information on the blackboard; dictating notes; or giving handouts to students. This form does not have to be, and certainly is not, beneficial for every student. It often happens that students only memorize the taken notes without any attempt to understand the content nor the relationships within the curricular content.

It is not correct to passively wait until students learn everything alone and to hope that they understand the curricular content. The whole educational process should be primarily focused on activating students. It is necessary to motivate and support them permanently in order to make knowledge acquisition an enrichment for them in the social, emotional and, last but not least, in the cognitive field.

Understanding the topic and being able to match new information with the knowledge acquired earlier, to work with them and to apply them in various fields of life is crucial for every student. If teachers show their students the ways how they can easily structure their knowledge by themselves and understand the topic better, not only the quality of their knowledge changes but their attitude towards learning and the particular subject, too.

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Practical Use of the Eye Camera in Pedagogical Research (Processing of Selected Data Using the Eye Tracking Method)

*Jana Škrabánková**

Abstract: The paper deals with author's pilot experiments using the eye tracking method for the primary school children examination. This method enables to gain a large amount of research data based on the tested people's eye movements monitoring. In the paper, there are processed chosen research data of four gifted students' examination in the context of their mathematical and logical intelligence.
Key words: eye tracking, research, mathematical and logical intelligence, gifted students.

1 Introduction

The Eye Tracker is a unique device used in many branches of the human activity – i.e. in advertisements and the estimate of its efficiency, in a marketing research, in a diagnostic of consumer´s behaviour, readers of web pages, experimentally in medicine and it begins to be used in a pedagogical research and in cognitive science. The Eye Tracking is the term for the technology that enables to follow the movements of user´s eyes at the screen, it enables to follow the exact place what the eyes are looking at in the course of time and also the way where the user´s eyes are moving at the screen from one place to the other one. "Tracking of an eye with the eye camera enables to measure precisely the direction of the tested person. The system consists of two cameras – one of them scans the respondent´s eye and the second one records his vision angle. Connection of both signals makes the output video where the direction of the tested person sight is possible to see and the moving red point shows the place of the sharp vision, which means the place what the respondent looks at. The advantage of the eye camera is in exact recording of the eye moving where (unlike the other technologies of the qualitative research) is no subjective impression of tested persons. That´s why it is used in marketing research as well as for web page design, advertisements or TV spots. The other important part of the camera use are direct and indirect interactions of the human being with the

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*   Jana Škrabánková, Department of Pedagogy and Andragogy, Faculty of Education, University of Ostrava, Ostrava, Czech Republic; jana.skrabankova@osu.cz

computer. In the direct interaction, the eye camera replaces the input devices of the computer and it makes its control easy, mainly to handicapped people. During the indirect interaction, it serves as a diagnostic tool and the computer analyses the place of the eye fixation and it causes another action." (Rázek, 2008, p. 7).

2   The Measurement Theory

Jeroným Klimeš states that the eye tracking is always based on the combination of two information:

- Information of eyes or a head turning
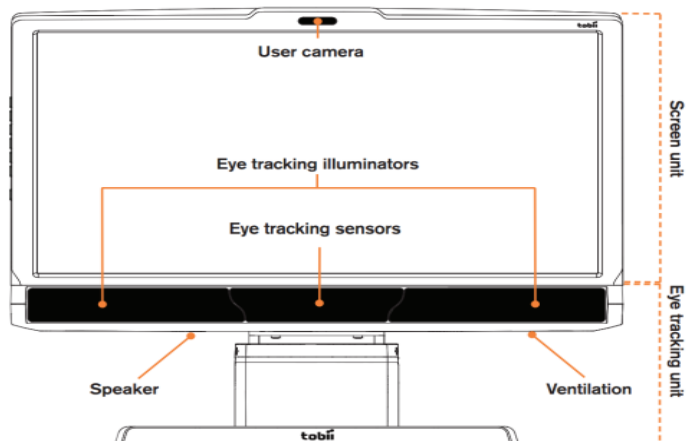- Information of a visual field of the human (Klimeš, 2008).

Figure 1. Device in the basic setting (Tobii Eye Tracker user manual, revision 2, page 24 – Front panel) (Jedlička, 2014).

The device records so called gaze patterns – sequential eye moving during reading the text, watching pictures or video etc. The movement is recorded as an eye fixation (circles) and saccades (lines among them). During saccades the eye doesn't catch any information. Thanks to individual fixations and added saccades among them, the device shows the progress of given picture(s) watching and we can do conclusions of it.

Typical use of the eye camera is the enter device position for computer programmes HCI (Human-Computer-Interaction). The example of the concrete application is i.e. writing using visual sense that is useful aid for users with certain type of handicap.

3 Content and Methods

The Eye Tracking is possible to perceive as an instrumental and behavioural method. It shows exactly what the tested person does and not his/her opinion or ideas at the moment. "That´s why it is mostly necessary to combine research using eye tracking and the other methods of questioning. The result of the research comes from three sources – see Fig. 2." (Klimeš, 2008)
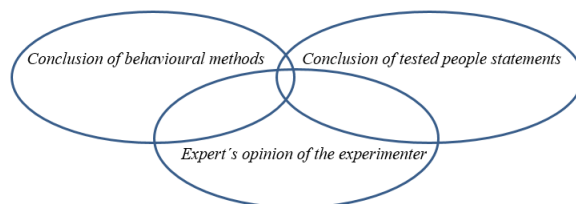

Figure 2. Sources of research results.

"Each of these methods brings mainly the information that is not possible to verify with other methods but some percent of all data can be confirmed. Similarly, even experience, attitude and opinion of the experimenter can influence the conclusion of the research very much." (Rázek, 2008, pg. 40). The author also writes: "That´s why the experimenter is expected to be reasonable and to have his own consideration and evaluation of the tested material on the base of his previous experience and knowledge. His opinion is usually partly in collision with empiric data." (Rázek, 2008, pg.40).

The method that completes the classical Eye Tracking is a retrospective loud thinking. Ondřej Harink states: "There is a deep dialogue at the computer where runs a video of the given respondent´s eyesight after the tested stimulus. The record includes even the record of the web camera that scans the face of the tested person during work with a stimulus material (web page /TV spot).
Everything is displayed at the same recording so that the respondent can see his/her eyesight and the face expression during all the time of the contact with the tested material. He/she can easily remember the reasons of his/her behaviour and also it is worse to stylize." (Herink, 2012).

"Eye tracking is possible to use in several levels:
-       *Simple observation how the human manipulates and works with presented materials from his point of view*. There, it is possible to ignore the exact position of the sight and to keep an eye on individual behavioural operation: holding the post parcel, the way of opening the envelope, sequence of reading individual parts of the mail, the way of leafing through the manual or the instructions. Demands of such kind of observing can satisfy any miniature

camera fastened at the head of the human but if we have an eye camera that enables this, we can use it even for this kind of work. Anyway this kind of observation enables to define questions and hypotheses that are specified in following phases.

- *Simple observation of the human eyesight.* This observation is focused on the point of sharp vision and the best is watching it in a slow-motion where and in what sequence the human examined given materials. Even, this way of the material observing serves mainly to a quantitative description: What saw this man? Why did he not understand some connection? Could he realize the intention of creators at this speed of browsing? Etc.

- *Coding or other progress for evaluation of recordings.* Various methods of coding enable to quantify a fluent flow for the eye behaviour. Results of coding enable to present an individual behaviour in transparent graphs and to abstract rules that are valid for the whole group. That´s why coding will be included in the following chapter." (Klimeš, 2008).

3.1.　Methods Used for the Pilot Experiment

- direct observing of gifted children
- dialogue
- coding method
- Eye Tracking method

In the pilot experiment, there was important how children proceeded during the text and picture observing. It was presented at the screen. And also there was important if they were able to solve related tasks and how they it did. For this study, I chose an analysis of just one assignment where I would like to show - with the coding method and the analysis of pictures at the screen - the effects and the events that happened during solving at respondents. In the paper I rely on the fact that similar research of gifted children at the primary school in frame of their mathematical logical intelligence as an important part of natural science and mathematical talent still has not been done. During the choice of respondents, I proceeded from the Gardner Typology of Intelligence within the J. M. Havigerová conception (Havigerová, 2011).

Logical mathematical dimension of intelligence includes understanding to numerical symbols and signs´ meanings that are related to numerical operations. Above the world of senses, the pure abstract and logic are dominating (they are manifesting themselves very early, however, from the age of forty their productivity is subsiding).

The shows of talent in a given field:
- They like to count and they enjoy it.
- They put questions, for example "Where does the space finish?" "When did time start?" etc.

- They like logical games, logical puzzles and riddles. They can do it for a long time.
- They prefer strategic games (i.e. chess) and they are very good at them.
- They like to do experiments to try things that are unknown to them.

For the pilot experiment, the respondents were chosen by the intentional choice. There were four children of the primary school at the age of seven to ten that they attend the Club of Gifted Children in the Moravian-Silesian Region. All these children are members of Mensa CR, they show a strong interest in mathematics and natural sciences and also their performance in this field is above average.

3.2.   Coding
Coding consists in a definition of basic effects or events. In accordance with Klimeš, there is possible to understand the effect as a time section when the concrete searched behaviour is occurring and it make sense to speak about duration – the child has examined a given task for x seconds.

"Event means the time moment when a special behaviour occurred and there is no sense or it is not useful to speak about duration." (Klimeš, 2008). In example, in time 14:02-16:00 the tested child chose the answer. The important fact is that there was chosen the answer and there is not cardinal if the decision took 1 or 4 seconds. We record just the time of occurrence. (Time is usually written in a form of hh:mm:ss,ff where H is an hour, M is a minute, S is a second, F is a fraction of a second).

Klimeš codes also so called absenting events (events that did not happen). This process is suitable when we want to have a complete knowledge of behaviour of the whole group. At these events, there is no need to speak neither about duration nor about time. We can have a code that signs: "The task was not been solved." Absenting events in the interpretation of my results are not used.
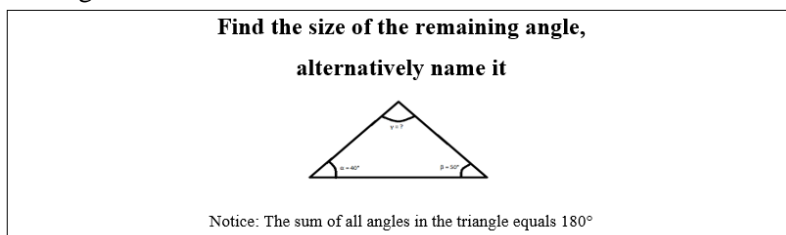
For the coding, we must have at least a video recording with a time code and a recorder.

Legend for the tabs:
Number of fixations…… number of duration at the effects; where the respondent stopped his sight
Total time……………… total time when the respondent watched the given code repeatedly
Max…………….……… the longest time when the respondent watched the given code

Min…………………….. the shortest time when the respondent watched the given code.

The task assignment:

Find the size of the remaining angle,

alternatively name it

Notice: The sum of all angles in the triangle equals 180°

4 Measuring results

Table 1

Summary of codes – Jan

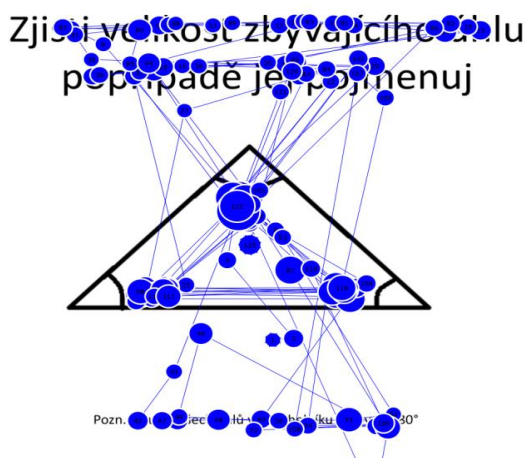| Code / number of returns	Number of fixations	Total time (s)	Max. (s)	Min. (s)
Assignment / 6x	31	10,7	3,5	0,3
Triangle / 9x	72	24,9	10,1	0,4
Notice / 3x	13	4,7	3,2	0,6

Figure 3. The eye track in last 0:43,486 seconds - Jan (Source: Author).

5   Conclusion

The eye tracking is considered as one of possible parts of the quantitative research since the 19th century. The ways of eyes watching are not by far new and they are possible to be divided into two groups. "One of them judges the eye position towards the head and the second one follows the eyes in the field or the target of the sight. Methods using the eye camera provide the eye position thanks to the interaction of the pupil´s position and the reflection of the reference beam from the cornea. In combination with the scenic camera and unification of both recordings, the video arises. It roughly displays our visual angle and the exact point the sight is aiming." (Rázek, 2008, p. 81).

The pilot experiment uncovered a lot of areas that are possible to search. In our case, it should be i.e. the research of the time needed for the task solution depending on placing the Notice at the screen. The experiment proved that the children with mathematic and logical intelligence are able to solve tasks beyond their curriculum. The experiment also proved that these children are able to keep their attention during all the time of the task solving at their maximum and even their attention is increasing within the time necessary for the solution of difficult mathematical tasks. Repeatedly it is becoming apparent that there is necessary to create suitable educational methods and tools for the children with mathematical and logical intelligence development and it is necessary to support it in connection with the successful talent development.

In the end, it is important to mention that: "… contribution of testing by the eye camera can be partly distorted. We can learn what the sight is aiming at but we cannot explicitly exclude that the reader or the web visitor is thinking of something else all the time or if he understands all well." (Rázek, 2008, pg. 81). That´s why it is necessary to fill in the Eye Tracking method with other suitable research practices - as I attempted in this paper.

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Visual Observations as Exercises in Physics

*Jozef Drga – Martin Bulko – Karol Petrík – Mária Csatáryová – Stanislav Šimkovič**

Abstract: Visual meteor observations are a fun and interesting approach to astronomy and to scientific research in general. It can be used for laboratory or practical exercises in physics at high schools and universities. The students can personally collect and analyze the acquired data. The output consists of Zenithal Hourly Rate (ZHR) values, spatial density and population index. In this paper, the so called counting method is described as it is the most suitable method for beginners. As a practical example, the ZHR curve of the Lyrid meteor shower was evaluated and the maximum and the duration of the shower were calculated.
Key words: meteors, practical exercises in physics, visual observations.

1 Introduction

Visual meteor observation is an easy to grasp method that provides scientific outputs. After a couple of minutes spent by observations you can become a part of an international team, and you will be able to learn how the interplanetary matter surrounding the Earth is distributed. The principles are simple and provide an interesting and engaging alternative to practical exercises in physics. The requisites are: a sleeping bag, a camping mat, a flashlight, a stellar map with stellar magnitudes, and studying the following lines.

Visual meteor observations have a long tradition in Slovakia. The first national meteor expedition took place on 10.-25.7.1958 on the hill Bezovec which lies in Považský Inovec mountain range near Piešťany. Since then, several observation groups have been formed in Slovakia. In 1998, the International Meteor Organization (IMO) was established. Its task is to coordinate scientific research

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*   Jozef Drga, Alexander Dubček University of Trenčín, Trenčín, Slovakia; jozef.drga@tnuni.sk

    Martin Bulko, Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Bratislava, Slovakia; jadrovystudent@gmail.com

    Karol Petrík, Observatory and Planetarium in Hlohovec, Hlohovec, Slovakia; kpetrik@astronyx.sk

    Mária Csatáryová, Faculty of Education, University of Prešov, Prešov, Slovakia; maria.csataryova@unipo.sk

    Stanislav Šimkovič, High School of Piarists, Trenčín, Slovakia; s.simkovi@piaristi.sk

activities in the field of meteor astronomy, and coordinate the collaboration between amateur astronomical observers and professional scientists. Because of recent technical advancements, high sensitive CCD and CMOS detectors are now picking up the baton of visual observations. However, the visual observations still play a role in determining the so called population index. Meteors can also be observed by radars or radio waves. This paper focuses on the description of methods dealing with obtaining and evaluating of results from visual meteor observations carried out by students, teachers and general public. A possibility of using these observations and evaluation of results as an alternative form of practical exercises in physics is also presented in this paper. Included is also the analysis of Lyrid meteor shower observations from the years 2009-2015.

2 A few notes on meteor showers

The term meteor shower refers to the increased frequency of meteor occurrence during a certain period of time. The trajectories of the meteors are approximately the same, and originate from a seemingly small area which can be considered to be a single point. This point is called the radiant. A meteor shower originates from comets releasing a material during the period of increased comet activity (usually when the comet is near its perihelion). Since meteor trajectories are roughly parallel, from Earth-meteors geometry it follows that a meteor does not start to glow directly in the radiant (see Figure 1). Beginners could pick up a suitable meteor shower for their observations by referring to Table 1. The table shows the start and the end of meteor shower activity, presumed date of its maximum, the location of the radiant at the time when the maximum occurs in right ascension (α) and declination (δ) coordinates, average Zenithal Hourly Rate (ZHR), average value of the population index (r), and the code of the shower. A more complete list of meteor showers can be found on the IMO website (www.imo.net), or on the website of the International Astronomical Union.

Table 1

Important meteor showers

Name	Start	End	Maximum	Right Ascension α	Declination δ	Average ZHR	r	Code
Quadrantids	28.12	12.1	4.1	230	49	100	2,1	QUA
Lyrids	16.4.	25.4	21.4	271	34	15	2,1	LYR
η Aquariids	19.4.	28.5	5.5.	338	-1	40	2,4	ETA
δ Southern Aquariids	12.7	24.8	30.7	240	-16	15	3,2	SDA
August Perseids	17.7	24.8	12.8	48	58	60	2,2	PER
κ Cygnids	3.8	25.8.	18.8.	286	59	3	3,0	KCG
α Aurigids	28.8	5.9	1.9	91	39	7	2,5	AUR
September Perseids	5.9	21.9	8.9	48	40	5	3,0	SPE
Draconids	6.10	10.10.	9.10	262	54	?	2,6	GIA/ DRA
Orionids	2.10	7.11	22.10	95	16	20	2,5	ORI
Northern Taurids	10.9	20.11	11.10	32	9	5	2,3	STA
Southern Taurids	20.10	10.12	12.11	58	22	5	2,3	NTA
Leonids	6.11	30.11	17.11	152	22	15 - ?	2,3	LEO
Geminids	4.12	17.12	14.12	112	33	100	2,5	GEM
Ursids	17.12	26.12	22.12	217	76	7	3,0	URS

Figure 1. The photo of a meteor shower.

3 General information regarding the organization of observations

The visual observation is usually carried out in the groups consisting of 2 to 6 observers. Each group also contains a person who records the observation results. The observers usually divide the sky either into quadrants based on the four cardinal directions plus the radiant, or they pick up the center of the visual field. Another good choice is the conic section of the sky with the apex in the location of the observer, angled at 30° from the radiant. It is advisable to supplement the observation with some kind of group activity (a night game, barbecue, telescope observations). The counting method (also called C method) requires noting the time of meteor occurrence, the name of the meteor shower and the magnitude of the meteor.

An alternative method is the P (plotting) method. This method requires detailed knowledge of celestial sphere and is therefore suitable for advanced observers only. The name of the meteor shower where an observed meteor belongs to is determined by the direction and trajectory length of the meteor (the trajectory of the meteor extended backward must intersect the radiant). The closer to the radiant, the shorter is the meteor trajectory, as can be seen in Figure 1. A common scenario is that the trajectory of the meteor corresponds to the radiant, but in the vicinity of the radiant this trajectory is excessively long. In such a case the meteor does not belong to the meteor shower in question, and is part of the background. These background meteors, also called sporadic meteors, are not associated with any particular meteor shower.

The brightness (star magnitude) of the meteor is recorded with 0.5 magnitude accuracy. The brightness is determined from the comparison of the brightness of the meteor and a chosen star or the object with known brightness (Polaris – 2 mag, Altair – 1 mag, Vega – 0 mag, Sirius – 1.5 mag, Jupiter – 2 mag, full Moon – 12 mag). Information about star brightness can be found in celestial atlases or celestial maps.

Sometimes it could be interesting to keep an eye on so called tracks in the shower. These tracks are caused by the gases ionized by the meteor, or by the subsequent recombination of ions. The duration of these tracks ranges from tenths of second to minutes.

It is important to determine the ability of an observer to discern poorly visible objects on the sky. This is related to the quantity called limiting magnitude. The limiting magnitude is defined as being the magnitude of the faintest star near the zenith that the observer can detect using the slightly averted naked eye. The method consists of counting the stars in triangular areas predefined by IMO

(IMO, 2013a). Some of these areas are shown in Figure 2. The sensitivity of an observer's eye is determined according to the number of counted stars. For these purposes, the standard limiting magnitude is set to 6.5 magnitudes.

The observation should be divided into intervals. The recommended duration of an interval is 0.5 – 1.5 h. The breaks start at the beginning of the first minute and finish at the end of the last minute of the break. No meteor must be recorded for the observer taking the break. The duration of the breaks is recorded in order to determine the effective observing time.

The observation must meet the following criteria:
a) The radiant must be higher than 20° above the theoretical horizon.
b) The value of observer's limiting magnitude must be at least equal to 5 magnitudes.
c) The part of the sky assigned to an observer must not be covered by clouds or ground objects by more than 20%.
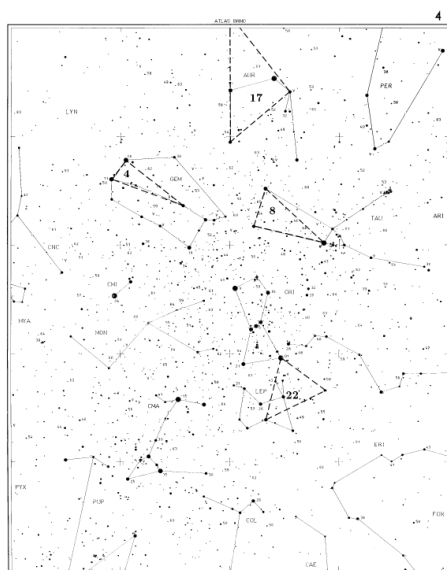d) The observation cannot be realized if the Moon is full, or nearly full.

Figure 2. The areas at the celestial map used for determining the limiting magnitude (4, 8, 17, 22).

4 Mathematical background

From the observation it is possible to determine the so called Zenithal Hourly Rate (ZHR) which is defined as:

$$ZHR = \frac{N\,F\,r^{6.5-M}}{T_{eff}\,\sin(h)}$$

(1)

N is the number of observed meteors, F is the correction factor due to obstruction of the field of view, T_{eff} is the effective time of observation, M is the limiting magnitude and h is the radiant altitude. The field of view correction factor F is given by:

$$F = \frac{1}{1-k}$$

(2)

k is the percentage of the observer's field of view which is obstructed (by clouds, for example). For instance, if the average obstruction during the observation was 10%, then k=0.1. The effective observing time is defined as:

$$T_{eff} = T - \sum_{1}^{A} B_i$$

(3)

B_i is the duration of a break, A is the number of breaks and T is the total interval length. Lastly, the population index is given by:

$$r = \frac{N(m+1)}{N(m)}$$

(4)

N(m+1) is the number of meteors of magnitude m+1 and N(m) is the number of meteors of magnitude m. From these observations it is possible to determine the spatial particle density and the mass index (Koschack, Rendtel, 1988; Koschack, Rendtel, 1990a; Koschack, Rendtel, 1990b).

All these calculations will be carried out by the International Meteor Organization, you do not have to deal with them in detail.

5 Electronic visual report form

The forms below validate and submit data for entry in the IMO Visual Meteor Database and the creation of ZHR activity graphs (IMO, 2013b). In the following paragraphs we will provide information how to fill in all these forms.

Figure 3. Visual report form Part 1 – Basic information.

The first section requires entering some of the observer's personal data - First name, Family name, Country and IMO Code (if it has been assigned). The section named Observing location contains fields for entering longitude, latitude, height (above sea level), name of the observation place, and country and IMO code of the observation place (for instance, Trenčín IMO code is 23711). The next section requires specifying the night of observation as a pair of local dates (two consecutive days should be entered). Lastly, one needs to specify the beginning and the end of the observation in Universal Time (UT). The conversions between UT, Central European Time (CET) and Central European Summer Time (CEST) are as follows:

UT = CET − 1 hour
UT = CEST − 2 hours

Figure 4. Visual report form Part 2 - Showers considered for observation

In "Part 2 - Showers considered for observation" we have to insert the IMO three-letter codes of the observed meteor showers. The codes can be found in (Meteor showers, 2014). "RA" stands for right ascension and "Dec." for declination on the day of observation. Note that if the meteor shower is included in the IMO list, right ascension and declination will be calculated automatically.

Figure 5. Visual report form Part 3 - Observed number of meteors per period and per shower.

Part 3 of the Visual report form shown in Figure 5 requires entering the beginning and the end of individual observation intervals. In case of shower maxima or outbursts, short observation periods should be used (e.g. 5 minutes). As a rule of thumb, one row (one time interval) should contain no more than 20 observed meteors. The table also contains fields for entering the right ascension (RA), declination (Dec), effective observation time (Teff), field of view correction factor (F), and limiting magnitude (Lm). The columns marked as M or N are for entering the method of observation and the number of observed meteors, respectively. The last two columns are reserved for sporadic meteors.

Shower	Period (UT)	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	Tot

Figure 6. Visual report form Part 4 – Magnitude distributions for showers and sporadic meteors.

Part 4 of the Visual report form shown in Figure 6 is important for determining the population index (formula 4). The column "Shower" should contain the codes of individual meteor showers. It is recommended to use the same time interval as in Part 3. It is also possible to merge the intervals into bigger ones, but one row should not contain more than 30 meteors.

The rest of the columns in the table are marked from -6 to 7, and are incremented by 1. The observer is supposed to enter here the number of observed meteors of a given magnitude. For instance, if we detected two meteors of the magnitude 3, then we should enter the number two in the column "3". If we detected a meteor of the magnitude 1.5, we should enter the number 0.5 in the columns "1" and "2", respectively. The column 'Tot' (total) will be calculated automatically. Also, please do not forget to include the magnitude distribution of sporadic meteors (SPO).

Comments (add your name if you report for somebody else):

Reporter e-mail*: (you will receive a copy of the observation)

Check for errors   Submit

The "Submit"-button will become available when no errors are found.

Please contact visual@imo.net if you feel your observation triggered incorrect errors.

Figure 7. Visual report form Part 5 – Comments & email.

The last part of Visual report form (Figure 7) is reserved for comments and the e-mail of the person who filled in the Visual report form (the reporter). Comments field can be used to enter the name of the reporter, description of observation conditions etc. Lastly, we click on "Check for errors" button and if no errors are found we can submit the whole report by clicking on "Submit".

6   The Lyrid meteor shower

As a practical example, the ZHR curve of the Lyrid meteor shower is evaluated in this section. The Lyrid meteor shower is active from April 16 to April 26 (McBeth, 2014). The maximum usually occurs on April 22. This meteor shower is related to C/1861 G1 Thatcher comet (Molina & Moreno, 2013).

In order to increase the sample size and reduce the statistical error, the ZHR data from 7 consecutive years (2009-2015) were used. In total, 4910 Lyrid meteors and 1746 time intervals were taken into account. The population index value of 2.1 was used.

The Lyrid meteor shower has been studied by various techniques (Porubcan, Hajduk, Cevolani, & Trivellone, 1996; Porubcan & Simek, 1988; van Wassenhove, 1987). According to our analysis based on fitting the ZHR profile by a suitable function, the meteor shower activity may actually start sooner (April 11) and finish later (May 3) (Figure 8). The following Gaussian-parabolic function was used for fitting (Drga & Janek, 2014; Drga & Bulko, 2014):

$$ZHR = A(x - B)^2 + C + De^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} \qquad (5)$$

The fitting parameters are shown in Table 2.

Table 2

Fitting results.

Parameter	Value	Error
A	-0,025	0,009
B	31,5	1,3
C	3,7	0,3
D	11,4	0,7
б	0,49	0,05
μ	32,23	0,04

The position of the peak of meteor shower activity (this value can vary) was found at solar longitude $\lambda = 32.21$, which is in approximate agreement with the value of 32.32 published in (McBeth, 2014). The difference between these values is ca. 2.64 hours.
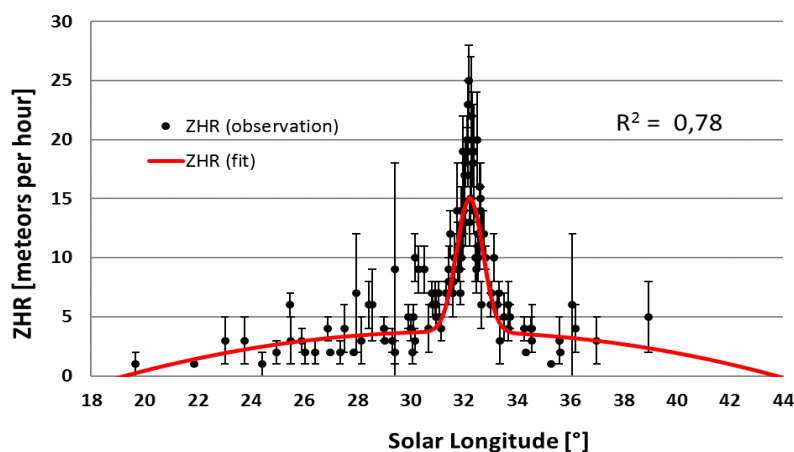

Figure 8. ZHR profile of the Lyrid meteor shower.

7   Conclusion

Visual meteor observations can be used as a fun addition to the laboratory exercises in physics. They are suitable for lower and upper secondary education, as well as for freshmen at universities and general public. There are many possible outputs of these observations, i.e. the graph of ZHR as a function of time, ZHR as a function of the observer, limiting magnitude as a function of time, or limiting magnitude as a function of the observer. Population index and

other relevant parameters can also be computed if we want to deal with this subject in more detail. The authors of this paper hope that the teachers will find this contribution useful and that it will make the teaching and learning physics more appealing. As a practical example, the ZHR profile of the Lyrid meteor shower was analyzed by a combination of Gaussian and parabolic function.

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INFORMATION

Professor PhDr. Gabriela Petrová, CSc.

*Erich Petlák**

In april (April 10, 2016), Professor PhDr. Gabriela Petrová, CSc., an outstanding Slovak pedagogue working at the Faculty of Education at Constantine the Philosopher University in Nitra, celebrated her life anniversary. We presume that thanks to her professional and organizational skills and her presentations at many professional events, but also her membership in many professional committees, hundreds of our teachers know her. Those who know her for a longer period of time know her as a vital personality with a desire to always organize something and to collaborate with others.

The words above say a lot about the life path of Professor Petrová. In her case, being a pedagogue is not a coincidence, a view in her curriculum vitae shows that her first steps after finishing elementary school lead to the Secondary Pedagogical School in Turčianske Teplice. During her studies at the secondary

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* Erich Petlák, Catholic University in Ružomberok, Ružomberok, Slovakia; erich.petlak@ku.sk

pedagogical school, she developed her pedagogical skills and then she continued her studies at the Faculty of Arts of Comenius University in Bratislava in the field of pedagogy. After her successful graduation in 1979, she started working at the position of an administrative officer at the Department of Education of the Faculty of Education in Nitra, which has become a part of Constantine the Philosopher University in Nitra.

Professor Gabriela Petrová has always been not only a responsible teacher but a diligent and creative personality, too. Before I start the description of the rich list of her activities which will follow after these words, I find it important to emphasize that since her arrival at the faculty till today, she has always deserved respect and recognition. Besides having a highly demanding job, her students have remained at the first place for her. And that is one of those aspects that make Professor Petrová so popular among students but also her colleagues at her home university and other universities both in Slovakia and the Czech Republic.

For Professor Petrová her attempts to provide highly professional education of students are characteristic. She has always cared about her professional development. The years in which she earned her scientific and pedagogical degrees are a proof of her serious and systematic approach. In 1980, it was the degree of PhDr., in 1988, after finishing a 5-year external program of study in Brno, she defended her candidate dissertation thesis "Application of the Principle of Consistency in University Training of Primary School Teachers" at the Faculty of Arts of Jan Evangelista Purkyně University in Ústí nad Labem and she earned the scientific degree of CSc. In 2001, she defended her habilitation thesis "Teacher Training for Differentiated Educational Practice" and gave her habilitation presentation "Increasing the Efficiency of the Educational Process by Means of a Humanistic Approach to Students" at the Constantine the Philosopher University in Nitra. In 2006, she was awarded the degree of Professor in Pedagogy by the President of the Slovak Republic. Professor Petrová has produced a long list of publications, but also her educational work (including the annual student competition Student Scientific Professional and Artistic Activity) is very important. She keeps showing her students what pedagogical optimism and humanism are. It is worth to mention that the professional development of Professor Petrová indicates her focus on the field of pedeutology in connection with many didactic aspects.

Taking into consideration the character of this paper, only a selection of her activities in this field is offered. In her portfolio, e.g. three monographs, two university textbooks, several chapters in domestic and foreign monographs and university textbooks, approximately 180 studies and articles in domestic and foreign journals, 19 conference contributions in Slovakia and equally 19 conference contributions abroad are included. Her professional work,

communication with the world, exchanging experiences and publication abroad are needless to mention. It is admirable that that Professor Petrová has participated in 25 stays abroad – Cordoba, Freiburg, Katowice, Madrid, Kyjev, Lueven, Tielburg, Reykjavik and others – where she represented Slovak pedagogy abroad, but also gained new knowledge for her school and her students. Also for this informal work she is exceptionally popular with her students and doctoral students, to whom she gives advice and whom she helps and guides.

Such a rich list of activities indicates a very active and creative personality who must be involved also in other than only pedagogical didactical activities. It is natural that creativity, commitment but also a good orientation in the field of her interest were noticed by her colleagues at the faculty. They found Professor Petrová the person whose abilities can help the department, the faculty and last but not least, the whole university. So the department administration officer became the deputy head of the department and, after being awarded the degree of Professor, she was elected the Dean of the Faculty of Education. She was the Dean for two office periods from 2002 to 2010. Those are the years when the faculty achieved significant success. It is not a subjective opinion but the point view of the pedagogues according to whom the mentioned years are perceived as really progressive for the overall development of the Faculty of Education of Constantine the Philosopher University in Nitra and Professor Petrová contributed to it to a great extent. It is probably Professor Petrová's destiny to coordinate, lead and manage something. Since her period of office ended, she has worked as the Head of the Department of Education.

The list of her activities would not be complete if I did not mention her activities in the scientific boards of several universities in Slovakia but also in the Czech Republic, e.g. Charles University in Prague, University of Ostrava and Institute of Lifelong Learning in Brno.

Professor Petrová's energy and abilities are admirable. Taking a look in her portfolio we can find out that currently she is the member of three editorial boards and, at the same time, many professional committees and panels. For instance, she is a member of the Accreditation Committee - an advisory body of the Slovak Republic's Government, chairperson of the Accreditation Commission of the Ministry of Education, Science, Research and Sport of the Slovak Republic for further education of educational and professional staff, a member of accreditation teams for several fields, a member of professional committees for pedagogy in Nitra, Bratislava, Banská Bystrica, Trnava and other universities. This all is only an incomplete list of her activities as she is also a member of habilitation and inauguration committees, etc.

Professor Petrová's awards are the logical outcome of her activities. The Great Medal of St. Gorazd in 2016 and The Small Medal of St. Gorazd in 2014 are among the most valuable ones, but she has also received several awards of the Minister of Education of the Slovak Republic, and gold and silver medals of universities both in Slovakia and in the Czech Republic – Bratislava, Nitra, Banská Bystrica, Brno, etc.

The picture of Professor Petrová would be incomplete without a look into her private life. Her two sons, having their mother as a role model, completed their university studies in the fields of economy and management. Both of them work at interesting job positions – one of them is the Editor in Chief of a recognized professional journal and the other one is a PR manager. It is natural that Professor Petrová, as a loving mother, is proud of them and often speaks about them. I would like to add that Professor Petrová can probably manage work not only at the faculty and the department, but also in her household as her husband's job is not an easy one – he is a doctor.

I am sure there are many things that I have not mentioned but I must not forget to mention the human aspect of the personality of Professor PhDr. Gabriela Petrová, CSc. We have spent together 40 years of work that have united us and our colleagues as a younger team. We had to face "anger", experienced many pleasing but also problematic situations, but it belongs to everyday work life. What I would like to say is that turning back in time, it was a different era when we helped and supported each other, gave advice and were pleased by the success of our colleagues. I am glad to have the opportunity to proudly recall those times and to mention the workplace to the development of which Professor Petrová has contributed a lot. Probably not only me but there is more of us who wonder what is the source of her energy, enthusiasm and, maybe, also sacrifice for others. Professor Petrová follows Gordon B. Hinckley's quote "Without hard work, nothing grows but weeds."

What else to add? Dear Professor Petrová, do not let the weeds grow. We believe that you can do it and we will have the opportunity to meet your work for many years. For doing so, we wish you good prosperity, and a lot of family, personal and professional satisfaction. We wish you all the best.

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