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Association of scientists  
Veljaka Lukića Kurjaka 41,  
75 000 Tuzla, Bosnia and Herzegovina  
human@red.co.ba

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## QUALITY OF FAMILY INTERACTIONS AND ADOLESCENTS' PERSONALITY TRAITS

Tamara Efendić-Spahić<sup>1</sup>

*Original scientific paper*

*The Faculty of Philosophy in Tuzla, University of Tuzla*

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### ABSTRACT

*Family as the basic social unit is the primary environment of the development of an individual. In the family setting an individual satisfies (or should satisfy) the basic human needs such as the need for safety and love. In the studies of patterns of unadapted behavior of children and adolescents, temperament is most often stated as the key human characteristic feature that is the most important predictor in the development of unadapted and antisocial forms of behavior. The survey of dispositional empirically identified and inheritance-determined characteristics has been described in detail by Eysenck's dimensional model of personality through mutually orthogonal and bipolar characteristics: Neuroticism, Extraversion and Psychoticism. The formation of these dispositional characteristics is closely related to parents' sensitivity to child's needs and the level of parents' engagement in their parental role. Therefore, the aim of this research was to examine to what extent the assessment of the quality of the relationship with parents is an important predictor for explaining the basic dimensions of adolescents' personalities. The research was conducted on an appropriate sample of 135 adolescents, students of the Faculty of Philosophy in Tuzla. The results confirm that the aspects of negative relationships with mother and father are important predictors for explaining dimensions of Neuroticism and Psychoticism, which are very significant correlations of unadapted and antisocial behavior. Also, the results indicate less significant importance of positive relations with mother and father for explaining dependent research variables since it is presumed that positive relations act more as a protective factor whereas the assessment of negative relationships with parents is certainly more important, especially for the dimensions related to bad adaptation of adolescents. The results also indicate equal importance of mother and father in the upbringing process for explaining the basic personality dimensions of adolescents since negative relationships with both mother and father appear as equally important predictors for explaining the dimensions of Neuroticism and Psychoticism in adolescents.*

**Keywords:** family, temperament, adolescence, Eysenck's model of personality, adaptation

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### INTRODUCTION

Vukasovic (1997) states that family is the basic social community, the first and primary social community, and as such it is the basic foundation for the life of every individual. The psychological importance of family has always been

emphasized, and the beginnings of studying the mechanisms of its influence on an individual can be seen in psychoanalysis. Sigmund Freud (in Krstic, 1996) placed most of the basic theoretical terms into the context of family.

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#### <sup>1</sup>Correspondence to:

Tamara Efendić-Spahić, The Faculty of Philosophy in Tuzla, University of Tuzla  
T. Markovića 1, Tuzla, B&H.  
Phone: 0038735252187  
E-mail: tamara.efendic-spahic@untz.ba

Namely, according to this author the structure of personality and the patterns of the later behavior as well as the adaptation are largely the result of the parent – child relationship. Adler (in Krstić, 1996) also analyzed family as the basic pattern of interpersonal and social relations, especially emphasizing that the consequences of these relations target children.

If every child who lives in a family up to the age of two gets attached to the known guardian, the quality of that connection is different from child to child. The technique of an unknown situation is the most frequently used procedure for the evaluation of the quality of attachment of children aged one to two. Based on the behavior of child in a strange situation, aimed at evaluating the quality of attachment, Bowlby (1973) distinguishes two basic types of attachment:

- a) Secure attachment – the children who developed secure attachment to the parent or guardian in an unknown situation show clear signs of separation anxiety when the contact with the mother is broken. However, when they stay alone, they do not show the signs of worrying as they believe that the mother will return. If such worry exists, an unknown person can comfort them.
- b) Insecure attachment – this form of attachment can be identified by two behavior forms. In the first case child avoids insecurity in a way that he/she does not look for mother's closeness at all. In the second case an ambivalent insecurity appears – child expresses an intense reaction to mother's leaving by separation anxiety, but child also opposes to the contact when mother returns.

Lacković-Grgin (2006) states that attachment theory aims at explaining the tendency of human beings to develop strong emotional relations to others, and it offers a proper theoretical framework for understanding why some individuals have difficulties in developing and keeping a satisfactory relationship in adulthood. Within the attachment theory there are two basic hypotheses that make the theoretical concept of the attachment concept:

- a) attached behavior is a characteristic of human beings during their entire lives,
- b) attachment patterns in childhood in the parent – child relationship determine the quality of relationships at a later age.

Every relationship in adulthood has a possibility to become attached, provided it satisfies the following three conditions:

- 1.) existence of desire for the closeness of the person we are attached to,
- 2.) sense of security as a consequence of the contact with the person we are attached to,
- 3.) sense of agitation or discomfort which appears because of the separation or loss of the object of attachment.

Although there are differences in the attached relationships in childhood and adulthood, the dynamics is the same (Bartholomew, 1993, adopted from Lacković-Grgin and Čubela-Andorić 2006). In order to differentiate the attached relationships from the unattached, it is necessary to emphasize three functions that such relationship needs to have. Every relationship that is to be marked as attached needs to include the tendency of a person to stay close to the attached person, especially if he/she is in a threatening situation, or the situation is threatening to his/her relationship with the attached person. A close attached relationship shall be every relationship that offers safe haven during illness, danger, or threats. In other words, person uses close attached relationship as sanctuary, protection, and support. An attached relationship must also be a secure base that will allow unlimited exploration of the world.

### **Family interactions and other behavior**

Berk (2008) states that psychoanalytical and etiological theories describe that inner feelings of affection and safety, which are consequences of a healthy relationship of attachment, have favorable effects on all the aspects of psychological development. The continuity of care about child determines a relation between the quality of attachment and later development (Lamb et al. 1985, Thompson 2000, in Berk, 2008). Vasta, Haith, and Miller (1999) claim that the main issue in research into attachment is related to the effects of secure and insecure attachment on other aspects of child's functioning. A number of research proved that securely attached children show many positive characteristics that are not shown by children whose relationship with guardian is of lower quality. One of these qualities is child's cognitive competence. Several experiments showed that securely attached children are later more successful at solving problems.

(Frankel and Bates, 1990, Jacobsen et al. 1994, Matas et al. 1978, in Vasta, Haith and Miller 1999). Securely attached children are also more curious and prone to explorative behavior than other children (Hazel and Durett, 1982, Slade, 1987, adopted from Vasta, Haith and Miller, 1999). Finally, one research showed that cognitive competence of four-year-old children can be predicted based on their mothers' sensitivity towards them (and probably the quality of their attachment) at the age of three months (Lewis 1993, in Vasta, Haith and Miller, 1999). It seems that securely attached children are socially more competent. They are more willing to cooperate and more disciplined, and have better relations with their peers (Jacobson and Willow, 1986, Londerwille and Main, 1981, Pastor 1981, in Vasta, Haith and Miller, 1999). These researches indicate relatively clearly that classification of children by the procedure of exploring in an unknown situation can be useful in predicting child's later cognitive and emotional competence. It is possible that, as a result of the fact that child feels secure in the presence of guardian, he/she feels more secure in exploring his/her social and physical surrounding, thus developing important social and cognitive skills. Berk (2008) claims that when parents react to their child with sensitivity, not only during nursing but also later, child shall probably develop well.

### Research aims

The main aim of the research is to study how adolescents perceive their relationships with their parents, and whether there is a connection between the adolescents' perception of relations with father and mother and their basic personality traits. According to the existing research into the relationship between parents and their children (Bowlby, 1973; Lacković-Grgin, 1994, Smojver-Ažić, 1999), it is justifiable to expect that the perception of relationships with parents plays an important role in adaptive behavior of adolescents. The results of the research into the perception of relationships with parents (Bezinović, 2000; Kuburić, 2001; Vulić-Prtorić, 2002) indicate that appropriate relationships with parents are the most significant protective factor in the development of children and adolescents, and that they play an important role in shaping the personality traits of adolescents.

Therefore, in accordance to the theoretical premises and the past research into the role and importance of parents to the development of individual, the aim of this research is aimed at examining the correlation of adolescents' perceived relationship with parents and their basic personality traits.

### Research problems

In accordance to the research aims, the following research problems have been identified:

1. To examine the perceived relationships with parents in the group of young men and women;
2. To determine to what extent the basic personality traits – Extraversion, Introversion, Psychoticism, can be explained by the facets of perception of positive and negative relationship with mother and father;
3. To determine whether the evaluations of the relationship with the parent of the same sex are more predictive for the explanation of basic personality traits, or the domination of mother's parental characteristics remains stable during the adolescent period.

### Hypotheses

In accordance to the existing theoretical concepts about the importance of perception of the relationship with parents, the main research hypotheses have been postulated:

1. Regarding the fact that personality traits of children are closely related to parents' sensitivity to child's needs, it is expected that the elements of perception of positive relations with mother and father as a protective factor will be significant for the explanation of Extraversion dimension and Emotional stability, while the elements of perception of negative relations with mother and father will prove to be significant predictors for the dimension of Psychoticism and Neuroticism.
2. Regarding the fact that in our culture mother's parental role is dominant in terms of taking care of children regardless of their development stage, the elements of perception of the relationship with mother are expected to be more significant predictors for explaining dependant research variables.



## RESEARCH METHODOLOGY

### Subjects

The research included a random sample of 135 subjects: 81 girls and 54 young men, students at Tuzla University, aged 19 to 21. All the subjects come from the complete families, they live with their parents or guardians, and the equal number of them live in urban and rural places.

### Research instruments

With the purpose of testing the research hypotheses, the following research instruments were used:

1. Questionnaire of past relationships with parents (Smojver-Ažić, 1999)
2. Questionnaire of present relationships with parents (Smojver-Ažić, 1999)
3. Eysenck Personality Questionnaire –EPQ (1994)

### Procedure

The data collection lasted for two months. The questioning was voluntary and anonymous. The questioning was conducted in smaller groups, up to 20 subjects, so that they are provided with time for work and the necessary privacy. The time for filling in the questionnaire was not limited, and it lasted between 60 and 90 minutes on average. All the subjects were given standardized instructions for work.

## RESULTS

The first step in data processing was the calculation of mean values and dispersion indices for independent and dependent variables, followed by determining reliability coefficient for every research variable. The results are given in the following tables.

*Table 1. Mean values and dispersion indices for evaluations of past and present relationships with parents*

Mean values and dispersion indices of perception of relationships with parents	N	M	Std. deviation
Total result on the subscale care-father	126	70.79	13.92
Total result on the subscale care-mother	129	77.57	12.44
Total result on the subscale perception of support from father	131	40.46	9.60
Total result on the subscale perception of support from mother	132	43.64	7.37
Total result on the subscale control-father	127	20.64	7.06
Total result on the subscale rejection-father	132	2.89	3.29
Total result on the subscale control-mother	126	22.21	7.07
Total result on the subscale rejection-mother	129	27.49	17.39
Total result on the subscale negative relations towards father	131	30.20	21.03
Total results on the subscale negative relations towards mother	129	25.65	18.43

Table 2. Descriptive parameters of basic personality traits

Mean values and dispersion indices of basic personality traits	N	M	Std. deviation
Extroversion	132	21.14	4.04
Psychoticism	132	6.15	2.34
Neuroticism	132	11.63	4.03

Table 3. Reliability coefficients for every scale/subscale (Cronbach alpha)

Scale/subscale name	Particle number	alpha
Control - father	11	0.728
Rejection - father	5	0.779
Control - mother	11	0.726
Rejection - mother	5	0.733
Negative relationships - father	29	0.942
Negative relationships - mother	29	0.926
Care - father	23	0.918
Care - mother	23	0.882
Perception of support - father	13	0.901
Perception of support - mother	13	0.901
Extroversion	30	0.685
Psychoticism	25	0.418
Neuroticism	21	0.815

Table 4. Multiple regression analysis of perceived relationships with father (predictor variables) and personality traits of subjects (criteria variables)

Predictors (father)	Extroversion			Psychoticism			Neuroticism		
	beta	t	p	beta	T	p	beta	t	p
Care	-0.112	-0.62	0.537	0.277	1.565	0.855	0.262	1.51	0.135
Control	-0.208	1.443	0.156	-0.028	-0.195	0.846	0.047	0.341	0.734
Rejection	0.117	0.888	0.377	-0.054	-0.419	0.677	-0.189	1.498	0.138
Negative Relationships	0.05	0.27	0.788	0.447	2.481	0.015*	0.55	3.115	0.003**
Perception Of support	0.02	0.119	0.906	0.072	0.435	0.665	0.005	0.033	0.974
	<b>R=0.298 F=1.651</b>			<b>R=0.360* F=2.536</b>			<b>R=0.405** F=3.334</b>		
	<b>R<sup>2</sup>=0.089 p=0.155</b>			<b>R<sup>2</sup>=0.130 p=0.034</b>			<b>R<sup>2</sup>=0.164 p=0.008</b>		

\*significance level with the risk of 5%    \*\*significance level with the risk of 1%

Perceived relationships with father did not prove to be significant predictors for the dimension of Extroversion ( $R=0.298$ ;  $p=0.089$ ), but the perceived relationships with father are significant predictors for the dimension of Psychoticism ( $R=0.360$ ;  $p=0.034$ ), although the perception of relationships with father can explain only 13.4% of psychoticism variance.

The dimension of perception of negative relationships with father proved to be a significant predictor for Psychoticism ( $\beta=0.447$ ;  $t=2.481$ ;  $p=0.015$ ). Our results are consistent with the results of some similar research (Patock-Peckham and Morgan-Lopez, 2009) which found that authoritative parenthood of fathers has a protective effect on the feeling of reject

ion by father, which is for example important for the absence of depression symptoms in adolescents, regardless of their sex. However, these authors also state that parental influence, especially at an early adolescent age, is multifaceted and very complex. Perceived relationships with father proved to be significant predictors for Neuroticism of adolescents

as well ( $R=0.405$ ,  $p=0.008$ ), although perceived relationships with father can explain only 16.4% of Neuroticism variance. It is interesting that the dimension of perception of negative relationships with father ( $r=0.55$ ;  $t=3.115$ ;  $p=0.003$ ) stands out as the most significant predictor for Neuroticism and Psychoticism of adolescents.

Table 5. Multiple regression analysis of perceived relationships with mother (predictor variables) and personality traits of subjects (criteria variables)

Predictors (mother)	Extroversion			Psychoticism			Neuroticism		
	beta	t	p	beta	T	p	beta	t	p
Care	0.137	0.813	0.419	-0.065	0.422	0.675	0.031	0.199	0.843
Control	-0.277	1.693	0.095	0.239	1.604	0.113	0.232	1.528	0.131
Rejection	0.029	0.209	0.835	0.032	0.257	0.798	-0.106	0.83	0.409
Negative Relationships	0.026	0.157	0.876	0.357	2.339	0.022*	0.398	2.556	0.013*
Perception Of support	-0.232	1.0203	0.233	0.092	0.525	0.601	0.138	0.769	0.444
		<b>R=0.226</b>	<b>F=0.708</b>		<b>R=0.464**</b>	<b>F=3.631</b>		<b>R=0.426*</b>	<b>F=2.927</b>
		<b>R=0.051</b>	<b>p=0.619</b>		<b>R=0.216</b>	<b>p=0.006</b>		<b>R=0.182</b>	<b>p=0.019</b>

\*significance level with the risk of 5%

\*\*significance level with the risk of 1%

Perceived relationships with mother did not prove to be significant predictors for Extroversion of adolescents ( $R=0.226$ ,  $p=0.619$ ), but they did prove significant for Psychoticism ( $R=0.464$ ;  $p=0.006$ ) and Neuroticism ( $R=0.426$ ;  $p=0.019$ ). Thus, perceived relationships with mother can cover 21.6% of the result variance in the dimension of Psychoticism and 18.2% of the result variance in the dimension of Neuroticism of their children. It is interesting that perception of negative relationships with mother stands as a significant predictor for Neuroticism and Psychoticism of adolescents ( $r=0.357$ ;  $t=2.339$ ;  $p=0.022$  for Psychoticism;  $r=0.398$ ;  $t=2.556$ ;  $p=0.013$  for Neuroticism). Concerning the fact that the dimension of perception of negative relationships most frequently appeared as the most significant predictor in multiple regression analysis, it can be said that this aspect of perception of relationships with parents stands out as most predictive for explanation of Neuroticism and Psychoticism of adolescents. It is important that the relation with parents in the adolescent period reflects the quality of relationships from the previous development stages. The modification is that in adolescence this relation achieves its final effect on personality traits, image of self, but also

the forms of behavior that individual will carry as an internalized part of personality and relations to important others during the entire life.

## CONCLUSIONS

By analyzing the correlation between perception of positive and negative relationships with parents and basic personality traits on a random sample of 135 subjects, students at the Faculty of Philosophy, Tuzla University, the following conclusions were made:

1. Perceived relationships with mother and father proved to be significant predictors for explaining the dimensions of Psychoticism and Neuroticism. Dimensions of negative relationships with mother and father stand out as the most significant predictors for explaining dependant variables.
2. Perception of relationships with mother and father did not prove to be a significant predictor for explaining Extroversion of adolescents. Therefore, the part of hypothesis related to the connection of positive relationships with parents and the dimension of Extroversion is rejected.

3. On the basis of the proportion of predictor variables in explaining the basic personality traits of adolescents, it can be concluded that positive aspects of relationships with parents are not significant in explaining the basic personality traits of adolescents. They act more as a protective factor, while the aspects of negative relationships with mother and father are more significant for explaining Neuroticism and Psychoticism, dimensions closely related to adolescents' adaptation.
4. Although it is considered that mother's dominance in upbringing within our culture is principal regardless of child's development stage, the results of this research clearly indicate that the aspects of negative relationships with mother and father are equally significant predictors for the dimensions of Neuroticism and Psychoticism. Therefore, the hypothesis about higher predictability of perceived relationships with mother in explaining the basic personality traits of adolescents is rejected.

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## SINGLE-PARENT FAMILIES-SOCIAL STATUS, NEEDS AND CHALLENGES

Anita Burgund<sup>1</sup>  
Marina Pantelic  
Marko Milanovic

*Original scientific paper*

*Faculty of Political Sciences, University of Belgrade*  
*Faculty of Political Sciences, University of Belgrade*  
*Faculty of Philosophy, University of Belgrade*

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### ABSTRACT

*There is no doubt that pluralization of society and societal conditions have an impact on the modern family, its role and structure. Changes in the hierarchy of societal values and attitude of society towards family lead to significant changes in its structure and way of functioning. The image of the family consisting of father, mother and children has more often been replaced by the image of families with one parent and children. There are multiple causes of single-parent families (single parenthood) such as death, divorce, abandonment of the family by one of the parents, etc. The positions and attitude of society towards single-parent families is different and it's actually depending on the cause of their occurrence. The aim of this paper was to identify basic needs and challenges of single-parent families in Serbia. For this purpose, we have organized three focus groups with 18 single mothers (six in each focus group). The results are presented in the context of creating new policies for improving the position of single-parent families in Serbia.*

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### INTRODUCTION

Today, with the general increasing trend of divorces, there are more and more single-parent families where the whole childcare is being carried out by one parent, usually mother. Regardless of the widespread of phenomenon and increased number of single-parent families, there is lack of research in our country and region dealing with this phenomenon. Determination of the term "single parent" is not clearly specified in Serbian legislation; even The Law on Financial Support for Families with Children<sup>2</sup> is missing glossary. In this paper, the term "single-

parent" is defined as a parent: *who lives alone with child, regardless of whether he/she receives or not child support. He is characterized as a single, because in court decision when child is entrusted to one of the parents, stands that "he/she is having independent custody.*

Conceptual determination issue is reflected in the term that indicates that parent alone, without the help of other parent, takes care of the child. Depending on the interpretation, it assumes that parent is: alone, independent, lonely, left to its own, single or in common law marriage.

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#### <sup>1</sup>Correspondence to:

Anita Burgund, Faculty of Political Sciences, University of Belgrade  
Jove Ilića 165, Voždovac, Belgrade, Serbia  
E-mail: anita.burgund@gmail.com

<sup>2</sup>The Law on Financial Support for Families with Children,  
„Službeni glasnik RS“, br. 16/2002 i 115/2005.



Hence, this term would include several, according to the needs and problems, heterogeneous groups of parents: those whose partner have died, whose partner have not recognized paternity and those who have become single by court decision of independent custody. By the Dictionary of Social Work, single parent is a term that refers to the circumstances when only one parent, for objective or subjective reasons, is taking care of child or children. The objective reasons include: death of spouse, child/children custody to one of the parents after divorce, partner's illness, extended leave for serving the sentence, military service, etc... The subjective reasons include circumstances such as: child birth outside marriage or female artificial insemination providing that father is unknown. The fact that only one parent takes care of posterity may be aggravating only when one of the parents, even though he/she has capabilities, refuses to give financial support or otherwise participate in child support and education (Vidanovic, 2006).

Because of the lack of state concern and help, in some countries (Bosnia and Herzegovina, Croatia, Serbia...) single parents organize their associations. When it comes to eligibility on the basis of single parenthood, divorced parents do not have legal status of single parent if there is a legal decision to pay child support. However, they often face the same problems as single parents, especially when it comes to psychological and social aspects of these problems. The most common reason for father's absence from family is divorce. Having all this in mind, in this article the term "*single parent*" includes all parents who independently take care of child/children regardless of the causes of occurrence of single-parent families.

Since the single-parent families are very heterogeneous group within which not necessarily all are at risk of having the same rights or in meeting the same needs, and as they have quite different ways of coping with difficulties, the aim of this paper is to describe the position of single parents in Serbia by displaying theirs (parent's) rights and needs, self-perceptions of single parents, challenges and difficulties they are facing and social stigmas that are attributed to them. Based on the identified needs and priorities, the suggestions for improving the quality of life of single-parent families will be created.

## Statistics

In last fifty years, the share of non-marital births in total births has significantly increased in all European countries. The same applies to Serbia, where in the period 1950-2008 the share of non-marital births has increased for 2.8% (from 8.0% to 22.8%) and their number for one fifth (from 13.141 to 15.747). Simultaneously, the total number of births within marriage has been reduced to one third – from 150 thousands in 1950 to 53 thousands in 2008 (Penev & Stankovic, 2010).

In the period 1968-2005 in Europe, the percentage of children living with one parent has risen from 6% to 16%, the largest percentage of these children (90%) live with their mothers. In European countries, women are dominated in single-parent families, mostly in Portugal (94%), while the highest percentage of single fathers (about 20%) is in Denmark, Luxembourg and Finland (Stankovic & Penev, 2010). In Croatia, 83% of single-parent families are families consisting of mothers with children, while fathers with children count only 17% of single-parent families. The Nordic countries and France have the highest number of single-parent families. Countries such as the Netherlands, Belgium, Luxembourg, UK, Germany and Austria are among the countries with an average level of prevalence, while in Ireland it is significantly less. However, in southern Europe, cohabitation is not spread in such an extent. Among persons in the age group 30-39 years, cohabitations represent half of all partner communities in Sweden; one third in Finland, Denmark and France, and in UK, the Netherlands and Austria one quarter. Every fifth unmarried couple of this age group is cohabitation in Belgium, Italy, Spain, Ireland and Luxembourg, while in Portugal and Greece it's every tenth (Kiernan, 1999; Kasearu, 2007). In Serbia, the number of single-parent families is unknown as it involves several different categories, which have already been mentioned above. Namely, the existing data shows that the proportion of single mothers with children is 12%, but it does not show why they are considered as single mothers. During the 1990's, the category of single mothers in Serbia has increased for about 50%. The increase in this category was affected by the increase in divorces. In the period of 1971-2002, the divorce rate has risen from 1.2% to 1.4% in central Serbia (Bobic, 2004).

The increase in number of single-parent families (mothers with children) have been caused by significant increase in non-marital births which was registered in 1990's. In the period from 1991 (13.5%) to 2001 (20.2%), the significant increase in non-marital birth was reported, and according to this every fifth child in new millennium was born outside marriage (Bobic, 2004).

#### **Eligibility on the basis of single parenthood**

Depending on the country, single mothers are two to three times more likely at risk of poverty than in average population and if we want to prevent transmission of poverty from one generation to another, improvement of the status of these families is of vital importance. These data shows that, there is a large number of single parent families, but the largest number of them in Serbia are women (Bobic, 2004). However, to a certain extent there are some data about single mothers, but single fathers are social group that has been very neglected and invisible so far. They say for themselves that they feel "invisible", lonely and socially excluded (Raboteg-Saric & Pecnik, 2010).

Single parents in Serbia are eligible to number of rights on the basis of single parenthood. One of these rights is the right to increased child allowances by submitting request to municipal administration for child care in their place of residence (<http://www.cekos.rs/rešenje-ocenizusima-za-dečiji-dodatak-od-13-08-2012-godine>, December 2012). In majority of cases, Centers for Social Work (CSW) do not record single parents as specific category of users, but like all other citizens who can be entitled to social welfare system if they meet certain conditions. Depending on income, single parents are having right to cash social assistance, allowance for care and assistance of another person and increased allowance for care and assistance of another person, free meals at public kitchen, and the city of Belgrade provides regular financial support, scholarship for students, as well as regular financial support for women victims of domestic violence after leaving the Safe House. According to the Law on Social Protection<sup>2</sup>, if one parent is not working but

taking care more than 15 years, for a child whose needs for care and assistance of another person, enable them increased allowance, by the general regulations of pension system, can get special allowance in the amount of minimum pension, which also applies to single parents. When it comes to eligibility to any financial assistance, all income must be taken into consideration, including child support, and if it's not paid, it is necessary to submit proof. Along these material support, in Belgrade non material support, such as counseling and psychological support, is available to single parents. Since this is a service that is provided on the local level, it's missing in many municipalities. It is obvious that eligibility is on the basis of materially vulnerability, and not on the basis of single parenthood, which is the biggest problem for single-parent families. The Constitution of the Republic of Serbia (Article 66)<sup>3</sup> states that single parents, as well as families and children in general, are having special protection. Unfortunately, it is missing legislative operationalization of this provision.

#### **LITERATURE REVIEW**

According to the Mouvement Mondial des Meres (MMM), nongovernmental organization which is in cooperation with EU working on representing the needs and interests of single parents, there is consensus between interviewed women, that motherhood was irrevocable and profound change in their lives, which was for most of them was experience they were not adequately prepared for. However, all spoke about the immense joy of motherhood, and agreed that it is worth all the trouble.

Three major problems faced by single parents and which transcend national, cultural and socio-economic differences are:

- 1) Reconciliation of family life with professional life,
- 2) Social recognition and affirmation of motherhood and family labor,
- 3) More time for taking care and commitment to children.

<sup>2</sup>The Law on Social Protection, „Službeni glasnik RS“ br.24/2011.

<sup>3</sup>The Constitution of the Republic of Serbia, „Službeni glasnik RS“ br. 98/2006.

Reconciliation of family and professional life of mother is seen through: the need to adjust the working hours with children school work (corporate managers, flexible time schedules), and most emphasized the necessity and importance of making certain financial decisions that would allow them to spend more time with their children. Eighty percent of mothers wanted to be with the children until the child is at the age of three or even until the child begins to go to school. When children reach school age, and while they are in their teens, mothers want to have the ability to opt for flexible hours or work part-time, which would be in line with school classes and children's responsibilities.

Although single parents who take care of their child alone find that harder than those who share responsibilities, they all have the same needs though, the same experience of importance in parental role, the same need for recognition of responsibility and time to fulfill their role. Loneliness in parenting, time pressure and lack of money often creates more stress and greater insecurity, which has a domino effect on children. According to the EC report on child poverty, single parent families are at the biggest risk of poverty in the EU, and by far the largest part of single parent families are those with single mothers (COM, 2010)

In economic terms, the appeal of single-parent families in all countries of the EU refers to the need for financial compensation for parenting function performance. Understanding and recognition of economic value of unpaid family labor would lead to financial compensation by building a system of pensions and part-time work. This proposal would contribute to a greater involvement of fathers, which is, the main condition for the improvement of singlemothers in general, and especially divorced or mothers who got separated.

Besides legal, in the world there are various forms of institutional support to single parents. The problem of single parenthood can be solved by "networks" of counseling for parents and parenting schools. So, for example, in Stockholm (Sweden), in every bigger municipality there is a family center where various experts (psychologists, social workers) are providing counseling support to single-parent families.

Given the above-mentioned problems in defining categories of single parents, research dealing with the aspects of Single Parents in Serbia is largely missing. According to data from comprehensive

research, single parents and their children are at greater risk than the rest of the population. Research of the economic security and parenthood (Fackson, Bentler, Franke, 2010) found that employment and adequate wages are main preventive factors when it comes to the life satisfaction of parenting (Hoffhian & Youngblade, 1999). According to the data of various researches the most vulnerable families are the one whose members have insecure employment, single parents and marginal groups who mostly consist of women (Esping-Andersen, 2002).

Numerous studies (Fackson, Bentler & Franke, 2010) has also shown that single mothers are at higher risk of depression and depressive symptoms in relation to the total population, especially if they are unemployed and economically dependent on the help system.

The Social Inclusion and the Serbian Poverty Reduction and the World Bank, as part of the research impact of the crisis on vulnerable and disadvantaged groups, identified the following issues for single mothers in Serbia:

- staying out of work and less abilities to find a new job, the problem about education and child care costs, health care, lack of benefits when applying for kindergarten;
- insufficient protection by the state in the following areas:
  - 1) Lack of mechanisms to collect alimony or to obtain child support in some cases (when men are changing jobs or having private businesses) can take a long time, even up to two years;
  - 2) If they are unemployed it is very hard for them to find preschool institution, and if their child does not attend day care they are not able to work at all;
  - 3) Mothers complain that they are often faced with blackmail and exploitation at different levels, because they are perceived as unprotected (Ipsos, 2009).

Research of the impact of poverty and temporary jobs on single mothers (Cherlin, 2009) has shown that the non-standard working hours proved to be a factor which increases family conflict (Staines & Shoulders, 1983), increased parental stress (Joshi & Bogen, 2007) and reduces joint family activities (Staines & Shoulders, 1983). Research (Sigle-Rushton & McLanahan, 2002) has shown that the presence of social support networks and flexible working hours enable single mothers to find a partner, and reduce parenting stress.

### **Societal attitudes and self-perception**

Family structures can often have the potential for stereotyping and labeling people (e.g., not married mother, a single father). Research on students, teachers, nurses and social workers are found and determined that the family structure is a social category to which stereotypes are being created. Ganong et al (1990) conducted a meta-analysis of 26 studies of stereotypes associated with family structure. It was found that people who were considered to come from a nuclear family (married adults, children from two parent families) are evaluated more positively than those who were considered to come from other types of families (adults who were not married, children from single-parent families). In the eighties, they argue that the nuclear family, consisting of mother, father and children is perceived as functional and "normal", while all other forms of stereotyped family as dysfunctional. It was especially positive image of motherhood in the context of the traditional nuclear family than in other contexts. The stereotype of the divorced mother is dyed with their perceived failure in the area of marriage and family life, while unmarried mothers are observed even deviant, difficult to meet the demands of parenting, family relationships and life in general (Ganong & Coleman, 1995).

Recent research also found negative stereotypes about people from unconventional families. For example, in relation to the parents who are married, single and divorced parents are described as the one who have a poor family relationships in greater extent and poor parenting skills: They are mostly perceived as irresponsible, selfish and impatient (Bennett & Jamieson, 1999). Some studies point to differences in social attitudes toward various subgroups of single parents with regard to gender or how they became single. Bennett and Džemison when examining the different groups of parents in the UK have confirmed the existence of stereotypes about married, divorced and unmarried parents who are identified in the previously described studies in the United States (Ganong & Coleman, 1995).

Camera (Kammer, et al. 2010) has analyzed how women construct the identity and adapt to the image that society has of them. She has analyzed the discourses that construct subjectivity stigmatizing single mothers and came to the conclusion that under certain conditions, women adapt or resist

to such an image. The study of the cultural context of single mothers were investigated, and the marginalization of issues that affect the formation of identity and self-perception single mothers (Josephson, 2002; Richardson & Taylor, 2008). This research deals with impacts, i.e. analysis of the impact of social policy on vulnerable groups, and policy sensitive to the needs of these groups (Murphy, Hunt, Zajiček, Norris & Hamilton, 2009).

### **The purpose of the research**

Main assumption of this research was that the needs of single parents in Serbia and the world is not different, but the options for meeting those needs vary from state to state. The aim of this study was to identify the main problems of single-parent families and gather suggestions for improving their position in society. In order to influence policy-makers to engage single-parent families in legal regulations as vulnerable group, which would provide eligibly on basis of single parenthood? The expected differences in self-perception dimension, because it is considered socially and culturally specific. Positive or negative self-perception points to support or stigma that society attributes to single parenthood.

### **METHODOLOGY**

In order to gain deeper insight into the position of single mothers, three focus groups with single mothers have been organized. Guide for focus group was created based on the analysis of relevant legislation, results of previous researches and interviews with representative of Association of single mothers, Zemun. At the end of focus groups parents were asked about their needs and support needed to improve their life situations. This question was important because the aim was also to communicate attitudes and perception of single mothers and present them to policy makers and other researchers, as well as to empower users through active participation.

Participants were selected on the basis of mother's income and education, with the support of the Association of Single Mothers, Zemun. Income was taken as a criterion for the formation of focus groups because it is an important factor in determining support from social welfare institutions, and also determines the level of support that mother can provide in raising a child.



Also one of the goals was to identify available support to parents in relation to financial situation. Insufficient income increases the number of working hours of parents, which negatively influence the quality of life of single parent families. The assumption is that a lack of material resources contributes to negative self-perception of parental capabilities and competencies. Therefore, we hypothesized that mothers with different level of income face different problems, and therefore they need different types of formal support.

Association informed its members about the research and asked them to sign up for the focus group. There were three groups: low income (who cannot meet basic needs), middle income (who can meet only basic needs) and high income (who provide for all their needs). Total of 18 mothers participated in focus groups, 6 mothers per group. Focus groups were carried out during November 2011 in the office of the Association.

## RESULTS AND DISCUSSION

The focus group results will be presented by the topics that were dominant for all three groups:

1. Specific difficulties that single-parent families are faced with
2. The needs of parents
3. Self-perception and marginalization

### Specific difficulties that single-parent families are faced with

Single parents in all three groups stressed the *economic situation* as the most important problem of single parenthood. In the low-income group, which mainly consists of single mother with primary school education, financial situation is shown to be extremely difficult and existentially threatening. They have expressed uncertainty when it comes to meeting their basic needs (nutrition of children, paying taxes/bills).

Mother (55), unemployed, four children:

*"Every month I face the same situation, I don't have a roof over my head and if I do not pay the rent, landlord will kick me out, and if I do pay the rent, I don't have enough to provide food for my children..."*

In the focus groups with middle income families, financial situation has been characterized as difficult for several reasons. The dominant reason

is that the other parent does not pay child supporter they pay part of what is supposed. A certain number of participants stated that a problem is that former partners abuse financial aid (by not paying alimony or paying it irregular), thereby trying to control their lives even after separation. Economic problems are especially accentuated for parents who have more children and whose children suffer from a chronic illness. As one of the reasons for financial problems they also pointed out the inability to reconcile family and professional life, which is why they were unable to hold a steady job. Frequent changes of job and lack of time did not allow them to advance and get well paid job. Only the parents who are living in an extended household with their parents had slightly higher financial security.

All parents have also stressed lack of in situation a land informal support as a very important problem. In this case, most difficulties were expressed by mothers with the lowest income. They pointed out that they have no institutional support, that they perceive that employees of the CSW condemned them for their choice and that they do not sufficiently inform them about their rights.

Mother (20), pregnant with a child:

*"When I have been in CSW to get help, they had told me they cannot give me any money and that it is my own fault that I have many children without resources to care for them ..."*

Single parents with middle income are not satisfied by their relationship with professionals and cooperation with institutions of social protection, primarily because the law does not adequately recognize single parents as group that need social support in order to meet their needs. Mothers with high income similarly pointed out that they lack institutional support in the form of services that are tailored to the needs of single parents. They also describe their relationship with professionals as fair, although they think that CSW did not help much because legislation, do not recognize needs of single, so they are practically invisible. The reason for this difference regarding relationship of professionals toward single mothers can be explained by the marginalization of single women with low income and basic education on the one hand, as well as a lack of information of these women about their rights, leading to false expectations of professionals.



As only non-institutional support, single parents recognize support from their parents, relatives and friends, but they also report that they rarely use this kind of help. The main reasons for low informal social support from parents, mothers with low incomes identify high workload of their parents, illness or old age. Help from friends is lacking mostly because they were often moving.

Mother (55), unemployed, and four children:

*"Everything depends on me, and I'm not sure I can do it ..."*

For single parents with medium income, support of friends is rarely used for fear that they will not be able to repay this assistance which may eventually affect their relationship. The group of mothers with high income was heterogeneous regarding reasons for lacking informal social support, but unanimous in attitude that they would use it if it was available.

Poor financial situation is main reason for concern and fear of single parents. They point out that their biggest fear is that they will not be able to pay their bills and feed their families. Parents with the lowest income even fear that state authorities do not take away the children, due to lack of funds. Related to this fear is the need for mechanism that will assure support of other parent in caring for child needs. A certain number of parents in all three groups stated loneliness and the fear of failing in parenting as possible difficulties.

Single mother (30), employed, higher income, higher educated:

*"Whenever I go to the birthday parties and the events with my child I'm alone, all the other kids come with their mom and dad, and mine is always only with me. I feel that my child is missing a father figure and a someone who is going to share the parenting with me ..."*

### **The needs of parents**

Single parents in all three groups similarly verbalized their needs and agreed that their needs are no different from the needs of other parents, but that they need more support from the government and relevant institutions. As the most important, they identified the need for the introduction of rights regarding single parenting. The differences mainly were in the following: lower-income parents demanded more financial secu-

rity, in particular through the ability to actualize privileges from their tenancy status, more information on rights, free legal advice and representation in court over child support implementation, better treatment from professionals and benefits in terms of education, access to medical care and development of children (free checks, medicines, books, equipment for school, help in clothing and free meals at school).

Middle-income parents also requested rights regarding their single parents' status and formulated them as the need for a higher standard of living. Better standard for them means: organizing services where they could leave their children for babysitting while at work or in order to have some time only for themselves. This service should be either free or by a beneficial price, because their financial situation does not allow them to pay the full cost of an extended stay.

The advantage in getting a job based by single parent status is the second right that the entire group stressed out as significant, and also the release from night work and flexible working hours. According to The Labor Law (Article 91)<sup>4</sup>: "a single parent who has a child under seven years of age or a child with severe disability can work overtime or at night, only with his consent in writing". Thus, the legislation protect single parents from night work, but only if they have a child under the age of 7, and parents' attitude is that this measure is necessary in a much longer period for the child. Middle-income parents also stressed the fact that child allowance should be paid to children regardless of their financial situation, financial situation of the family, so it would be a measure of support for single parent families.

Single mothers of the third group formulated rights on the base of single parent status primarily through the creation of professional psychological support and counseling where they could turn for help. No parent (in any of the focus groups) did use counseling services and / or psychological help. The only kind of support and help was psychosocial support through the Association and it was evaluated as very useful. However, in a group of parents with middle and lower income need for advisory assistance was not recognized as extremely important.

<sup>4</sup>The Labor Law, "Sluzbeni glasnik RS", 54/09.

Low-income mothers have pointed out that because of the difficult financial situation and commitments (work) they do not have time to go to counseling, while middle-income parents pointed out that the assistance of professionals does not mean much and that they feel more comfortable in self-help groups, like the Association, because they share the same concerns and problems, they feel a better understanding and that they can help each other with their experience.

Mother (42), unemployed, widowed:

*"In this group we all became friends. We think of each other, congratulate each other's birthdays and share our troubles... Our women do not like institutions, we have all experienced the inconvenience, they are like some gendarmes who judge us and work for the government, not for us ..."*

Single mother (30), unemployed:

*"Here (at the Association) we all have similar problems, and when you hear someone else's, and you see that the others are struggling and that you're not the worst, and all of them listen to you and give advice, and no one condemns..."*

Mothers in the third group were also asking for employment benefits, and their greatest need is steady work, because it would provide security and stability for them.

### **Self-perception and marginalization**

One of the topics of conversation was how they perceive themselves as single parents, and whether they feel that they are condemned or in any way marginalized by their environment for being single parents. In the low-income group mothers said that they feel marginalized only by professionals in the CSW. They said they had experienced condemnation and embarrassment, that they were seldom heard and given some support.

Unemployed (50), single mother of four children:

*"They look at me like I'm happy that I'm in this situation and as they give me the money out of their pockets, saying to me: 'Why did you give birth to so many children when you do not have means for supporting them. If you have no money, we'll put the children in foster care'"*

In the middle-income group parents were at different ages, and the basis on which they become self-supporting, and therefore gave different answers. Widows said they have never been discriminated against and that the environment for them has always been benevolent and willing to help them because of their position. Divorced women are perceived differently reaction environment on their site, but did not describe the feeling of serious marginalization or experience shame, humiliation and inferiority. The greatest condemnation of the environment was experienced by women who have given birth out of marriage. In addition to the experience of loneliness in parenting, they often mentioned the environment condemnation. The issue of marginalization was mostly apparent in the youngest group of single mothers with middle-income:

27 years, had a child with 17 years:

*"I'm the youngest mom at PTA meetings and there I felt the contempt the most and was looked askance by other parents ..."*

Most of the mothers who gave birth out of marriage in all three focus groups, said that because of the condemnation of society and the autonomous child care *"do not have a life, a partner, have a few friends and difficulties to make new friends"*.

Regarding that there are different responses to the question of marginalization from the parents with basic and parents with middle-and upper-income (which is related to education and belonging to different social groups), also their perspectives on over coming discrimination differ too. Low-income women reported that professionals should be more sensitive to their position and do not condemn, while the parents of middle and upper-income emphasized that personal attitude has allot to do with the experienced marginalization and discrimination of the environment. They said that it is important that they feel confident and good, because that is the only way to be able to prevent negative attitudes and convictions, and be a good role model for their children. About this issue the parents in all three focus groups were most supportive. Those who feel discriminated against are encouraged, empowered, supported and advised on how to over come this situation.

## CONCLUSIONS AND RECOMANDATIONS

Given the challenges they face, and because of the different positions and the grounds on which they became self-supporting it is important to point out some recommendations that, at different levels, could promote position of single-parent families.

Firstly, it is necessary to improve living standards of single-parent families - improve economic situation of single-parent families, to ensure the effective realization of alimony and provide employment and vocational adjustment with parental roles.

Then there are recommendations with respect to information about rights and the availability of support:

- Single parents should be informed about their rights and possible forms of assistance
- Ensure availability of professional psychological help for single parent and child,
- Provide counseling and practical support to socially isolated single mothers,
- Encourage the establishment and operation of the association for single parents.

In institutions that provide assistance to single parents (CSW, counseling for marriage and family, etc.) is especially important for professionals to nurture non-judgmental attitude towards clients and to engage them in the decision-making process in regard to their future. In this way it supports the family and prevents children entering the social welfare system as children without parental care. Creation of new counseling and support services governmental and non-governmental organization would provide support to parents throughout Serbia. This service could help both psychologically and organizationally, by searching for networks and resources to help parents cope even without additional financial aid from CSW which often is not enough. Eligibility on the basis of delivering the priority of single parents in employment and protecting them from being fired from work, would engage wider community, especially employers, to become more sensitive to the needs and problems of this social group.

At the level of community it is necessary to sensitize society to the problems of single parenthood and prevent the spread of marginalization and discrimination of single-parent families. In addition, it would be useful to encourage premarital, marital counseling and post-divorce counseling that would help to separate the partnership role from parental, and although the partnership is ended, parents could

preserve their parental roles.

Neglect of the public interest in single-parent families is evident by the small number of research on the subject both in Serbia and in countries in the region.

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## FORMULATION AND EVALUATION OF EFFERVESCENT GASTRO-RETENTIVE FLOATING TABLETS FOR CONTROLLED RELEASE OF AN ANTI-ULCER COMPOUND

Aleksandar Aleksovski<sup>1</sup>  
Emina Zahirović  
Amra Demirović  
Emilija Spaseska Aleksovska

*Original scientific paper*

ZADA Pharmaceuticals, Bistarac Donji bb, 75300 Lukavac, Bosnia and Herzegovina

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### ABSTRACT

*Effervescent floating gastro-retentive matrix tablets present novel and promising approach towards targeted and controlled drug delivery in the stomach and in the upper part of the small intestine. This kind of dosage form could be obtained by combining in a suitable ratio effervescent compounds and hydrophilic/hydrophobic polymer/s. The aim of our investigation was to develop controlled release effervescent matrix tablet which will float over the gastric media for longer than 8 hours and will release the active compound in a continuous manner over 8 hours period. We used ranitidine HCl as a model drug which has narrow absorption window in the upper small intestine, and is a good candidate for this type of dosage forms. We employed sodium bicarbonate and citric acid as effervescent compounds and two different types of hydroxypropyl methylcellulose (HPMC K4M and HPMC K15M) as a controlled release hydrophilic polymer. Three batches of tablets were produced (one containing HPMC K4M, other containing HPMC K15M, and the third containing 1:1 mixture of these two polymers) and every batch was compressed with two different forces 5.5 kN and 4.7 kN, so completely six probes of tablets were made. All six probes complied the pharmacopoeial requirements concerning mass uniformity, content, friability and hardness. All six probes tended to float fast to the surface of the medium and tend to hydrate and swell fast enough which actions provided controlled release of the compound over period of 8 hours. No significant differences in the dissolution profiles of all six probes were noticed during the investigation.*

**Keywords:** *gastro-retentive, controlled release, effervescent, hydrophilic polymer, floating, swelling*

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### INTRODUCTION

Oral drug administration is still the most common and most popular pathway of medical application due to several advantages such as: ease administration, less invasive treatment and greater patient's compliance. In terms of ameliorating the therapeutic outcome, minimizing

side effects and increasing patient's compliance scientists pay huge attention on developing oral controlled (extended) release dosage forms which will deliver the active compound in a controlled fashion over longer periods of time (Qui et al, 2008).

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<sup>1</sup>Correspondence to:  
Aleksandar Aleksovski, ZADA Pharmaceuticals  
Bistarac donji bb, 75300 Lukavac, B&H  
Phone: 0038970735642  
E-mail: aleksandar.a@zada.ba; acko\_aleks@yahoo.com



Controlled release dosage forms (tablets and capsules) provide many advantages over conventional solid dosage forms such as: lower incidence of drug concentration fluctuations in both the plasma and on the site of action, lower incidents of side effects, decreased dosage regime etc. Controlled release dosage forms could be designed as mono- or multi-dosage units in a form of: matrix systems (hydrophilic or lipophilic), membrane systems, osmotic systems (Aulton, 2007). Conventional oral controlled release dosage forms may not be suitable for some active substances, such as those which demonstrate changeable solubility at different pH values, those which do not provide uniform absorption through whole GUT, compounds which show instability at certain region of the GUT (Wilson & Crovley, 2011). These aspects led scientists into research and development of novel targeted controlled release oral dosage forms. One of the approaches towards targeted oral therapy is gastric retention of solid dosage form. Gastro-retentive solid dosage forms are kept in the stomach for prolonged period of time, providing controlled release of the active substance in this region while resisting gastric motion and emptying sequences (Wilson & Crovley, 2011). Gastric retention is beneficial for active compounds which have narrow absorption window in the upper parts of the GUT (stomach or duodenum) such as riboflavin and levodopa; active compound which act locally in the stomach (some antacids); compounds which are unstable or have low solubility in alkaline media and compound which may be harmful for the micro-flora of the small intestine or the colon (Nirav, 2011, pp. 571-580).

Many techniques for gastric retention are developed and one of the quite successful techniques is the production of effervescent hydrophilic matrix systems (mostly tablets)

Effervescent hydrophilic matrix tablets are composed of hydrophilic polymers (hydroxypropyl methylcellulose, hydroxyethyl cellulose, hydroxypropyl cellulose, polyethylene oxide, chitosan, alginate, guar gum, xantan gum, acacia etc.) and effervescent components such as sodium bicarbonate/sodium carbonate with or without citric/tartaric acid in combination (Kumar et al, 2011, pp. 423-436). The controlled release of the active compound is based on dif-

fusion and erosion and it is due to the capability of the outer part of the hydrophilic matrix to hydrate and swell in contact with the gastric media which leads in formation of outer hydrated porous gel layer (Dwivedi & Kumar, 2011, pp. 1413-1426). The gastric media could easily penetrate into this porous gel layer and to dissolve the active compound which then leaves the matrix by diffusion through the gel layer pores. When the outer layer is completely hydrated it starts to erode and it is replaced by new polymer layer which undergoes continuous hydration. By erosion additional amounts of active substance is delivered to the media. In contact with gastric fluids effervescent matrix tablets exhibit in-situ effervescent reaction which leads to CO<sub>2</sub> formation, which CO<sub>2</sub> is entrapped into the hydrated and swelled polymer layer. All these actions lead to decrease in system's bulk density and buoyancy over the gastric content (Aleksovski, 2012, pp. 23-30). Ranitidine is reversible, competitive inhibitor of histamine H<sub>2</sub> receptors. It is used in the treatment of peptic gastric and duodenal ulcers, gastro-esophageal reflux disease, Zollinger-Ellison syndrome and corrosive esophageal disease. It is known that the conventional ranitidine dose of 150mg inhibits the gastric secretion up to 5 hours but not up to 10 hours. On the other hand the dose of 300mg shows fluctuating drug levels in the plasma (Reynolds, 1996). Due to the narrow absorption window in the upper small intestine ranitidine is suitable candidate for development of effervescent hydrophilic matrix tablets.

Hydroxypropyl methylcellulose (HPMC) is very frequently used hydrophilic polymer in the production of controlled release matrix tablets, due to its inert nature, pH-independency, suitable flowability and compressibility and safety (Wen & Park, 2010). High viscosity HPMC grades tend to be most suitable candidates for controlled release matrix preparation due to the fast hydration and gel layer formation which provide continuous release of the active compound (by diffusion and erosion) and maintenance of tablet integrity. Combination of HPMC-s with different viscosity grade usually provide modification of the rate and extent of drug release (usually and intermediate drug release is obtained) (Aleksovski et al, 2012, pp. 22-31).

## MATERIALS AND METHODS

### Used Materials

Ranitidine HCl (Orchev Pharma PVD LTD, India); Methocel K4M® (HPMC with viscosity 4000mPa.s.) and Methocel K15M® (HPMC with viscosity 15000mPa.s) (Colorcon®, UK). Sodium bicarbonate, citric acid and talc (MERCK, Germany); Microcrystalline cellulose (MCC) (JRS PHARMA GmbH KG, Germany); Copovidone (BASF, Germany); Magnesium stearate (Dr. Paul Lohmann GmbH KG, Germany). All other ingredients, solvents and reagents were with analytical grade.

### Methods

#### Evaluation of powder mixture

All powder compounds (except magnesium stearate) were accurately weighted, passed through standard sieve 0.8mm and mixed thoroughly

for 5 minute. After sieving powder mixture was evaluated for bulk density and tapped density (PhEur 7), Carr's index and Hausner ratio and angle of repose (standard funnel and petri dish with radius of 4.75cm).

### Tablet production

After mixing powder compounds, Mg stearate was added to the powder mixture by passing it through a standard 0.8 mm sieve. Powder mixture containing Mg stearate was thoroughly mixed for period of 1 minute. Floating matrix tablets were produced by direct compression using FETTE 1200 rotary tablet press. Three batches of caplet 14mm x 7mm white-yellowish tablets with mass around 400mg were produced. Each batch was made with two different compression forces 5.5kN (P1/1, P2/1, P3/1) and 4.7kN (P1/2, P2/2, P3/2). Complete composition of formulations P1, P2 and P3 (mg) is shown in Table 1.

Table 1. Composition (mg) of P1, P2, P3 batch of tablets

Compound	P1	P2	P3	Role
Ranitidine HCl	168	168	168	Active compound
HPMC K4M®	120	/	60	Hydrophilic polymer
HPMC K15M®	/	120	60	Hydrophilic polymer
Sodium bicarbonate	50	50	50	Effervescent compound
Citric acid	10	10	10	Effervescent compound
MCC	32	32	32	Diluent
Copovidone	12	12	12	Dry binder
Magnesium stearate	4	4	4	Lubricant
Talc	4	4	4	Lubricant/glidant
Σ	400	400	400	

## Evaluation of the produced tablets

Tablets were evaluated regarding mass uniformity (Mettler Toledo balance), resistance to crushing (Varian VK 200), friability (Varian dual roche type drums), estimation of drug content (Agilent technology 1200 RRLC, VWD detector). Dissolution test was made in accordance with USP (paddle apparatus Varian VK7025), 75rpm speed, in simulated gastric fluid (USP) at temperature of 37°C. The released amount (%) of active substance was measured in the intervals of 1, 2, 4, 6, and 8 hours and determined by UV/VIS Spectrophotometer (Thermo Finigan Evolution 300) at wave length of 313nm, with a dissolution medium in the reference cell.

## In vitro buoyancy studies and swelling index

Randomly selected tablets from all three batches and with two different hardness values were placed in a 100 ml beaker containing simulated gastric fluid (USP) at 37°C. The time required for tablets to raise and settle on the media's surface was measured and was named as **floating lag time (FLT)**. Floating period of the tablets was examined through time interval of 8 hours. The period through which tablet

remained on the media's surface referred as **total floating time (TFT)**. The swelling index of the tablets was determined in 100 ml simulated gastric fluid (USP) at 37°C in 1 hour intervals in total period of 8 hours. After each hour tablets were withdrawn from the media, the excess liquid was removed by using filter paper, and the tablets were weighted. Swelling index was determined using the following equation:

$$SI(\%) = \frac{(\text{mass of tablet after certain time}(h) - \text{initial mass of tablet}) * 100}{\text{initial mass of tablet}}$$

## RESULTS AND DISCUSSION

### Powder and tablet properties

Concerning powder properties it could be concluded that all three powder mixtures demonstrated similar and relatively good powder flowability, which could be noted from the results for Carr's index (CI), Hausner ratio (HR) and angle of repose (AR). Namely powders having values for CI < 21%, HR < 1.26 and AR < 36° tend to have fair flow and no addition of flow aid compounds is required. The complete results for powder properties are given in Table 2.

Table 2. Properties of P1, P2 and P3 powder mixtures

Propertie	P1	P2	P3
<b>Bulk density (g/ml)</b>	0.568	0.570	0.579
<b>Tapped density (g/ml)</b>	0.714	0.714	0.727
<b>Carr's index (%)</b>	20.45	20.17	20.35
<b>Hausner ratio</b>	1.257	1.252	1.256
<b>Angle of repose(°)</b>	35.86	34.87	35.01

In terms of pharmacopoeial demands it could be concluded that the examined tablets (from all three batches in both hardness values- in continuation six probes) comply the requirements. Concerning mass uniformity all six probes showed satisfactory results since none of the average masses didn't vary for more than 5% of the desired mass (400 mg) and also

none of the examined tablets didn't have mass variation of ± 5%. Concerning drug content all six probes proved to comply the pharmacopoeial requirement of not more than ± 5% of the declared content. In terms of friability all six probes showed values lower than 1%, which is in accordance with the current pharmacopoeias.

No significant difference in friability values between tablets consisting of different polymer and compressed at same force was noticed. It could be noted that tablets containing the same polymer/polymer blend have slightly different friability values. Namely tablets compressed with larger force tend to have slightly lower friability compared with the ones compressed with smaller force. This could be due to the increased hardness of the tablets and increased binding ability of HPMC when compressed

under higher forces. When observing tablets containing the same polymer/blend it could be concluded larger compression force produces harder tablets. When comparing hardness values in tablets composed of different polymer/blend and compressed with the same force it could be postulated that the hardness decreases in the following order HPMC K4M > HPMC 15M > HPMC BLEND. The obtained values are expressed as mean value  $\pm$  RSD(%) in Table 3.

Table 3. Tablet properties for batches 1/1, 1/2, 2/1, 2/2, 3/1, 3/2

	P1/1	P1/2	P2/1	P2/2	P3/1	P3/2
<b>Mass</b>	392.32 $\pm$ 0.	389.57	396.78	391.29 $\pm$ 0.	401.26 $\pm$ 0.	398.45 $\pm$ 0.7
<b>uniformity</b>	82	$\pm$ 0.84	$\pm$ 0.54	69	92	0
<b>Content (%)</b>	99.34	100.21	102.75	102.34 $\pm$ 0.	101.63 $\pm$ 0.	100.95
	$\pm$ 0.47	$\pm$ 0.53	$\pm$ 0.77	28	67	$\pm$ 0.37
<b>Friability (%)</b>	0.12			0.17	0.15	
	$\pm$ 0.03	0.14 $\pm$ 0.06	0.12 $\pm$ 0.03	$\pm$ 0.04	$\pm$ 0.05	0.18 $\pm$ 0.04
<b>Hardness (N)</b>	140.48 $\pm$ 2.	128.12	136.26	118.01 $\pm$ 4.	131.26 $\pm$ 2.	111.83 $\pm$ 5.5
	93	$\pm$ 2.83	$\pm$ 2.45	90	62	3

### Floating and swelling properties of the tablets

From the obtained results for floating times it could be concluded that tablets containing HPMC polymer blend (Methocel K4M and Methocel K15M) had shortest FLT compared to tablets made by the same compression force which contained single polymer. There wasn't any significant difference in FLT between tablets composed of different single polymers made under same compression force. In terms of probes containing the same polymer which were made by different compression forces it

could be noted that a slight difference in the FLT exists. Namely harder tablets tend to have longer floating lag time compared to softer tablets, which could be explained by the lower ability of water to penetrate and to hydrate the outer polymer layer and to provoke effervescent reaction which will provide floating of the dosage form. Concerning total floating time (TFT) all six probes remained buoyant over the media for periods longer than 8 hours. The complete results for FLT and TFT are given in Table 4.

Table 4. Results for in vitro buoyancy studies

	P1/1	P1/2	P2/1	P2/2	P3/1	P3/2
<b>Floating lag time (s)</b>	121.67	116.33	122.70	118.67	105.47	93.00
<b>Total floating time (s)</b>	>8	>8	>8	>8	>8	>8

In terms of swelling index regarding tablets composed of the same polymer/blend but compressed with different forces, it could be concluded that softer tablets have higher swelling capability compared to harder tablets which could be due to the lower inter-particle connections in the tablets and higher porosity which lead to greater water uptake and greater and faster swelling degree of the matrix. Tablets containing HPMC K4M tend to swell less compared with the tablets containing polymer

blend (intermediate swelling) and tablets composed of HPMC K15M which tend to have largest swelling index. This could be due to the highest solubility and erodability (due to low viscosity) of HPMC K4M in the media compared to the tablets containing polymer blend (intermediate viscosity) and tablets containing HPMC K15M which has highest viscosity and lowest solubility and erodability. Complete results of the swelling index of all six probes are given in Table 5.

Table 5. Swelling index (SI-%) values

	p 1/1	p 1/2	p 2/1	p2/2	p 3/1	p3/2
<b>SI after 1h</b>	52.17	60.55	79.29	87.05	85.46	88.41
<b>SI after 2h</b>	114.57	128.75	135.35	139.59	139.09	143.82
<b>SI after 3h</b>	163.68	175.82	198.73	206.59	182.45	197.22
<b>SI after 4h</b>	208.43	224.17	231.06	236.54	205.01	214.10
<b>SI after 5h</b>	227.87	243.25	256.31	274.36	255.39	269.52
<b>SI after 6h</b>	270.84	293.63	294.94	310.15	284.96	291.18
<b>SI after 7h</b>	301.79	316.53	349.24	364.72	318.74	328.71
<b>SI after 8h</b>	325.31	355.72	401.26	412.69	349.37	377.07

#### In vitro dissolution studies

All six probes of tablets formed a gel layer fast enough which give them firmness and provided controlled release of t active compound in period of 8 hours by both diffusion through the pores of the hydrated polymer layer and erosion of the tablets surface. There are no significant differences into the dissolution profiles of tablets containing the same polymer/blend and compressed by

different forces, nor of the tablets containing different polymers compressed by the same force. It could be concluded that all six probes are eligible for developing effervescent gastro-retentive controlled release matrix tablets. Results of drug released studies are calculated as mean value (%)  $\pm$  RSD(%) (Table 6) and are also shown as a cumulative curves on a plot (Figure 1).

Table 6. Dissolution profiles of examined tablets

	P1/1	P1/2	P2/1	P2/2	P3/1	P3/2
after 1h	30.28 $\pm$ 7.86	27.69 $\pm$ 0.84	25.95 $\pm$ 5.95	26.05 $\pm$ 5.79	27.56 $\pm$ 5.09	27.61 $\pm$ 1.27
after 2h	45.03 $\pm$ 2.13	45.29 $\pm$ 3.92	45.89 $\pm$ 2.88	42.45 $\pm$ 2.35	47.32 $\pm$ 2.77	44.86 $\pm$ 1.75
after 4h	67.2 $\pm$ 0.85	66.46 $\pm$ 1.26	66.74 $\pm$ 4.55	65.46 $\pm$ 1.97	69.25 $\pm$ 0.96	68.24 $\pm$ 1.92
after 6h	80.06 $\pm$ 1.36	81.73 $\pm$ 2.17	79.57 $\pm$ 2.16	80.53 $\pm$ 2.07	81.92 $\pm$ 2.35	80.75 $\pm$ 1.87
after 8h	89.1 $\pm$ 3.66	91.52 $\pm$ 1.96	88.06 $\pm$ 4.41	87.28 $\pm$ 1.52	91.73 $\pm$ 2.12	89.80 $\pm$ 1.54



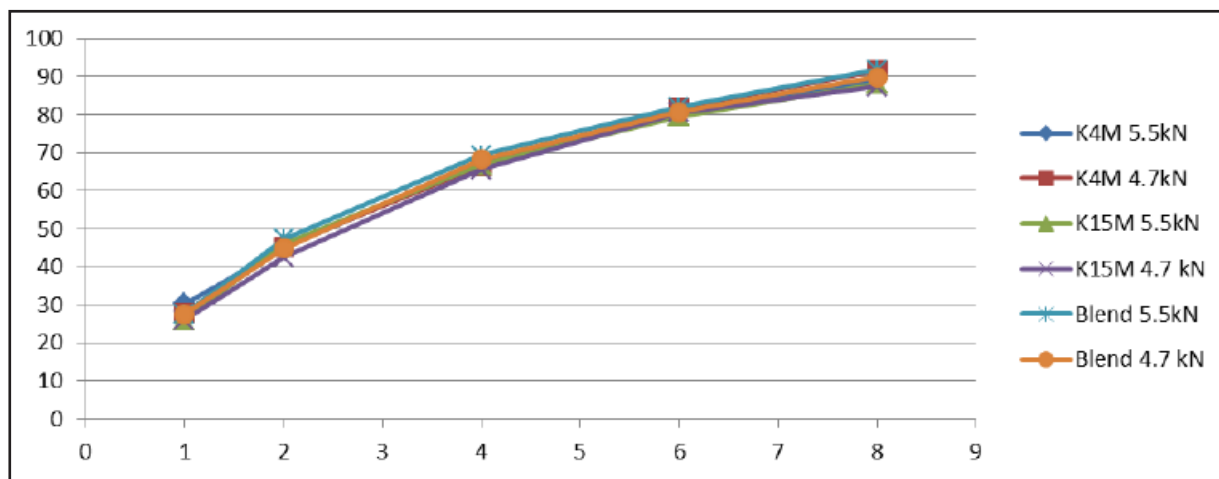


Figure 1. Cumulative release curves of all six probes (x axis- time (hours); y-axis drug released (%))

## CONCLUSION

Effervescent floating matrix tablets are promising approach in the development of targeted gastro-retentive controlled release dosage forms, since they could be easy produced and easy administered by the patients, and also they tend to have extended residence in the stomach area where they deliver the active compound in a controlled fashion over longer time periods. Ranitidine is one of the most used medicines in the present time, intended for treatment of different kind of GUT conditions such as peptic, gastric and duodenal ulcers, gastro-esophageal reflux disease, Zollinger-Ellison syndrome and corrosive esophageal disease. Due to its narrow absorption window ranitidine is a good candidate for developing gastro retentive dosage form. In our work we have successfully designed and produced gastro-retentive effervescent matrix tablets based on sodium bicarbonate and citric acid (effervescent compounds) and HPMC (polymer which control the release of the active compound). Two types of HPMC-s (HPMC K4M and HPMC K15M) and a 1:1 polymer mixture were used to produce

three batch of tablets, and in every batch some amount of tablets were produced by compression force of 5.5kN and another amount were produced by 4.7kN (six probes were produced). From the obtained results it could be concluded that all powder mixtures intended for tableting showed fair flow properties and no flow aid addition was required. All six probes of tablets complied the pharmacopeial requirements concerning mass uniformity, content, hardness and friability. All six probes had short FLT, and remained buoyant over the gastric fluid for more than 8 hours. The used amount of 30% polymer/blend provided fast hydration and swelling of the outer matrix region which enabled continuous release of the drug compound through period of 8 hours and kept tablet integrity during that period. There were no significant differences in the release profile between probes containing different polymers and/or probes compressed with different forces, so it could be concluded that all six probes complied the requirements of our research.

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## THE ROLE AND SIGNIFICANCE OF HOMEWORK IN INITIAL MATHEMATICS TEACHING

Sead Rešić<sup>1</sup>  
Mirjana Bradarić

*Original scientific paper*

*Department of Mathematics, Faculty of Natural Sciences, University of Tuzla*

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### ABSTRACT

*This thesis elaborates on the role and importance of homework in the initial stages of teaching mathematics. The aim is to determine and analyze the degree of burden on students with homework. The following tasks were performed as a starting point for this research: determining the degree of correlation between the time that student spends on weekly homework and the student's homework amount determined by the pedagogical norm, determining the level of parents' participation in helping students with homework, determining the degree of correlation of differentiation of homework with the students' motivation for doing homework. Homework plays an important role in the initial stages of teaching mathematics, and takes up a significant place in the process of studying and teaching mathematics. The results, analysis, and conclusions are presented upon research.*

**Key words:** *Mathematics, school, homework*

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### INTRODUCTION

In the history of teaching, the students' relation towards homework has not always been equable, as is not today. In the 'old school', dominated by so-called lectionism, students were burdened with repetition of lessons in order to memorize them. Besides repeating lessons, homework included exercising to acquire elementary skills of reading, writing, calculus. This is why in the old school the character of homework was reproductive. In the new school homework is still present, but its point and character is changing. Not only is it of reproductive character, but it is also productive, i.e. it has the character of independent new knowledge "earning" (Tomić & Osmić, 2006).

This type of work must have contributed to acquiring the ability of independent work, that is, self-education. Throughout history, homework has accompanied the process of mastering the subject matter. Often, homework was assigned to students to allow them to master certain topics until the teacher comes to their area again. This way, students studied individually and progressed without the help of a professional. A similar manner of knowledge supplementation has been kept even until today, with certain corrections. As the subject matter became more complex through history and demands from students got greater in quantity, the type of homework adjusted to the demands of new subject matter.

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#### <sup>1</sup>Correspondence to:

Sead Rešić, Department of Mathematics, Faculty of Natural Sciences, University of Tuzla  
Šabana Zahirovića 10, Tuzla, B&H  
Phone: +387 61 101 230  
E-mail: sresic@hotmail.com

The very conceptions regarding the need for doing homework, manner of reviewing it, as well as the question whether homework should be included while forming the final grade vary. Today, there is the dilemma about what the child needs, what volume of knowledge, and how much, as well as what, to ask from the child in return, in the form of feedback, which will be done individually at home. Due to this vagueness, there are variations with many teachers, and the question is posed: What is homework, how to assign tasks, what to give for homework, how much to assign, and is homework even necessary? *Homework* is the student's activity which derives from everyday schoolwork obligations, but is performed outside of schoolwork. It is also possible to provide an answer to the question *how to assign* tasks. First and foremost, most of the tasks prepared for student's individual work should be textual in nature and contain information from the student's immediate surroundings. The teacher's obligation is to analyze every task with students and provide instructions for work, and precisely that ensures success in teaching.

The question *what to give* for homework is not difficult to answer, if one bears in mind that everything that was the subject of discussion during previous classes, should also be the subject of individual work. The best policy is to assign tasks which encompass more teaching units.

To the question *how much homework to assign*, the answer depends on the grade which students are in, the content, structure, complexity of subject matter. Homework is a significant factor in developing student's individuality (including transcribing). The higher the level of interest for mathematics teacher manages to achieve in a student, the more secure they can be that the child will come up with the results on his/her own. This is a great mutual success! If the child is not interested, it leads to him/her being burdened with various demands from the teacher or developing resistance towards school, homework, and generally responsibility about work.

## THEORETICAL PROBLEM DISCUSSION

### Introductory mathematics teaching

Mathematics teaching in the first five grades of elementary school in Bosnia and Herzegovina is called introductory, while the science that studies nurture and education within it is called methodic of introductory mathematics teaching. Every type

of methodic, as is the case with that of introductory mathematics teaching, has its own subject of studying, which is mathematics nurture and education in the first five grades of elementary school.

The educational influence of teaching is affected by: the curriculum, students' books and additional materials, school's equipment regarding teaching resources and aids. Mathematics teaching in lower elementary school grades consists of methodical unifying of mathematical knowledge, logical thinking and working-technical agency in the process of continuous pedagogical activity.

*Knowledge, thinking and acting* are the three basic activity components in general, and this applies also to organized nurture and teaching generations of students. The realization of mathematics classes in lower elementary school grades depends on adequate resolution of the following methodic questions:

- Psycho-physical characteristics of lower elementary school students,
- Aim and tasks of teaching mathematics,
- Specificities of mathematical education. (Markovac, 1992)

### Psycho-physical characteristics of lower elementary school students

Characteristics of psycho-physical age of students from first to fifth grade of elementary school represent a factor which determines the content, methods and forms, teaching materials etc. in teaching mathematics. Being familiar with and appreciating those characteristics presents the precondition of methodic organization in teaching mathematics.

To that end, three most important characteristics of lower elementary school students are presented.

*Children of this age* react to all forms of influence from immediate surroundings.

This validity applies also to behavior in mathematics classes.

Accordingly, being uninterested in mathematics is not one of psychological characteristics of students. Not reacting in classes is in a certain manner a latent state which should be changed, put into motion and methodically accept in the process of teaching mathematics.

*Children of this age explore, they are very emotional, their psychological development is continuous, they learn best when they are active...*

### Aim and tasks of teaching mathematics

The aim of teaching mathematics is to:

- Capacitate students to master elementary mathematical knowledge necessary for understanding events and laws that govern nature and society;
- Contribute to developing mental abilities, forming a scientific outlook on the world and a comprehensive development of the students' personality;
- Capacitate students to apply mastered mathematical knowledge in solving various practical tasks in life;
- Capacitate students to successfully continue their education in mathematics.

The tasks of teaching mathematics are to enable:

- Students to acquire knowledge necessary to understand quantitative and spatial relations and laws in different instances which occur in nature, society and everyday life;
- Students to acquire basic mathematical culture necessary for revealing the role and application of mathematics in various areas of human activity, as well as for successful continuation of education and inclusion in the work market;
- Development of student's ability to observe, perceive and think in a logical, critical, creative and abstract manner;
- Development of cultural, work, ethical and aesthetical habits in students, as well as mathematical curiosity in observing and studying phenomena.

### Specificities of mathematical education

Education is a fundamental pedagogical and didactical category of teaching, comprised of quantity of facts and information, system of knowledge, skills and habits, and basic capabilities and abilities of a

personality. Dismantled in this manner, educational value bears a distinctive influence on its very realization in the practice of teaching mathematics in lower elementary school. Education in mathematics is manifested by mediate knowledge about the objective world through numbers, their relations and spatial dimension. From this standpoint, the following should be taken into consideration: differentiation between the terms 'science' and 'mathematics teaching', distinguishable specificities of mathematical education and guidance through mathematics teaching.

Mathematics as a school subject, especially today, in the era of dynamic scientific and technical-technological development, as well as overall computerization, bears immense significance and role in pedagogic and educating the young generation, as well as in preparing it for their future life and work. Mathematics teaching presents a major segment in integral general education and a basis for development of a wholesome student's personality, since it significantly contributes to general students' accomplishments (educational, pedagogic and functional). (<http://uciteljtk.com.ba/Npp.pdf>; accessed 07/05/2012)

### Mathematics teaching layout

Teaching layout is an official school document prescribed by the appropriate state organ. Mathematics teaching layout determines the number of mathematics classes for the entire academic year. Within the concept of nine-year elementary education is derived as follows: 1<sup>st</sup> grade has 2 mathematics classes a week, i.e. 68 classes a year; 2<sup>nd</sup> and 3<sup>rd</sup> grades have 3 mathematics classes a week, i.e. 105 classes a year; 4<sup>th</sup> grade has 4 mathematics classes a week, i.e. 140 classes a year; 5<sup>th</sup> grade also has 4 classes a week, i.e. 140 classes a year.

*Framework of mathematics teaching layout for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> grades in nine-year elementary school*

No.	Obligatory school subjects	Number of classes per week					Number of classes per year				
		I	II	III	IV	V	I	II	III	IV	V
1	Bosnian language	3	4	4	4	4	102	140	140	140	140
2	Mathematics	2	3	3	4	4	68	105	140	140	140
3	My environment	2	3	3	3	3	68	105	105	105	105
4	Music	2	2	2	2	2	68	70	70	70	70
5	Art	2	2	2	2	2	68	70	70	70	70
6	Physical education	2	2	2	2	2	68	70	70	70	70
Total		13	16	16	17	17	442	560	560	595	595



## Mathematics teaching curriculum

Curriculum is an official school document which prescribes the subject matter that will be studied within a school subject, that is, which knowledge, skills and habits the students should acquire in each grade. The content of mathematics is given as clearly formulated *program units*, with specified number of classes dedicated to each program unit and with an array of topics which should be divided into subject units for the entire academic year.

In this manner, *teaching units* are formed for methodical organization of mathematics classes. We will indicate the content (subjects and areas) of the curriculum in nine-year elementary school. (Web source: <http://uciteljtk.com.ba>; accessed 07/05/2012)

### PROGRAM UNITS FOR FIRST GRADE OF NINE-YEAR ELEMENTARY SCHOOL EDUCATION (teaching units)

1. Comparing, assessing and measuring the size of objects
2. Objects in the shape of a sphere (ball), cube, cylinder and pyramid
3. Flat and curved facets (surfaces), shapes and lines
4. Sets, numbers, relations and operations

### PROGRAM UNITS FOR SECOND GRADE OF NINE-YEAR ELEMENTARY SCHOOL EDUCATION (teaching units)

1. NUMBERS
  - Summation and detracting in a set of numbers up to 20
  - Set of numbers up to 100
2. GEOMETRY
  - Objects in the shape of a sphere, cube, parallelepiped, cylinder, pyramid and cone
  - Facets (surfaces) and lines
3. MEASURING AND MEASUREMENTS
  - Measuring length, measuring mass, units for measuring liquids, units for measuring time, units for measuring money.

### PROGRAM UNITS FOR THIRD GRADE OF NINE-YEAR ELEMENTARY SCHOOL EDUCATION (teaching units)

1. Summation and detracting up to 100
2. Flat and curved facets (surfaces), shapes and lines

3. Multiplying and dividing up to 100
4. Measuring, comparing and assessing

### PROGRAM UNITS FOR FOURTH GRADE OF NINE-YEAR ELEMENTARY SCHOOL EDUCATION (teaching units)

1. Numbers in the first thousand
2. Straight line in a plane
3. Summation and detracting up to 1000
4. Circle
5. Multiplying and dividing up to 1000
6. Measuring quantities and sizes

### PROGRAM UNITS FOR FIFTH GRADE OF NINE-YEAR ELEMENTARY SCHOOL EDUCATION (teaching units)

1. Numbers in the first million
2. Summation and detracting up to one million
3. Multiplying and dividing up to one million
4. Arithmetic expressions
5. Numbers over one million
6. Set of natural numbers (N) and set  $N^0$
7. Angle
8. Triangle
9. Surface of a rectangle
10. Volume of a parallelepiped (especially cube)

### Material conditions for realization of classes

Basic material conditions are organization of work and provision of class resources, as well as students' out-of-school activities. In the analysis of above-mentioned conditions, it is most commonly claimed that they are very bad, since schools are poorly equipped for class realization. This claim is not true, but it is true that available space and resources in many schools are not organized and equipped for mathematics. Therefore, material status of schools cannot be blamed for insufficiently equipped classrooms with teaching resources for elementary mathematics classes. The responsibility lies on the teacher himself/herself, who, in an inadmissible reduced manner takes their position in the very process. An innovative teacher will animate students to individually make teaching aids and thus create learning and exploring with the very resources they produce and make. For example, by modeling a potato into a parallelepiped, a child will in the best possible way notice the six flat surfaces and six rectangles; to model Roman numerals (numbers) matches can be of assistance.

Matches can be used to model arithmetic expressions when solving mathematical problems, where we combine and constantly change shapes – this is more practical. It is important to accurately create task models from matches, which will make the exercise warmer even though *we will never light the matches*. Still, with all that has been said, spatial conditions in our schools are not amiable for realization of ‘prolonged students’ obligations’ in the school classroom. Therefore, especially in mathematics teaching, we must depend on students’ activities at home. Working areas are the school media library and specialized classes.

These conditions are initial necessities for successful organization of mathematics teaching in lower elementary education. A specialized mathematics classroom is not ‘a laboratory’, but rather a classroom adequately equipped for all subjects in lower elementary education. It also contains implemented instruments for mathematics classes. If methodically well conceptualized, a specialized classroom is suitable for work with a special section of one grade and work with a combined section of multiple grades. Educational role of the specialized classroom is supplemented with the school media library. That room is connected with all classrooms for lower elementary education. It is equipped with all the aids which are used by all the classes of all grades in the school. The term teaching resources and aids refers to a variety of material objects used in learning a particular school subject. In different school subjects and different stages of education, different teaching resources and aids are employed. Even within the same school subject, depending on the age of students, different teaching resources and aids are used. The use of teaching resources and aids depends also on the level and quality of intellectual development of students for whom they are intended. It is also based on the psychological fact that learning is more successful if more components for input of information are included.

Since the beginning of organization of mathematics teaching, there have been efforts to facilitate, rationalize and intensify the process of acquiring knowledge, developing thought process and forming the levels of success necessary for work and life.

The fundamental task of mathematics teaching is development of abstract manner of thinking. However, not one abstraction can appear if there

is no concrete image in the consciousness. For lower elementary mathematical imagery, it is necessary to employ appropriate teaching resources. In order to emphasize the methodical value of teaching resources, we will place accent on their characteristics and classification, due to their function in the process of mathematics teaching. Every teaching resource possesses characteristics of importance for methodical intensification of students’ activity. Teaching resources should primarily be easily explicable and explicative (i.e. simple enough to explain certain mathematical values and relations in nature and society).

For effective use in teaching, resources should be: accurate by function – mathematical information must be scientifically verified; distinct by form – to induce clear mathematical notions; have a pleasant outlook – their appearance should induce aesthetic emotions; and adequate for use – to be easily demonstrated. For the needs of lower elementary mathematics teaching, there are various teaching resources and aids, which are usually divided into natural and artificial ones. Natural ones are those from immediate surroundings or those which are adjusted by slight reshaping to teaching needs.

*Natural teaching resources* are, first and foremost, objects in immediate surroundings (desks, chairs, chalk, etc.), then objects which belong to students (marbles, stickers, drumsticks, different fruits, books, pencils, erasers, etc.). All these objects can in certain situations be used in elementary mathematics teaching.

*Artificial teaching resources* are those that are specially constructed and manufactured for the purpose of learning. This group encompasses, for example, plastic slates (triangles, squares, circles), tokens (of various shapes and colors), models of geometrical figures, different gauges (for measuring length, surface, mass, volume, time), graphic aids (drawings, pictures, numerical pictures), geoplan, colored sticks (colored numbers), various magnetograph applications, logical blocks, abacus, film-strip, element-film, etc. In this group there can also be those teaching resources which bring elements of games into learning, and are mostly used for practicing and revision. Classification of school subjects has a specific methodical value when employed in a concrete mathematical situation.

Innovative resources are, due to dynamic development in technology, widely used, but are methodically insufficiently tested in pedagogical practice. This why they will be grouped into basic and auxiliary resources and their methodical function in the organization of mathematics teaching process will be emphasized. These resources are for the most part arbitrarily interpreted in theory and named in practice. This has a negative effect on their methodical value.

Basic innovative resources are: slides, filmstrips, overhead transparencies and educational software created for mathematics teaching. Average effect of these resources depends on the kind of perception they engage.

For example, audio-resources have an effect of 10-30%, visual ones 30-50%, audio-visual resources 50-70%. The methodical message is clear, there is a need for greater investment in use of audio-visual resources, but it must be noted that this does not apply for mathematics teaching. The most common teaching aids are: blackboard, chalk and numerals. That is one of the reasons why mathematics does not contribute to education as much as it can and should in lower elementary education.

Auxiliary innovative resources are: episcopes, overhead projector, cinema-scope, computer, and other technical devices and appliances for visual projections of tasks, lines, images, shapes and similar pedagogical content for mathematical education of students. Methodical role of these auxiliary resources is far less than that of teaching resources, but is not negligible.

### **Methods of work in introductory mathematics teaching**

The primary feature of methods in introductory mathematics teaching is activity of participants in the teaching process, that is, teacher and students. For mathematics in lower elementary mathematics, the choice falls upon those methods which are best suitable for the nature of the subject matter, students' age and teacher's affinities.

According to this methodical criterion, mathematics teaching is amiable to all variants of verbal-textual and demonstrative-illustrative groups of work methods.

Verbal-textual methods for their cognitive basis have spoken or written word. Word, as a gno-

seological-methodical basis should be appropriate and deliberate according to mathematics subject matter and lower elementary students' ability to understand it. This group of teaching methods consists of: method of verbal presentation, method of conversation and method of text manipulation.

*Method of verbal presentation* is a manner of work in which the teacher (and occasionally students) exposes students to the content of what is being learned. It is based on verbal communication between participants in the work process and is one of the oldest teaching methods. In practice, it is noticed in several forms: *narration, describing, explaining and lecturing*. Considering the nature of mathematical content in introductory mathematics teaching, this method is mostly used in the form of explaining. It serves to explain the content of mathematical concepts, mathematical symbols and terms, procedures for oral and written calculation, processes of solving tasks, manners of rendering geometrical drawings. "*Explaining is communication the aim of which is to capacitate someone for understanding something they did not understand or know.*" It is a procedure through which students become familiar with new subject matter, and its main purpose is understanding, revealing and perceiving conceptual content of mathematical symbols, terms, processes, operations and gaining insight into their meaning.

*Method of conversation* represents mutual effort between students and teacher, which takes place in the form of questions and answers. These are formulated by both students and teachers, in a way that teacher's questions are always directed towards students, while students pose questions also among themselves, student to student.

As opposed to the method of presentation, which is a monologue in character, method of conversation is a dialog, because it is based on conversation between participants.

Conversation, more than presentation, invokes thought activity in students and activates attention. Conversation is suitable for assessing whether students have understood and mastered the subject matter. By posing questions to students, teacher estimates students' knowledge of certain teaching subjects, as well as whether there are, and of what sort, possible blanks in their knowledge.

Method of conversation appears in various forms, of which the most suitable form for the needs of introductory mathematics teaching is the so-called heuristic, discovery-type conversation. By posing questions heuristic in nature, students are lead to perceive that which is equal in a set of examples, and could not be discovered without such an answer. This is why this method is mostly used where the above-mentioned condition exists, primarily in practicing and checking students' homework.

*Method of text manipulation* is a manner of gaining knowledge and developing abilities through work with text. In introductory mathematics teaching, texts used are: student's book, teaching cards, collection of mathematical problems, or any other suitable texts with mathematical content. Text manipulation is a universal procedure of acquiring information, and therefore it should be nurtured even in introductory mathematics teaching. Working with a text with mathematical content may vary: acquiring numerical data, introducing descriptions of performing calculating operations or geometrical drawings, introducing subject content, generalization of rules, definitions, solving different calculus problems found in the text, etc.

Though the use of text, a habit is created to use books, that is, text as a source of knowledge, an understanding about the function of textbook is formed, as well as consciousness about the fact that one can find out what they do not know from a book. Apart from students, teacher also commonly uses texts with mathematical content while preparing for class, processing new subject matter, practicing and revising. While preparing for class, the textbook enables appropriate dimensioning of teaching unit content, establishing connection with previous and following studying and familiarizing with concepts and formulations that students should master.

Demonstrative-illustrative methods have the exemplar as cognitive basis. Exemplar as gnosological-methodical fundament may be an object, phenomenon, condition, picture, projection, symbol, pattern, etc. if suitable for cognition of mathematical values. All exemplars are used in the form of demonstration and illustration.

*Method of demonstration* is a manner of teaching which is conducted through pointing out (showing) and observing. It includes two aspects:

pointing out (mostly activity of the teacher) and observing (activity of students).

This method is used in all those situations when various objects, activities, processes etc. are being introduced. In introductory mathematics teaching, different teaching resources are demonstrated, such as didactic materials (plastic slates, sticks, rocks etc.), models of geometrical figures (cube, ball, cylinder), different gauges for measuring length (wood one meter high), surface (square meter of paper), volume (liter), mass (scale), time (hour). Also demonstrated are different graphic presentations (pictures, graphs, diagrams), applications on magnetograph or flannel-graph, element-film, filmstrip. Demonstrated resources serve as aid in mastering mathematical content.

*Illustration* presents clearly analyzing certain matter in order to understand a particular mathematical dimension. It can be verbal, with the help of adequate mathematical expressions, or illustrative, with the help of adequate symbols, outlines, schemata, projections and other visual expressions in teaching mathematics and geometry. Through assimilation of illustrative and verbal expressions, the students' thought process is intensified.

### **Evaluating students' success in introductory mathematics teaching**

Evaluating students' success is methodical preparation for grading them in methodology. This obligation cannot be performed during special classes since it involves extraordinary psychological and physical effort and sensitivity of lower elementary students. Grading students in mathematics is performed continuously within teaching, affirming and revision of mathematics subject matter.

This type of realization of educational process is a very complex and delicate teacher's obligation, for there is the question of various pedagogical content and sensitive ages of lower elementary students.

In order to achieve success in this sense, the teacher must take into account principles of grading (publicity, continuity, versatility); *components of grading* (knowledge, thought process, working-technical activity) and *types of grading* (combination of subjective and objective evaluation).



*Basic principles* of evaluating and testing are: publicity, continuity and versatility. *Public evaluation* is in accordance with principles of democracy in society. Therefore, the grade should be publicly announced, provide explanation and docket. Students should realize that every activity in teaching is evaluated and graded. *Versatile evaluation* is grading of knowledge, thought process and working-technical activity, as well as considering interest, investment, ability and working conditions of the student.

*Basic components* of evaluating and grading are knowledge, thought process and working-technical activity, and additional components are level of interest, investment, ability and working conditions of the student. According to the basic components, a grade is given, while methodical correction of the grade is performed according to additional components. *Knowledge* is evaluated according to volume, richness and factual characteristics. *Thought process* is evaluated in accordance with prominent abilities for describing, comparing, selection, deduction, systematization and data generalization.

*Working-technical activity* is assessed through bespoken elements of accurate perception, skillful handling of pre-concerted combination of materials and equipment.

*Basic types* of testing and evaluating are subjective and objective. Subjective evaluation depends for the most part on the teacher's impressions. Objective evaluation depends on the value of tasks of objective type.

### **Role and significance of homework in introductory mathematics teaching**

Students' homework presents a part of class-work. They stem from teaching and class-work itself and re-engage within it again in various moments of the teaching process, in different forms.

Students' homework has a multiple role. First and foremost, it represents individual work, individualize students in the process of gaining knowledge, as well as provide necessary preparation for life; homework serves to fortify knowledge and rehearse habits, and then the acquired knowledge is applied. Homework presents preparation for upcoming work at school; it also has a special pedagogic assignment, which consists of developing in students a feeling and responsibility for the tasks

that are put before them, diligence, organization skills, etc.

One of the most important characteristics which should be developed in students is the feeling for obligations: for example, a first-grade student experiences difficulties while doing homework, but does not seek help, which means that he/she is assertive in work because he/she knows that he/she cannot come to class in front of the teacher without the homework.

Homework is an amenable form of work because it helps building a personal style of work. Every student is an individual and it is not advisable to obtrude him/her with a uniformed manner of work. The opportunity to influence nourishing an aesthetical relation toward work should not be neglected, since a person's taste is measured by beauty.

It is necessary to capacitate students for homework, which is an activity that takes place as early as in the first grade. Capacitating students for individual work is conducted during regular classes while they are directly supervised by the teacher. As the student works individually, he/she becomes more independent in work, and, as homework is at the same time individual work, the teacher should constantly insist on the students' individuality.

Homework may have different aims: to rehearse and solidify acquired knowledge, skills and habits, to systematize and generalize knowledge, skills and habits, to prepare students for work in the following class, and all this has its root in classes. They can have various contents. They may encompass solving numerical problems, which has a goal to exercise procedures of an arithmetic operation, numeric technique, solving tasks verbally, where students apply their calculus knowledge, knowledge of mathematical operations, they practice drawing conclusions, etc.

Homework may be *individual* and *group* work. If one group of students performs a task which is a part of a joint problem, then we are talking about group homework, which contributes to educating students about collectivism, as well as forming a feeling of responsibility for completing the task. While assigning homework, the teacher must take into account the volume and *difficulty of tasks*. If tasks are too difficult, students lose belief in their abilities and instantly seek help from their family members, which takes away the basic significance of homework.

Homework should also not be too easy and not cause mental effort and endeavor to overcome difficulties. Students perform these kinds of tasks effortlessly, mechanically and disinterested. It is of great importance to be familiar with abilities of one's students, their work pace, home situation, etc. Sometimes it is necessary to make homework differentiated, either according to shortcomings of certain groups or to abilities of individuals.

It is necessary to carefully delimitate the volume of homework. In an experiment, as claimed by Selmir Gorušanin, conducted with third-grade lower elementary students, they were given homework of different volume: a) one-two tasks; b) about five tasks; c) no homework. Upon analysis it was established that students who were assigned five tasks for homework, and this kind of homework is considered voluminous, achieved overall results similar to those of students who never had homework. The best results were noticed with students who had one-two tasks or small-scale homework.

This leads to show that it is better to give small-scale homework, while apart from those one-two tasks it may be recommended that students on a facultative basis perform more tasks. The same author claims that small-scale homework has many advantages, such as: higher possibility of individual completion, ability to complete other obligations etc. (Gorušanin, 1979, p. 31) In elementary school, this is easier to achieve in lower grades. Great homework volume shortens the students' spare time. This means that the teacher must pay attention to the students' free time, relaxation and fun.

In normal conditions in Bosnia and Herzegovina, and according to recent results, it is recommended that duration of doing homework does not surpass:

in the I and II grade  $\frac{1}{2}$  to 1 hour, and  
in the III, IV and V grade 1  $\frac{1}{2}$  hour.

This does not necessarily apply for every student; some students will require exactly this amount of time, others less, and some of them more. This is why it is important to consider the class average, even particular students. The extent of homework will depend on how much the teacher knows their class and they will accordingly assign homework, while certain details about students can be found out through parents.

Nowadays, the homework system places so

much burden on students, that it exceeds all allowed limits. Piling up homework verbally and in writing basically means transferring classroom work from school to home, thus doubling or tripling students' working time. Teachers are often forced to do this due to objective difficulties (reduced working hours, several schools in the same building, a great number of students, etc.). A question is posed: which measures should be taken in this situation? Is there a possibility to come up with a solution which would unburden students while not damaging their general education?

There are possibilities which consist of the following:

- a) reduce homework in difficulty as well as in the number of tasks, i.e. duration for completing them;
- b) systematic, but planned homework assignment.

### **Assessing homework and the role of parents in its realization**

Scanning children's homework by parents has many positive sides. A written grade provides great pleasure for the student. It is simultaneously a reward for effort. A child will happily go home with a decision to do the following homework even better. Regularly giving grades to children also affects parents, since it serves as an incentive for them to proof-read the child's homework, and releases them from possible house duties.

Homework with an excellent grade is praised by parents, which gives children even more motivation to pay more attention to homework. Students who have not completed their homework a date is written with a note that homework was not done, and below an insufficient grade. This distresses student's consciousness about responsibility and the parent will also react to irresponsibility.

This grade includes the outlook of the task, alongside with other elements. A weak grade will compel the student to do their homework next time.

If the case occurs where a group of errors is found in homework, additional work is necessary, since this is an obvious sign that students did not understand the presentation of the subject matter or teacher's instructions.

The teacher must constantly follow the progress of each student, offer help if it is necessary and encourage students to perform homework tasks as accurately as possible. While evaluating homework it can be noticed that tasks are done for students at home by their older siblings, or even parents.

### **Negative attitude toward homework**

The quality of students' knowledge largely depends on proper organization of their homework, accurate methodical procedures while assigning and employing them. The causes of formalism in students' knowledge can be traced to inaccurate methodical procedures in the area of homework. Some of the major causes will be indicated.

Firstly, it should be mentioned that there are cases where teachers underestimate this form of work, thus employing it too little or even not at all. Formation of such attitude in teachers was influenced by teachings of certain representatives of activity-school, who negated the value of homework for students, denied students' ability for individual work, while forbidding homework for the sake of health protection, freedom and rights of children. In this sense, Ellen Key posed a very determinate attitude. Hugo Gaudig fights for free spiritual work in school environment, but is very critical regarding students' homework. It is interesting that such an extremist course regarding emphasis on individual work and students' individuality in general, such as Dalton-plan, negates the value of homework. On the other hand, some limit homework, as well as classes, to voluntary students' work, where there is no assignment-giving or forcing students to perform them. ([http://www.google.ba/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0C CQQFjAB&url=http%3A%2F%2Fwww.zwrx.pondi.hr%2FDidaktika%2FDidaktika%2520-%2520Dragec.doc&ei=kXw3UP\\_wEvPN-4QSIwYGIDQ&usg=AFQjCNHUEF7xVjdxqvvETwCXB5Xt4SQ74A&sig2=x0wLlw85igzi0CF77DTIzw](http://www.google.ba/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0C CQQFjAB&url=http%3A%2F%2Fwww.zwrx.pondi.hr%2FDidaktika%2FDidaktika%2520-%2520Dragec.doc&ei=kXw3UP_wEvPN-4QSIwYGIDQ&usg=AFQjCNHUEF7xVjdxqvvETwCXB5Xt4SQ74A&sig2=x0wLlw85igzi0CF77DTIzw))

It is obvious that such an improper and negative attitude of teachers toward homework reflects as a lower knowledge quantum in students, weaker quality of knowledge (i.e. knowledge is not permanent and within formalism of students' knowledge). Not employing homework in teaching means renouncing great opportunities for knowl-

edge solidification, rehearsing skills and habits, and very importantly, renouncing the possibility for students to individually apply their knowledge, connect theory and practice and conduct certain practical work. All these actions impede the appearance of formalism in students' knowledge. When there is no homework as part of teaching, students rarely have the opportunity to apply acquired knowledge through conscious activity while solving various problems, to individually observe objects and phenomena, to conduct practical work and experiments, to make different objects and teaching aids, to express acquired knowledge in a variety of ways.

Negative attitude toward students' homework cannot be justified by the fact that conscious activity of students should be expressed throughout the entire teaching process, not only through homework. The point is not to transfer students' conscious activity onto the area of homework, but rather to expand it from classes to homework. To remove homework from the teaching process would mean to mutilate teaching, to consciously denounce one form of students' work, a form of work which cannot be completely replaced by anything, while it can, if properly organized, greatly inhibit formalism in students' knowledge. The cause of formalism in students' knowledge can also be found in the fact that certain teachers do not employ homework as activity, or they do, but insufficiently. The second group of causes encompasses teacher's inaccurate activities involving students' homework, which is the result of incorrect understanding of tasks/problems and didactic possibilities of homework.

## **METHODOLOGICAL APPROACH**

### **Previous research**

Through analyzing pedagogical literature, it can be noticed that homework was a current theoretical and practical problem in lower elementary teaching. Its core, place, significance and role in teaching, pedagogy and education in general were emphasized. The specificities of students' work regarding homework, its content and types were elaborated upon. Upsides and downsides were analyzed, norms were determined for doing homework through different ages in elementary school, the manners of giving and controlling homework were written about.

Theoretically, it was claimed that the upsides of this teaching activity are: individuality in work, advancing according to individual pace, capacitating students for individual work, but also there were downsides: burdening students with homework, incapacity for individual work, difficulties in everyday control, etc. In practice, there were situations where students spend the same amount of time doing homework, as they spend in classes.

### **Subject and problem of research**

If the starting point is to be the subject of research, it is necessary to provide the definition of the very notion of 'homework', which implies completing work obligations that students have toward school and family, and is done at home.

One portion of homework refers to completing tasks at home.

Dr. Filipović emphasizes in his 'Didaktika' ('Didactics') (1980) that homework should include from 30 minutes for first grade to 2 hours in high school.

Educative workers often wander in the field of assigning homework, which is commonly formalistic and unchecked, without personal engagement in reviewing and marking homework.

For this reason, there are cases in higher elementary classes where students are burdened with homework more than in previous grades because of teacher's pure 'selfish' reasons, who emphasize that their subject is important. They assign homework in their school subject regardless of others. A teacher must take into account students' free time, relaxation and entertainment. Also, while assigning homework, teacher should pay attention to home environment of children.

### **Aim of research**

The aim of this research is to ascertain and analyze the level of students' exertion with homework. The research will establish the level of connection between students' exertion with homework and their motivation to learn the subject matter, as well as students' optimal exertion with homework.

### **Research problems (tasks)**

Requirements of every research demand setting certain tasks through the work, in order to avoid divagation and to render every piece of work, bounded by certain problems, valuable precisely

within the frame of those problems and demands set before them.

Bearing this in mind, the following problems have been the starting point of this research:

1. To determine the level of connection between temporal exertion of students with homework within a week and students' exertion with homework prescribed by pedagogical norms.
2. To determine the level of participation of parents in helping students complete homework.
3. To determine the level of connection between differentiation of homework and students' motivation to do homework.

### **Basic hypothesis**

In initial mathematics teaching, homework has a significant role in the process of learning and teaching mathematics.

### **Sub-hypotheses**

- H1: Teachers regularly assign homework.  
 H2: There are significant differences in the volume of homework.  
 H3: Teachers have different attitudes toward homework.  
 H4: There are differences in evaluating homework.

### **Research methods**

In this research, the method of theoretical analysis and the descriptive method were used in order to gain data necessary for solving this problem.

The method of theoretical analysis employs mostly deduction as logical-methodological procedure in pedagogical research. The basis for its application represent already ascertained pedagogical and other cognitions, expressed generally (notions, legitimacies, theories, etc.) gained through the use of other research methods and procedures. The importance of its application lie in its ability to perceive complex aspects of pedagogic realities, deduce significant characteristics and interrelations, as well as legitimacies of development of pedagogical phenomena. Sources for this method include pedagogical literature, as well as text-books in this field of expertise, research related to general social attitudes regarding pedagogy and education, and an existing corpus of scientific knowledge gained through empirical, but also theoretical scientific procedures.



This method is important while formulating research hypotheses, but it also bears significance while interpreting research results.

The descriptive method enabled gathering, editing and comparing data gathered during research. The core of descriptive method in pedagogical research consists of describing pedagogical phenomena. Their description familiarizes the researcher with them. Only through familiarization with characteristics of a phenomenon is possible to approach examination of causes and connections between phenomena. (Bandur & Potkonjak, 2002)

### Techniques and instruments of research

Research techniques enable organized, systematic and planned arrival to the set aim. In the framework of research technique there are appropriate tools, i.e. instruments of research, whose purpose is identification, gathering and measuring scientifically based facts. (Bandur & Potkonjak, 2002)

During realization of this research, techniques of *survey* and *content analysis* were used. When it comes to instruments, individual *questionnaires* (survey papers) for teachers and students and *interviews* for parents were used.

Possible answers were a, b and c.

Answers	a	b	c
Number of answers	11	2	1
percentually	78%	15%	7%

This means that, according to answers to the question above, 78% of examinees give homework after every class, 15% after presentation class, and 7% of examinees assign homework sometimes.

This confirms the first sub-hypothesis: teachers regularly assign homework.

### Sample and statistical data

The research was conducted in May 2012 in Elementary school 'Travnik'. The survey was conducted on a sample of 14 teachers and 219 students (II grade – 65 students, III grade – 82 students and IV grade – 72 students), while 105 parents were interviewed via method of random choice.

The student sample used for research is a simple random sample. The basic characteristic of a simple, random sample is equal possibility that all students will be satisfied with the homework the teacher assigns to them.

### RESEARCH RESULTS

Teachers were posed closed-type questions. Research results were systematized and presented tabular. The questions are provided systematically, as well as possible answers and answers to posed questions, followed by tabular presentation (numeric and percentual).

- The first question for teachers was:
  - When do you assign homework?
    - a) after every class
    - b) after presentation class
    - c) sometimes

The second question for teachers was:

- How many tasks do you assign for homework?
  - a) 5 -7 tasks
  - b) 3 – 5 simple tasks
  - c) up to 3 more complex tasks

Possible answers were a, b and c.

Answers	a	b	c
Number of answers	2	7	5
percentually	15%	50%	35%

This means that 15% of examinees assigns 5 – 7 tasks, 50% give 3 – 5 simple tasks and 35% of examinees assigns up to 3 more complex tasks. The second sub-hypothesis is also confirmed: there are significant differences in the volume of homework.

The third question for teachers was:

- When do you review homework?
  - a) cursory, at the beginning of every class
  - b) at the beginning of every class I only note if homework was done
  - c) occasionally in detail at home
  - d) every day cursory, sometimes detailed.

Possible answers were a, b and c.

Answers	a	b	c	d
Number of answers				
percentually	5	0	5	4
	36%	0%	36%	28%

This means that 36% of examinees review homework cursory and 36% occasionally in detail at home, while 28% presents combination of both answers.

The third sub-hypothesis is confirmed as well: teachers have different relations toward homework.

The fourth question for teachers was:

- I evaluate homework
  - a) qualitatively
  - b) quantitatively
  - c) both qualitatively and quantitatively

Possible answers were a, b and c.

Answers	a	b	c
Number of answers	1	0	13
percentually	7%	0%	93%

This means that 7% of examinees evaluate homework qualitatively, and 93% both qualitatively and quantitatively.

The fourth sub-hypothesis is confirmed: *there are different evaluation styles of homework.*

#### Analysis of results of students' questionnaire

The questionnaire was assembled in order to collectively examine students' interest for homework.

Answers to questions are represented tabular, individually by grades, and finally summarized.

This examination instrument will serve to ascertain the students' affinity through certain interest in homework, the way they fulfill obligations toward work, or simply, what is their relation toward homework.

Questions from students' questionnaire:

1) Does it take you a long time to do homework?

2) Does anybody help you to do homework?

3) Are there tasks especially given to excellent students?

4) Are there tasks especially given to weaker students?

5) Do you have homework for more than two subjects a day?

6) How many minutes do you spend on doing mathematics homework?

a) up to 15 minutes; b) 15 – 30 minutes; c) over 30 minutes

Possible answers to the first five questions are yes or no, and in the sixth question a, b or c.

II grade, total of 65 students

Question No.	YES	%	NO	%
1.	34	52	31	48
2.	47	72	18	28
3.	6	9	59	91
4.	8	12	57	88
5.	22	34	43	66

III grade, total of 82 students

Question No.	YES	%	NO	%
1.	41	50	41	50
2.	35	43	47	57
3.	15	18	67	82
4.	55	67	27	33
5.	65	79	17	21

IV grade, total of 72 students

Question No.	YES	%	NO	%
1.	45	62	27	38
2.	12	16	60	84
3.	32	44	40	56
4.	52	72	20	78
5.	64	88	8	12

The sum total of positive and negative answers from 219 surveyed students:

Question No.	YES	%	NO	%
1.	120	55	99	45
2.	94	43	125	57
3.	53	24	166	76
4.	115	53	104	47
5.	151	69	68	31

Answers to the sixth question:

Grade	II		III		IV	
No. of students and percentage	65	%	82	%	72	%
a) up to 15 minutes	19	29	34	41	25	35
b) 15 – 30 minutes	34	52	37	45	17	24
c) over 30 minutes	12	19	11	14	30	41

This table makes it obvious that out of 219 surveyed students, 78 or 36% of them spends up to 15 minutes doing homework; 88 or 40% of students spends 15 – 30 minutes; while 55 or 24% spend over 30 minutes doing homework. Thus, the conclusion follows that students do not spend a lot of free time completing mathematics homework, even though more than half of them claim that they invest a lot of time doing homework.

When comparing gathered results according to grades, it is visible that answers to some questions digress depending on the grade, while some are very similar. It can be concluded that lower-grade students ask more help while doing homework, they have less than two types of homework a day, and that teacher's demands increase when compared to higher grades.

The questionnaire also shows that students are mostly assigned the same tasks for homework, while in higher grades there is increased care about weaker students.

This survey cannot provide accurate status in schools and precise description of dealing with homework, since this varies from teacher to teacher, but it is interesting to present and compare the answers of interviewed parents.

The questions were answered by 105 parents, with the following results:

1. Do you believe that your child is overburdened with homework?

Answers: *yes* by 32 or 30% of parents, *no* by 73 or 70% of parents.

2. Do you help your child with homework?

Answers: *yes* by 53 or 50% of parents, *no* by 28 or 27%, *sometimes* 14 or 13% of parents.

3. Should a pedagogical norm be set, by which the time for doing homework would be determined?

Answers: *yes* by 21 or 20% of parents, *no* by 84 or 80% of parents.

All this data shows that parents want more for their children, while children (students) want less.

## CONCLUSION

Based on research and upon analysis of acquired data, the following conclusions can be drawn:

- Students' homework still has an extremely significant place in learning in introductory mathematics teaching;
- There are certain differences in the volume, quality, structure of homework in introductory mathematics teaching;

- With teachers, there is still a presence of reduced, narrow-minded outlook on homework, so some teachers believe that homework is or is not necessary;
- There are differences in evaluating homework;
- Parents who believe that homework should be given, that it is good and useful for their children ascribe great value to homework.

Demand against long-lasting, exhausting homework is difficult to elaborate upon, until the real state of affairs in practice is examined. This problem exists, but many do not wish to admit it.

A lot is needed, more is given, and too much is asked. Homework, in the sense which defines it, with precisely pedagogically defined tasks and reasonable and optimal time for work – YES.

Homework which exhaust the child, degrades, psychologically burdens, places time limitations – NO. That form of homework should not exist, and the sooner it is rooted out, the better. Having in mind the significance, methodic and educational aims that should be fulfilled through homework, as well as certain portrayed elements here, which significantly influenced the present

fairly weak quality of students' homework, the obligation of teachers and parents as well would be to put in more effort and take measures in order to amplify responsibility of all students toward their duties.

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## RELATION OF DEAF PERSONS TOWARDS BILINGUALISM AS COMMUNICATION MODE

Naim Salkić<sup>1</sup>

*Original scientific paper*

*Centre for hearing and speaking rehabilitation Sarajevo*

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### ABSTRACT

*Bilingualism of a deaf child implies concurrent cognition and usage of sign language, as community language and oral-voice language as language of greater community in which deaf persons live. Today, most authors consider that deaf persons should know both of these languages and that deaf persons need to be educated in both languages, because of their general communication and complete psycho-social development. Through research on sample of 80 deaf examinees, we affirmed the kind of relation that deaf persons have towards bilingualism, bilingual way of education and communication. The research results have shown that bilingualism and bilingual way of education and communication is acceptable to deaf persons and that there is no statistically significant difference between the sub-samples of examinees.*

**Keywords:** *bilingualism, sign language, oral-voice speech and language*

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### INTRODUCTION

Bilingualism of hearing persons implies cognition of two languages which have speech and writing form (Kangas, 1991). Bilingualism of a deaf child implies cognition of sign language, as community language of deaf persons and oral-voice language as language of greater community in which deaf persons live (Grosjean, 1997). Bilingual communication of deaf persons represents concurrent cognition and usage of two communication systems, oral-voice speech and language and sign language. Oral-voice speech and language represents the standard way of communication among persons. Sign language is the first and natural language of deaf persons (Grosjean, 1997, Bradarić-Jončić 2000). Since deaf per-

sons live in hearing world and since they have the need to communicate with hearing persons, they are forced to learn the language of hearing persons and to communicate in this language. It is doubtless that deaf persons should learn the language of hearing persons and use it, but it is also at the same time doubtless that deaf persons should use their standard way of communication, sign language (Kurtagić, Hasanbegović, 2004). Deaf persons, due to hearing loss, are not able to spontaneously learn oral-voice speech and language, but they are forced to learn it systematically, through special methods and procedures, during their educational-rehabilitation process (Hasanbegović, Salkić, Mahmutović 2009).

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#### <sup>1</sup>Correspondence to:

Naim Salkić, Centre for hearing and speaking rehabilitation Sarajevo  
Sarajevo, Bosnia and Herzegovina  
Phone: +387 61 193 291  
E-mail: salkicnaim@yahoo.com

Even besides system learning of oral-voice speech and language, which is necessary for them due to their communication interactions with the hearing environment in which they live, deaf persons still actualize their communication within population through sign language. In that way, they marginalize oral-voice language, which complicates the final aim of education and rehabilitation (Hasanbegović, Salkić, Mahmutović 2009). The level of adoption of the one, the other or both languages varies from case to case. In final, some children will be more skilled in communication through sign language, other in communication through oral-voice language, and some will be bilingual and communicate through both, sign and oral-voice speech and language. Today, most authors consider that deaf persons should know both languages and that deaf person should be educated in both languages, because of their general communication and complete psycho-social development. What is the relation of deaf persons towards bilingual way of communication as communication system which includes sign language as their first and natural language and oral-voice speech and language as the language of hearing community in which deaf persons live?

**Research aim:** Examine the relation of deaf persons towards bilingual communication system and bilingual way of communication and determine whether there is a statistically significant difference between the two sub-samples of examinees.

In accordance with the set aim, it was assumed that deaf examinees have positive relation towards bilingual communication system and bilingual way of communication, and that the two sub-samples of examinees are statistically significantly different in relation towards bilingualism and bilingual way of communication.

## METHODS OF WORK

### Sample of examinees

The research is done on sample of 80 examinees, which are, for the needs of affirming of importance of differences in relation towards

bilingualism and bilingual way of communication, divided into two sub-samples. First sub-sample was composed of deaf examinees who have, during their educational rehabilitation procedure and in their education and rehabilitation, been using oral-voice method as dominant method of adoption of knowledge, and partly sign method (N=40). Second sub-sample was composed of examinees who have, as per the same, oral-voice method of education and rehabilitation, finished that process and who live and work in the environment of the hearing, and who, as means of communication, use language as per their personal choice, sign, oral-voice or concurrently both (N=40).

### Measuring instrument

For the needs of the research, a measuring instrument is formed (questionnaire) which consists of 6 variables which define the relation of deaf examinees towards bilingualism and bilingual education and communication. The measuring of results was done as per Likert's type of scale, composed of three categories of answers (YES, YES/NO and NO).

### Sample of variables

1. I like to know and use the language of the hearing and the deaf.
2. I am glad when the hearing people speak in gestures, it eases the learning of the language of the hearing.
3. I often talk to the deaf and hearing people.
4. I talk more to the deaf than to the hearing persons.
5. I prefer to talk to deaf persons to the hearing ones.
6. I do not like to speak to hearing people at all.

### Methods of data processing

For data analysis, a method of descriptive and discrimination analysis is used. The basic statistical parameters, frequencies and percentages are calculated and it is affirmed whether statistically significant difference between the two sub-samples of examinees exists. Collected data is processed in statistical package SPSS 12.0 for Windows.

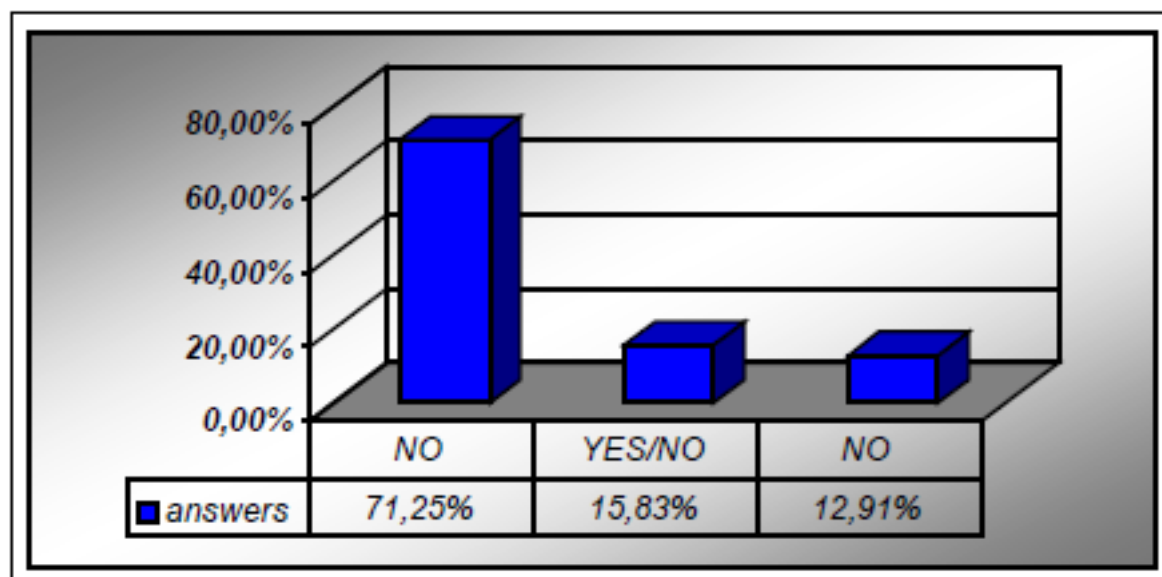
## RESULTS AND DISCUSSION

From table 1, it can be concluded that affirmative answers range from 47,50 % to 90 %, neutral from 1,25 % to 30 %, and negative from 2,50 %, to 30 %. From the content of variable 1, we can see that 72,50 % of deaf examinees likes to know and uses both, oral-voice and sign language, which takes us into conclusion that most deaf persons accept and have positive attitude towards bilingualism, bilingual education and communication and that it eases for them to learn oral-voice speech and language. This conclusion is confirmed by the answers of examinees on variable 2, from which we can conclude that 88,75 % of examinees are affirmatively related to assertion that they are glad that hearing people speak through gestures and that it makes it easier for them to learn the language of the hearing people and eases communication. The answers of examinees in variable 3 show that 51,25 % of examinees often talk to both, deaf and hearing people, which takes us into conclusion that

deaf persons, during their daily activities, use both languages and that they have positive relation towards bilingualism and bilingual way of communication. From the content of variable 4, it is noticeable that 90 % of examinees talk more to the deaf than to the hearing people, and 77,50 % of examinees prefer to talk to the deaf than to the hearing people which is shown by variable 5, which we expected, since there is a better cognition of sign language in relation to oral-voice, and resorting of deaf persons to sign language as their natural and, for them, easier language. Variable 6, however, shows that most examinees of 52,50 % is either neutral or denies assertion that they do not like to talk to the hearing people at all. On basis of analysis of frequencies and percentages of answers of deaf examinees on set assertions, it can be concluded that deaf examinees accept bilingualism and bilingual way of communication, and that they consider that bilingualism is making it easier for them to learn oral-voice language and communicate with the hearing people.

*Table 1 Distribution of frequencies and percentages of answers of the total sample of examinees as per particular variables*

VARIABLES	YES		YES/NO		NO		Total
	f	%	f	%	f	%	
1.	58	72,50	17	21,25	5	6,25	80
2.	71	88,75	7	8,75	2	2,50	80
3.	41	51,25	24	30,00	15	18,75	80
4.	72	90,00	1	1,25	7	8,75	80
5.	62	77,50	9	11,25	9	11,25	80
6.	38	47,50	18	22,50	24	30,00	80
<b>TOTAL</b>	<b>342</b>	<b>71,25 %</b>	<b>76</b>	<b>15,83 %</b>	<b>62</b>	<b>12,91%</b>	



Graph 1. Distribution of percentages of the answers of the total sample of deaf examinees as per all variables

Graph 1 shows that the largest percentage of examinees, 71,25 % of them, related positively to bilingualism and bilingual way of communication and that they do not have anything against cognition and appliance of oral-voice and sign language and that they consider that bilingualism and bilingual education is helping them to learn oral-voice speech and language and by that makes it easier for them to communicate and socially integrate. Neutral answers amount to 15,83 %, and 12,91 % of examinees replied negatively.

#### Analysis of frequencies and percentages of the two sub-samples of examinees

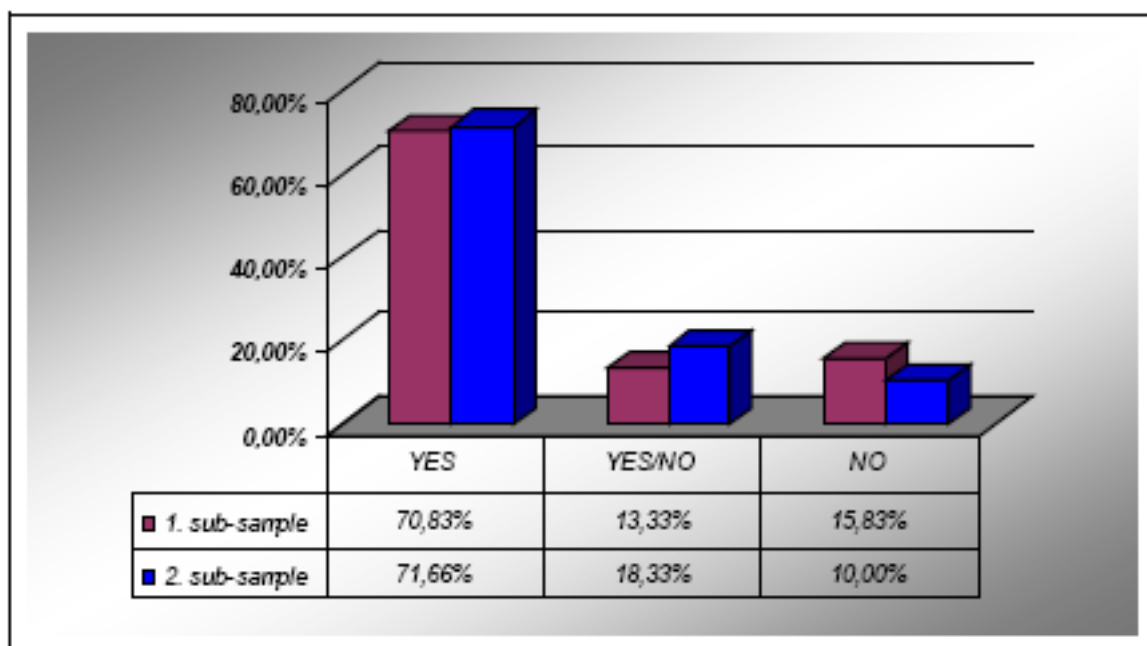
Comparative analysis of frequencies and percentages of answers of the two sub-samples of deaf examinees (Table 2), shows that both sub-samples have, in large percentage, a positive relation to set assertions from the content of variables, and it can globally be

concluded that bilingualism and bilingual way of education and communication is absolutely acceptable as for the population of deaf persons who are in the educational-rehabilitation process and who are daily exposed to oral-voice education and communication, and partly sign one, so for the grown-up deaf persons who have completed this process and who live and work in the environment of the hearing persons. Also, from the frequencies and percentages of the answers of the one and other group of examinees we can conclude that there are certain differences in answers on set assertions. Those differences are most probably the result of the influence of oral-voice method as the dominant method in the process of regular educational rehabilitation activities with the first group of examinees, and free choice of learning and using of the one, the other or both languages with grown-up deaf persons who have finished their education and who, as per their own choice, use one, the other or both modes of communication.

Table 2 Comparison of distribution of frequencies and percentages of answers of the sub-sample of examinees as per particular variables

VARIABLES	YES				YES/NO				NO			
	I f	II f	I %	II %	I f	II f	I %	II %	I f	II f	I %	II %
1.	25	33	62,50	82,50	10	7	25,00	17,50	5	0	12,50	0,00
2.	38	33	95,00	82,50	0	7	0,00	17,50	2	0	5,00	0,00
3.	18	23	45,00	57,50	15	9	37,50	22,50	7	8	17,50	20,00
4.	35	37	87,50	92,50	0	1	0,00	2,50	5	2	12,50	5,00
5.	33	29	82,50	72,50	1	8	2,50	20,00	6	3	15,00	7,50
6.	21	17	52,50	42,50	6	12	15,00	30,00	13	11	32,50	27,50
<b>TOTAL</b>	<b>170</b>	<b>172</b>	<b>70,83%</b>	<b>71,66%</b>	<b>32</b>	<b>44</b>	<b>13,33%</b>	<b>18,33%</b>	<b>38</b>	<b>24</b>	<b>15,83%</b>	<b>10%</b>





Graph 2 Comparison of distribution of percentage of answers of the two sub-samples of deaf examinees as per all variables

Graph 2 shows comparison of distribution of answers of the two sub-samples of deaf examinees towards bilingualism as way of education and communication. Largest percentage of examinees of the first sub-sample, 70,83 % of them, and 71,66 % of examinees of the second sub-sample related positively towards bilingualism and bilingual way of education and communication, and therefore we can conclude that bilingualism and bilingual education and communication is absolutely acceptable for both groups of examinees.

### Discrimination analysis

Through discrimination analysis we tried to determine whether there is a statistically significant difference between the two sub-samples of examinees in relation towards bilingualism and

bilingual way of education and communication. Statistical importance of differences between the sub-samples of unique sample of deaf examinees is determined on level of 0,01. On basis of strength of discrimination, standard deviation of examined groups, the  $\chi^2$  test, freedom level and statistical importance level of 0,01, it is ascertained that the two sub-samples of examinees are not statistically significantly different. Since, in descriptive analysis, certain differences in frequencies and percentages of answers of examinees are noticeable, and by discrimination analysis it is ascertained that they are not statistically significantly important on level of importance of 0,01, in further analysis we identified which variables are the ones that mostly, and on what level of importance, are discriminating the two sub-samples of examinees.

Table 3 Statistical importance of variability of inter-group means with Lambda, F test of importance and Canonical coefficient discrimination functions

Variables	L	F	Coeff. discrim. function	P
1	0,96	3,31	-0,39	0,07
2	<b>0,93</b>	<b>5,62</b>	<b>0,73</b>	<b>0,02</b>
3	0,97	1,97	-0,24	0,16
4	0,99	0,90	0,52	0,75
5	0,96	3,43	0,33	0,07
6	0,97	1,96	0,05	0,16

Table 3 shows that variable number 2 is discriminating two sub-samples of examinees on level of statistical importance of 0,05, which we can correlate with certain differences in frequencies and percentages of answers of examinees. Other variables do not statistically significantly differ the two sub-samples even on level of statistical importance of 0,05.

On basis of descriptive analysis of frequencies and percentages of replies of deaf examinees, assumption, that deaf examinees have positive relation towards bilingualism, bilingual education and communication, we can with certainty confirm, because 71,25 % of examinees has affirmatively related towards set assertions of measuring instrument. Assumption, that these two sub-samples of examinees are statistically significantly different in relation to bilingualism, bilingual education and communication, we can with certainty reject, because discrimination analysis proved that there is no statistically significant difference on level of importance of 0,01.

## CONCLUSIONS

Bilingualism, bilingual way of education and communication are acceptable to deaf persons, because most examinees replied that they accept this way of education and communication and that it makes it easier for them to learn firstly oral-voice speech and language and by that also general communication and learning. Cognition and usage of gesture speech and sign language by hearing persons, and especially by teaching staff eases the learning of oral-voice speech and language for deaf persons. Positive relation towards bilingualism, bilingual education and communication of deaf person confirms, through that assertion, that most of deaf examinees talks daily to

both, deaf and hearing people, but however, they state that they talk more with the deaf. Two sub-samples of examinees are not statistically significantly different, which means that, bilingualism and bilingual way of education and communication is acceptable even for population of deaf persons of school age and for population of adult deaf persons. We are of the opinion, that research must continue in this field so as to ease education and communication of the deaf.

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## GENETICALLY MODIFIED ORGANISMS – A SOLUTION TO WORLD HUNGER?

Željko Kaluđerović<sup>1</sup>  
Jovana Potpara

*Review paper*

*Faculty of Philosophy, Novi Sad, Department of Philosophy*

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### ABSTRACT

*In 2011, GM crops were grown on 160 million hectares spread over 29 countries, on all continents, marking a 94-fold increase in the area since their first commercialization in 1996, and making it the fastest adopted crop technology in recent history. Main reasons for this expansion are, by the proponents of GM food, its safety, potential to revolutionize agriculture and benefit the farmers and consumers alike. On the other hand, there are indications that GMOs are harmful to the biodiversity and become eco-contaminants, and can, especially in the long terms, negatively affect the human health. Authors think that patenting of living organisms by the multinational companies is unacceptable and unfair from the bioethical perspective, not only because they tend to hold monopolies in production and trade of GM plants, but also because of their efforts to gain domination over the very life. Finally, analyses made by many scientists show that the thesis that "Gene Revolution" will resolve the problem of hunger in the world was not justified in the previous decade.*

**Key words:** *Genetically modified organisms, "Gene Revolution", "Green Revolution", potentiality, actuality, bioethics*

Besides scientific discussion on the production and use of GMO<sup>2</sup>, which do not have the same value mark, nor they are offering simplified answers to numerous controversies regarding new technology,

### <sup>1</sup>Correspondence to:

Željko Kaluđerović, PhD, Faculty of Philosophy, Novi Sad, Department of Philosophy  
Dr Zorana Đinđića 2, 21000, Novi Sad, Serbia  
Phone: +381 21 459 279  
E-mail: zeljko.kaludjerovic@gmail.com

<sup>2</sup>For more details see: Ž. Kaluđerović, J. Potpara, "Understanding of Genetically Modified Organisms", in: HUMAN, Vol. 2. Issue 2, Tuzla 2012, p. 61-66. How do relevant data on GMO, or as they are more and more often euphemistically called biotech plants look like? Summarily, total area in the world used for growing of GMOs, in the period from 1996 to 2011, amounts to somewhat over 1.25 billion hectares. Areas from 2011 of 160 mil. ha under GMO represent an increase for about 94 times in comparison to initial 1.7 mil. ha in 1996., and shows that "Gene Revolution" undoubtedly represents the fastest adopted bio technology in modern history. Today GMO is grown in 29 countries at all continents, which represents a significant change in comparison to the initial stage. Namely, in 1996 GMOs were grown in only 6 countries, primarily in USA, Canada, Australia and Argentina, with the majority share (1.45 million hectares out of total 1.7 mil. ha) being grown in USA. Although, still today, about 43% out of the total area un-

der GMO is in USA, and 87% out of all areas in the world are at the American continent, there is a tendency of the spreading of areas under transgenic plants. Researchers, like James (C. James), tend to point out the fact that in 2011 the number of developing countries (19) growing GMO was 90% higher than the number of industrially developed countries (10). It is also a fact that about 60% of the total world population lives in the afore mentioned 29 countries where GMOs are grown. Also, somewhat more than a half of total areas under plant crops in the world (which amount to about 1.5 billion hectares), i.e. 52% or 775 million hectares, is located in these countries. Nevertheless, we should not forget that GMO, with 160 million hectares proportion, cover only about 10% of total world area under different plant species. Data further below have been taken from: C. James, Global Status of Commercialized Biotech/ GM Crops, ISAAA Brief No. 43., Ithaca, NY, 2011 (Internet address: <http://www.isaaa.org>).

we need to consider and looback at a well known myth that on Earth there are too many people and not enough food<sup>3</sup> and that the solution for such a situation lies in so called "Gene Revolution."<sup>4</sup> Most of GMOs' proponents after they have exhausted their arsenal of various scientific or quasi scientific arguments in favor of transgenic technology, they pull out the "key" argument that this entire revolution was actually conceived with the main idea to finally resolve, or to more efficiently procede towards the solution for a highly humanitarian aim that there are no hungry and undernourished people in the world<sup>5</sup>. A thorough approach to this problematics distorts the thesis of GMO proponents, as well as the intentions of the previous seventeen year long expansion in growing and production of transgenic plants. If transgenic technology produces great results, particularly in developing countries, how is it possible then that eighteen years after the start of the intensive growing of commercial GM organisms<sup>6</sup> and only two years prior of the projected year 2015, about 850 million on Earth

is starving<sup>7</sup>, and that, according to the former IMF director D. Strauss-Kahn, we expect that very soon additional 100 million people will starve? Why is it that in these counters every day more than 30 000 children below five years of age dies of hunger or from consequences of a disease directly connected to the food scarcity? Why did, from the global perspective, prices of food rise in the last few years for more than 80%, if almost all economic indicators are speaking in favor of GMO, and the areas under these crops are constantly expanding? How is it possible that leading cereal producers (Russia, Kazakhstan, Ukraine, Argentina, China, Egypt, India, Indonesia, Vietnam) are introducing restrictions to food import and strive to provide for themselves in the first place food but also social and political stability and safety? How could we comment and understand the warnings of UN experts that international cereal stocks have reached the lowest level in the last three decades, and that in 2008 almost 40 countries, including China and India, faced a food scarcity situation? How come that we have already started to talk about global crisis regarding food, which does not affect only the poor in developing countries, but erodes the income of their middle class for which the famous economist J.D. Sachs says that it is the worst such crisis in the last more than 30 years? Present information seem even more curios when compared to the data which shows that food production in the world is following the rise of population, i.e. that the rise in food production is 3%, while the rise of population is 2-2.5%<sup>8</sup>. How are we to align the previous catastrophic numbers with the data that the harvest in 2007 was one of the best ones in human history – in the world namely around 2.316 billion tons of cereal grew<sup>9</sup>. The inevitable conclusion is that in the world there is enough wheat, rice and other grains to provide 3500 calories a day per person, without including into this calculation many other common types of food – vegetables, beans, fruit, meat, fish... Based on the statistical data of UN it can be concluded that there is enough food to ensure at least with 2 kilograms a day per each human, being the following: somewhat over 1 kilogram of grains, beans and nuts, around half a kilogram of fruit and vegetables and in addition al

<sup>3</sup>A thesis based on Malthus' es (T. Malthus) paper An Essay on the Principle of Population, as it Affects the Future Improvement of Society from the end of XVIII century, which expresses a claim that the number of people on the planet earth is increasing by geometric progression and the food production by arithmetic progression and that this may endanger the survival of humans as a species. Malthus directly influenced Darwin by his idea about the limitness of the population increase due to limited food resources, or more precisely said, he inspired Darwin to postulate his own idea of the mechanism of natural selection.

<sup>4</sup>More elaborately about twelve myths about world hunger in F.M. Lappé, J. Collins and P. Rosset book World Hunger: 12 Myths, Grove Press, New York 1998. <sup>5</sup>James believes that the most important potential significance of GM plants will be their contribution to so called Millennium development goal of reducing poverty and hunger in the world for 50% until the year 2015. As an argument in favor of the necessity of GM technology estimations made by UN are mentioned that the number of people on planet Earth by the year 2050, according to moderate projections, will rise to 9.15 billion people, out of which 8.1 billion will live in developing countries. In addition it is mentioned that the amount of farmland per capita will be lowered from 0.25 hectares in 1998 to 0.15 ha in 2050, and that the total area for growing plants will remain approximately the same i.e. 1.5 billion hectares. Since, according to James, the yield of cereals in the last decade of the XX century was growing at the modest rate of 1% annually, and it is necessary to at least double the production of food in comparison to the present level, a complex of measures is proposed in which the transgenic technology is taking a central place.

<sup>6</sup>Among transgenic crops which in 2011 were the most cultivated ones, there are soybean, cotton, maize and canola. GM soybean covers 75% (or 75.4 mil. ha) out of the total area under this crop in the world (~100 mil. ha). Here we should also add that GM soybean covers about half (47%) of the total area under all GM crops. GM cotton covers 82% (24.7 mil. ha) out of total cultivated areas under these crops (~30 mil. ha), at the same time covering 15% of areas under all GM plants. GM maize, which is increasingly grown in this way, covers 32% (51 mil. ha) out of the total area under this crop in the world (~159 mil. ha), and 32% of all GM plants. GM canola is grown at 26% (8.2 mil. ha) of all areas under this crop (~31 mil. ha), thus representing 5% of total areas under GM plants.

<sup>7</sup>Data taken from the web site FAO: [http://www.fao.org/es/ess/faostat/foodsecurity/index\\_en.htm](http://www.fao.org/es/ess/faostat/foodsecurity/index_en.htm).

<sup>8</sup>These data show that Malthus hypothesis and assumptions do not have support in actual documents.

<sup>9</sup>A part of the answer may lie in the fact that only 48% of yield is intended for human food, total of 35% goes for animal food, while up to 17% will be turned into contemporary ecological fuel bioetanol.



most half a kilogram of meat, milk and eggs – quite sufficient to make the majority of people on the planet obese! Of course, somebody could say that these data are statistical average, and that this is not the case in poor countries in the south hemisphere. But, the data say that 78% of undernourished children under five years of age and living in developing countries actually live in countries which have surplus of food. India has since mid 1980 become praised as the country which reached self-sufficiency in food production or even become food exporter. It would not be unusual if at the same time in India ~5000 children did not die every day due to the consequences of being undernourished, and over 220 million of its inhabitants were not hungry. In sub Sahara Africa over 217 million people suffer from hunger, and this number is constantly increasing since the beginning of "Green Revolution"<sup>10</sup>, when it amounted to around 95 million. At the same time, in this part of Africa, which represents a paradigm of unsuccessfulness of "Green Revolution", and unfortunately the most drastic example of negative effects of lack of food on all life parameters, there are 11 countries which because of the demand of developed world for "more profitable food" (coffee, cacao, ornamental plants), reformed their agriculture towards this direction and became net exporters of food<sup>11</sup>. Also there is an interesting piece of data that in industrially most developed countries of the world the number of undernourished people today exceeds 19 million. In USA the situation is quite paradoxical: in that country, for example, 2/3 of the wheat in the world and 90% of soybean export, while around 2 million citizens are suffering from latent hunger, while additional more 9 million people is threatened by mild forms of hunger, and 23 million citizens of the country consumes low quality food.

When the very contributions of the "Green Revolution" are more closely considered it can be observed the success in the reduction of number of hungry people in the world is uneven. The number of hungry people in the developing countries from the end of 1960's to the middle of the first decade of the 21st century reduced from 960 million to 850 million, which certainly is a great success having in mind the rise in the population in the world for that period from 3.6 billion to around 6.5 billion, out of which the largest number was certainly recorded in the mentioned countries. However, the mentioned data are less impressive if we take out China from the statistics. Namely, in the same period the number of hungry people in China was reduced from nearly 390 million people to around 130 million. The data for other regions of the world excluding China show that the number of hungry people in them was stagnating at best, as in Latin America or in the Caribbeans, or it was rising, like in the South Asia and Sub Saharan Africa. To put it more precisely, the number of hungry people in the rest of the world was actually in the given period increased from 570 million to 720 million people, which leads us to an interesting dilemma: whether the "Green Revolution" or the "Chinese revolution" was more successful? It is clear that even if GMO would bring about a drastic increase in the yield, and which was not unambiguously confirmed, hunger would not be extinguished because the concentration and distribution of economic power would not change, particularly the access to arable land and the buying power of the poor (2.7 billion people on the planet has a wage lower than two dollars, while over 1 billion people disposes only with one dollar per day). Even the World Bank (WB) concluded that rapid increase in the production of food does not automatically mean the reduction in the number of hungry people<sup>12</sup>.

<sup>10</sup>The end of 1950's and early 1960's were marked by so called "Green Revolution", which by shortening the wheat stems changed the ratio of vegetative and generative parts of the plant in favour of the latter one, thus facilitating a significant increase in production primarily of wheat and rice. The central figure of the "Green Revolution" is the American scientist N.E. Borlaug, Nobel Peace Prize laureate for 1970.

<sup>11</sup>Certainly that among the causes of dying of hunger in Africa we can state also frequent and long lasting draughts, as well as expansion of deserts (Sahara expands annually even for 1.5 million hectares, i.e. 15.000 km<sup>2</sup>). We should not forget about demographic explosion, epidemics of HIV/AIDS, malaria, permanently instable political situation caused by straight lined borders drawn by former colonizers, exploitation of ore and oil by previous owners, corrupted political circles and some of the worst dictatorships in the history of human kind.

<sup>12</sup>Higher yields should, automatically, lead to higher profits for poor farmers (according to the data provided by James out of 16.7 million farmers involved in the production of GMO, around 15 million are small and poor farmers from developing countries), and to enable them to get out of the vicious circle of poverty. M. Altieri and W. Pengue in the article "GM soybean: Latin America's new colonizer" (Internet address: <http://www.grain.org/seedling/?id=421>), question this figure and the entire thesis. They believe that, considering the fact that around 59% of area under GMO, i.e. 93.9 million hectares, are under herbicide resistant plants, and that in developing countries such crops are cultivated for export by large agricultural producers, profit from their production and use will belong to primarily wealthy people.

Their conclusion is that the issue of hunger may be mitigated by “redistribution of the buying power and of the resources in favor of the undernourished ones.” In short, if the poorest do not have enough means to buy food, increased production would really mean nothing to them. Introducing new technologies will at present distribution of resources contribute to ever greater concentration of power and money in developed and rich countries, with possibly even more negative consequences upon the developing countries and the poverty in them. A tragic consequence of all of this will be more produced food in the world and even more hungry people! Eventually, authors are at the standing point that the main issue is not whether “green”, “gene” or some other subsequent science and technological revolution in the production of food will be good enough and adequate to mitigate or extinguish the problem of hunger in the world. The initial error was made in the initial thesis, since resolving of such a fundamental issue of human kind most certainly does not primarily depend on the profession itself, but significantly more on the agrarian strategy which a certain country will adopt, i.e. on realization of a series of organizational, economic and political measures which are to enable the minimalization of a deep and threatening social inequality among people. Specifically, when agricultural production is concerned, systematic measures are necessary that a community needs to adopt, in order to enable the overbridging of a gap between the poor and rich farmers. This can be achieved by stimulation of land reforms and by adoption of other compatible legal acts, with the aim to transfer smaller agricultural producers towards the center of economically shaken traditional

agriculture<sup>13</sup>. In order to be able to implement these measures it is necessary to achieve at least a minimal agreement in the wider social community on the principles of social justice and solidarity. Certainly, the elements of mentioned consensus, in addition to the fact that they need to exist inside the state, need to be present in the wider perspective, in order for the entire strategy to show more significant results not only at the local, but on the regional and global levels.

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<sup>13</sup>If scientists and philosophers studying bioethics can have any kind of role in mitigating and eliminating of the foods scarcity issue, this can be done as well by promoting the idea that the transformation of agricultural production into its sustainable development through a series of measures, one of which is related to the stimulation of so called ecological agriculture is recommendable. Such agriculture implies allocation of priority to recycling of agricultural products and wastes in comparison to artificial means of production (mineral fertilizers, pesticides, chemical agnes, genetical engineering). It also includes the use of biological and mechanical methods of growing instead of chemical, the increase of ecological diversity of agricultural production, as well as the use of plant and animal wastes. The intention is to stimulate the production based on completely natural processes, through an optimal crop rotation, by sowing plants which recover nitrogen in the soil and by use of manure.

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