

## **Talent Development through Familial Environment**

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### **Abstract**

*This article presents some of the main results from the research about development of talented students in mathematics. The research is focused on identification, analysis, and interpretation of all or most factors in the family environment that contribute to development of mathematical talent. The research results reveal the specific methods, actions, strategies, and other variables of the home environment that influence and affect development of mathematical talent. The revealed principles involved in the educational development of talented students will allow parents and educators to improve, modify, and develop new strategies of dealing with talented students in an attempt to enhance their outstanding development. This research is very important from scientific, social, and practical aspects. Parents, teachers, administration, policy makers, and the entire society have to support identification and development of talented students because of their remarkable contribution to science, culture, technology, and welfare of the society in general.*

**Keywords:** *talented students, family, environment, factors, mathematics, development, support*

### **1.Introduction**

Gifted and talented children differ from average children, and therefore it is necessary to adjust teaching methods to their needs so that they can develop optimally. This fact is very important because many gifted and talented students pass through schools unidentified, and often, when they are discovered, they are neglected by teachers because of their occupation by children who learn slowly. If talented students are neglected at school, family itself cannot do a lot in terms of their exceptional development. Such an approach is very detrimental to the talented individuals and for whole society.

In our research, we intended to explore the development of mathematically talented students in family environment and determine factors that contribute to development of their talent. This study represents the case study research. We selected ten students talented in mathematics who have expressed their mathematical talent through successes in schools, at universities and international math competitions.

We paid attention to the many factors in family environment such as socio-economic and educational status of parents, learning conditions, number of children in the family, parents work

with children on school obligations, the reaction of parents to successes and mistakes, etc. This research is very important from different aspects like social, scientific and practical. The social aspect -Talented students when they become adults they will be the main carriers of economic development, civilization building, and dissemination of culture and enthusiasm to entire community. We are convinced that it is necessary to invest maximum engagement on the identification and development of talented students because of themselves and their positive contribution to society.

The scientific aspect – this research reveals how family environment influence and contribute to development of mathematical talent. We find out what factors in the family environment and on which way and to what extent affect development of mathematical talent.

Practical aspect - According to Drašković (1998) nothing is as inappropriate as the equal treatment of children of unequal abilities and needs. As it is well known, gifted children are children with special needs. But, during educating and nurturing gifted and talented students in so many cases their emotional and social needs are neglected (Becirovic, 2005a).This study determines the practical activities in a family environment that contribute to the development of mathematical talent. We determined which strategies effectively influence on mathematical development and these strategies may serve as a reference for parents to properly guide their talented children.

Based on the research results we made conclusions and recommendation on the strategy of education and nurturing students talented in mathematics, which could be great benefit for parents and for teachers who are engaged in the development of talented students in mathematics.

## **2.Literature review**

The general development of the child starts from undifferentiated, untargeted and simple forms of interaction with the environment of the child and ends in a mature behavior: the conscious, planned and complex individual's relationship with the environment. Family is one of the main factors that affect the development of the whole personality (Rakic, 1976). Recent theory increasingly emphasizes understanding of talent as a result of the special combination of hereditary traits and their interaction with a supportive environment (Gardner, 1993; McCurdy, 1992; Sternberg & Lubart, 1995). Well-known is the fact that high results in the development of talent can be expected when it's nurturing starts as early as possible. Also, according many research numbers of students expressing signs of talent in their childhood do not guaranty their exceptional success in school and life (Howe, 1990, 1993; Tannenbaum, 1986).

Modern views on talent leave the notion that genius is born, that talent is entirely a matter of gene, and that an individual has or does not have talent. Foundations of the modern understanding of talent are:

- Talent is born and develops,
- The impact on the formation and development of talents is multiple,
- Development of talent is a long process (Čudina-Obradović, 1991).

Students talented in mathematics belong to the category of children with special educational needs. Their special educational needs are related to work with them in school and at home. Adequately

meeting their needs leads them to above-average success (Becirovic, 2005b). If we bear in mind these facts, it appears to be family among the most important and most responsible factor of encouragement and development of talent. Many researchers dealing with the phenomenon of talent agree that family is an irreplaceable factor as supportive environment for the overall development of the potential of the child (Shavinina, 2013). Family does so by creating appropriate conditions for development, creating a variety of opportunities that children have to use in the best possible ways, and acts by its overall socio-cultural context to their development (Becirovic, 2005c).

The abilities of gifted children in the exceptional measures differ from average ability children. During a childhood period two characteristics significantly differ from future talented mathematicians of all other children. These are asking thoughtful questions and lonely activity and daydreaming (Draskovic, 1998). In order to maintain and develop outstanding abilities of talented students it is necessary that teachers and parents pay to them special attention. Development of talent begins in the early stage of the general development as distinct, intense interaction of the child with the environment. It continues to proceed as a series of transformations during which very capable child talent may arise. The most widely seen, three basic transformations must occur to a child of high ability to develop his/her talent:

- Transformation of biological potentials into skills,
- Transformation of capabilities into creative ability and,
- Transforming creative abilities into creativity (Čudina-Obradović, 1991).

Mathematical competence is the ability to understand the essence of mathematical systems, symbols, methods and evidence, so that all of mentioned be learned, remembered and reproduced, and to be combined with other systems, symbols, methods and evidence, in order to be used in solving mathematical problems (Becirovic, 2005c). Unlike their peers, talented mathematicians are capable of rapid and broad generalization of mathematical problems and ideas (Arslanagić, 2004). They focus more on the core relations and the structure of the problem rather than the irrelevant details. Ability to learn math so far have been investigated mainly in two ways (Bandur, 1991). The first is psychological observation and introspective analysis of the thinking processes that manifest themselves in solving various mathematical problems. In psychology it is called introspective way in exploring the structure of the ability to learn mathematics. Another methodological approach in the study of structure ability to learn mathematics is a factorial.

According to Krutecky (Bruno, Bruno, J. and others, 1987) talented mathematicians have unique neural organization that has a profound effect on mathematical thinking. This trait often occurs in elementary form at age of seven or eight years and later developed into a major character. It is expressed in attempts to create mathematical environment, in a constant effort to pay attention to the mathematical aspects of different phenomena, in linking special and quantitative relations, relationships and functional dependencies. In short, they are trying to look at the world through mathematical eyes. Arslanagić (2001) differentiates two main types of mathematically talented students. First type is problem solvers. They are highly trained and successful in dealing with standard and non-standard problems, able to be optimally expressed in a very limited tests and competitions, his/her main interest is the search for solutions to problems set up by others. Second

is research type. Characteristic of such mathematically talented students is their interest and success in studies of unresolved problems. They give priority to long-term research problem; their main interest is focus on their own questions and answers, and search for their own concept, methods and algorithms for solving problems.

When it comes to adolescence period of talented mathematician, it is often referred to their independent learning and coaching by certain mentors. They are looking for experts in their fields for which they have opted, and strive to work closely with them. Express their exceptional skills in mathematics and physics. It is important to mention the gender differences in math ability. Many studies found that boys perform better than girls on tests of achievement in mathematics (Sally and Callahan, 1996; Constance, 1998; Beal, 1999).

In many states teachers who work with gifted and talented students do not have many opportunities for professional development in this area (Becirovic, 2007). If we take into account importance and significance of the development talented students and their contribution to society, we can say that this area in many educational systems is neglected and ignored even on undergraduate studies. But, beside this fact, there are some bright examples of successful teachers. For exemple Esi propose a system by reporting ti idea of an efficient functioning of the education process (Eşi, 2010, 41-50) or system whic exprime connexion between education, science and innovation Esi, 2015). Winebrenner (2000) provides a nice example of a teacher of mathematics. She gave the whole class the same test in mathematics and she very carefully observed each student to work. After a while she came to the conclusion that four students very quickly accomplished the test in relation to the rest of the class. By correction of the test she also realized that these four students solved mathematical problems the most successfully. In this way, she identified four talented mathematician and gained insight into the ability of other students. She formed working groups - one group was made up of four talented (homogeneous grouping), and said that they will work together until the end of the week. Activities and assignments were adjusted to abilities of talented and other children. She pointed out to them that her methodical approach quite acceptable to her and that will enhance their knowledge. In this way, the professor of mathematics in the normal school setting made the differentiation, and has done a lot to meet the educational needs of talented 'mathematicians and other students.

### **3. Research design**

According to many experts crucial influence on the development of talent has family and schools (Engblada, 1987, Schiefele & Csikszentmihaly (1995). This fact has prompted us to direct our research to family influence on the development of talent in mathematics. This research is focused on exploration of factors that contribute to the development of exceptional mathematicians who have achieved significant results both in school and in different levels of competitions. Thus, the subject of this research is determination of factors that contribute to the development of talent in mathematics in the family environment.

Our research is empirical and represents qualitative study. Through it we intend to identify and interpret the circumstances under which specific needs of talented mathematicians are met in family environment, so that these children develop into superior students. The goal of our research is the

identification, analysis and interpretation of the factors in the family environment which contribute to the development of mathematical talented.

Main research question of this work is: What factors in the family environment have an impact and contribute to development of mathematical talent. Therefore our task is to determine the development of talented students in mathematics through the home environment and determine how different activities in home environment stimulate their individual development in the field of math.

#### **4.Method**

With regard to the type of the research and the research question that we have set, we decided to apply case study method. A case study is a method in which all important aspects of a phenomenon or situation are investigated, where the unit of study takes an individual, institution, community or any group that is considered as a whole. This method includes information relating to a period of life history of research sample taken (McMillan, 2012; Good-Scates, 1971). Our case is a group of ten students talented in mathematics. The research is focused on their developmental path in family environment.

We used semi-structured interviews for collecting empirical data. When it comes to data collection instruments we used protocol for conducting interviews with the parents of the talented students and protocol for conducting interviews with ten students talented in mathematics. For the interview questions we consulted many previous research and books in field of the identification and development talented students like *Creating a scale to measure Motivation to achieve academically talented: Linking attitudes and behaviors using Rasch measurement* (Waugh, 2001) and *A comparative study of personality, values, and background characteristics of artistically talented, academically talented, and average 11th and 12th grade students* (Evert, 1986).

By interviewing parents of participants we found out what they were doing on the development of mathematical skills of their children. Also, we discovered how they dealt with them in a different situation which could have stimulating or constraining effects on the development mathematical talent of their children.

#### **5.The research sample and method of data analysis**

Almost all countries in the world organize mathematical competitions. The best students on national competition participate at international competition. Sample of this research consist ten students talented in mathematics and their parents. The most important criterion of their selection was their exceptional successes on national and international competitions. We selected ten the best students in field of mathematics from Bosnia and Herzegovina and we interviewed them and their parents individually.

Due this research represents qualitative study we applied qualitative data analysis. We created codes for analyzing interviews with parents and students. Afterwards, we clustered codes and created appropriate categories. Part of research results are displayed on charts.

#### **6.Research results**

##### **The characteristics of the family environment**

The theory of the development of specific talent represents a gap in educational literature. According to many authors, talent requires different set of circumstances to come at the first fore. These circumstances can be expressed and realized in different situations and family factors have a decisive influence on the beginning of talent development.

The first question posed to our participants is related to their place of residence and education. All participants answered that they live and study in urban areas. Also, it is important to mention that nine out of ten are raised in major cities in Bosnia and Herzegovina. By looking to the development of students talented in mathematics in terms of their place of residence and education, we can assume that there are several factors that may contribute to their extraordinary development in urban areas. Some of these factors:

- Better quality of education in urban areas,
- The existence of competition, e.g. in a small settlements students talented in mathematics and their parents can be satisfied with the fact that she/he is the most successful mathematician in her/his settlement and does not possess motivation for further progress, while in larger cities there is greater competition. This information we got from some teachers and parents,
- Better information system in urban areas,
- Optimal environment for development different skills (e.g. existence of clubs for talents such as "Club of Young Talents in Sarajevo").

Size of family members and birth order is also an important issue in the research of development talented children in family environment. We found that all the students talented in mathematics grew up in small families. Nine participants grew up in a family of four (two children and two parents), and only one student in a family of five (three children and two parents).

Our research findings are in agreement with the results obtained by Vernon, and Vernon Adamson. Their results show that a small size of family members is the most influential variable in the development talented children within the family environment (Evert, 1986). Based on the results obtained through our empirical research and the results obtained by Vernon, and Vernon Adamson, we can point out that size of family may have an impact on the development of mathematical talent and that children who live in small families have greater opportunities for mathematical development then children who live in large families. This statement is strengthened by the fact that 90% of our participants live in four and one in a family of five members.

When it comes to the birth order most of our participants are first born. Six of them were born as the first child (two participants are brothers).The results we have obtained are similar to Terman's research of highly talented children. He found that three-fifths of his sample is first born and they generally come from small families. Research conducted by Drews and Kincaid shows that half of their samples were first-born children and in Kincaid's research four-fifths of the participants come from small families where live from one up to three children (Evert, 1986).However, these results are not identical for all areas of talent. Thus, e.g., Scot Laurel Evert in his survey found that 67.7% of the talented in arts and 72.1% academically talented children come from families in which live three or more children, and 63.7% talented in the arts and 67,6% academically talented are middle born or they are the youngest children (Evert, 1986).

Taking into consideration our results and the results of other researchers we can say that birth order may influence to development of mathematical talent. Our assertion about birth order does not apply to all fields of talent but only on the mathematical area.

Socio-economic and educational status of the parents is an important factor in development of talented students in family environment. Under this we mean certain environmental characteristics of participants related to their parents' home, residence, and parents education. Success in school and many aspects of personality significantly depend on the social conditions, the environment that encourages or inhibits the individual development.

When it comes to our participants, so students talented in mathematics, we found that almost all of them come from highly educated families. The level of education of their parents is showed in the following graph:

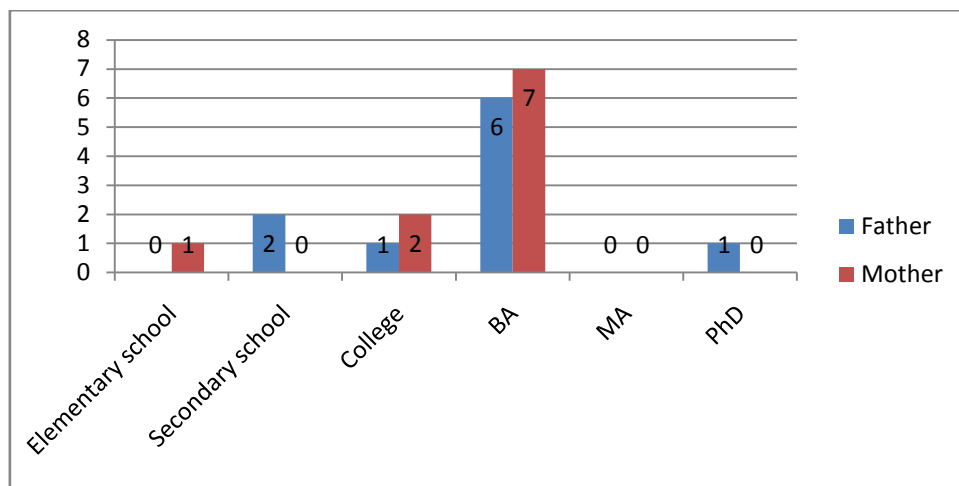


Chart No. 1: Educational status of parents

On the chart we see that the two fathers graduated only secondary schools, one graduated college, five graduated university BA degree (among them the father of two brothers participants) and one of them obtained doctoral degree. When it comes to the education of mothers one mother graduated only elementary school, two graduated college and six graduated universities BA degree (among them the mother of two brothers participants.). Also, it is important to mention that their parents mostly graduated at the Faculties of Natural Sciences, such as mathematics, physics, chemistry, and electrical. Seven fathers studied science and two social sciences. Half mothers studied the natural sciences, four social sciences, while one mother finished only primary school.

By analyzing our empirical data we can conclude the following:

- most parents of our participants are highly educated,
- most parents are educated in the field of natural sciences,
- parents education has a great influence on the development of mathematical talent.

From these data we can assume that parents as highly educated have more aspirations to encourage and support their children to develop their mathematical talent. Also, we can assume that they

organized a variety of activities from which they originated experiences that have contributed to orientation and exceptional mathematical development of their children. Because seven out of ten participants have one or more family members who are above average mathematicians we can infer the existence of the genes have influenced the development of mathematical talent.

By exploring the economic situation of the families from which our participants come we found that they come from economically stable families. Through analysis the answers, we realized that at nine participants both parents are employed and at the tenth participant only father. Taking into consideration that almost all parents are highly educated and employed, we can conclude that the participants come from families above average economic status, and that the economic situation of the family has a profound influence on the development of mathematical talent.

Marland in 1972 in his report on talented youth in the US Congress indicated that talents come from privileged families (Evert, 1986). So, in this case, our research provides similar results to earlier researches.

### **7. Conditions for learning**

In the study of development of our participants in family environment we considered that is necessary to examine the conditions in which they learned. According to obtained data the conditions for learning of our participants are largely varied. The first question referred to the provision of adequate space for learning. Only six parents said they have managed to provide fully adequate space for unhindered learning, while three parents pointed out (among them is parent of two brothers participants) that they could not ensure the best conditions for learning (Chart no. 2). However, they tried to organize all activities and use property on the best way in order to ensure optimal conditions for learning.

This part of our research could be compared with the research results of Drašković (1998) which was brought on the basis of empirical research of the impact place and the comfort of the apartment to learning. Her results show that housing conditions of the family and the success of students in the school are connected to each other. Success of students from families with high financial possibilities and students who live in a comfortable apartment are better in all teaching subjects (Draskovic, 1998).

We asked parents do they ensure sufficient time for studying to their children. In this case parents' responses are more balanced than at the previous question. Eight of them said they ensure sufficient time for learning to their children. Only one parent negatively answered to this question (Chart no. 2). The next question is related to the provision of adequate learning materials such as books, magazines, collections of mathematical assignments, etc. On this question all parents responded positively (Chart no. 2). To the question about providing attendance to specific courses out of school curriculum for their children some parents have responded positively and some negatively. Six of them said that their children attended to additional courses which were largely based on the interest of their children, and three parents said that their children did not attend to any additional courses (Chart no. 2). The last question in this section was about the provision of instructors for work with participants at home. In this case parents' responses are identical. None of them had hired a private instructor for the improvement learning of their children at home.



We can summarize that six of parents provide adequate space for learning, nine sufficient time for learning, all they provide the appropriate learning materials, seven provide attendance to additional courses and none of them had hired private instructors for the improvement learning of their children at home. So, for a remarkable mathematical development is necessary to ensure the appropriate space, the materials required for learning, sufficient time and certain courses based on the interests of children.

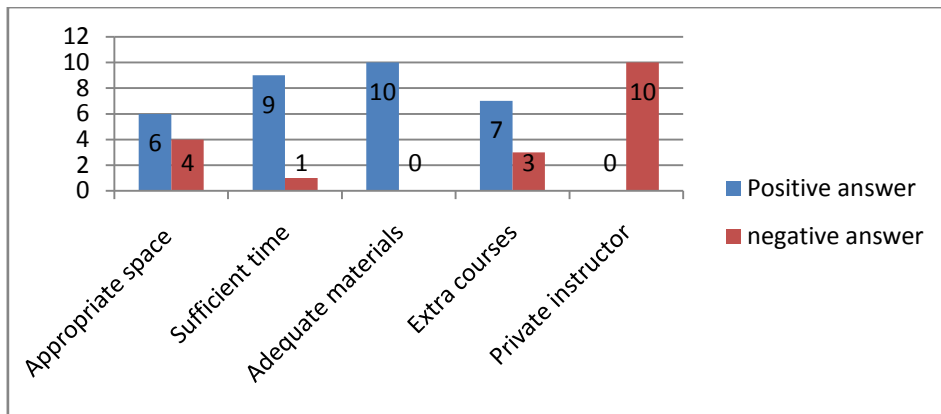


Chart No. 2: Conditions of learning

### **8. Parental support as an essential factor in the development of mathematical talent**

Each person has a great potential in certain areas, but the problem is how to identify and develop these potentials (Engblade, 1987). The identification and development of talented children is a very delicate issue. In this process should be included parents, teachers and experts in the field of talented individuals.

Participants are asked who had the most influence on their mathematical orientation and who gave them the most support on the way of their mathematical development. All participants said that primarily parents and teachers of mathematics influenced and supported them, but they also pointed out that they often talk with parents, teachers and friends in general about education and about math. When participants are asked to describe in detail how their families contributed their mathematical development they responded that it was moral support, they were advised by parents, provided all the necessary materials, space for learning, sufficient time, and trained in math at the lower ages. The participants also answered that their parents in some way express the happiness and satisfaction because of their success, and it contributed to participants' motivation.

All of our participants said that they have long-term objectives in the field of education, such as: complete undergraduate studies with a high average, graduate, obtain Ph.D. title, and contribute to science in their field. These goals are certainly derived from appropriate conversation with parents and teachers about education.

Motivation is the key driving force in all human activities. Without it, success would not be achieved either it would be minimal. In this section we discuss who and how encourage and stimulate our participants. To obtain information about these factors, we asked participants several of questions.

The first question deals with life in early childhood. Parents are asked to explain how they acted when their children frequently asked them certain questions, because it is common that appropriate responses may contribute to the development of thinking skills, and build curiosity and certain attitudes and values that can have a profound effect on further development. All the parents patiently tried to answer all questions of our participants. Also, by answers they tried to contribute to their knowledge and build certain attitudes and values about learning. Some parents have tried to direct their children to find answers themselves. This is explained on the following way:

*"We were trying to answer his questions and further explain him certain things that were related to his questions, and we have instructed him to found the answers in the environment or in the books,"* - one father said.

Many parents were not satisfied by the response to the questions, but they have tried to expand children's curiosity, use it to establish certain standpoints towards certain things, and some of them instructed their children to seek themselves information for which they are interested. Certainly, these approaches could contribute to the development of mathematical talent.

When parents are asked to explain the way how they encourage their children to develop their mathematical skills, parents answered similarly. Eight parents try to build a certain attitudes and values in their children. These attitudes are built through conversations, rewards, different types of support, etc. Only one parent said he have not done anything special in this terms. Parents explained to their children that all types of success take a lot of efforts and persistence. This approach contributed to intrinsic motivation of our participants. Following quote of one parent is good example of participants support:

*"I told them, 'What is required is a personal struggle for self, for life, for survival, for parents, for their country and for all the rest. There is a struggle at school no matter where you go into it. By good school grades you will help everyone. 'They took it seriously, and after they recognized themselves in mathematics. By their success they cheered themselves and cheered as to support them more, '"*- father of two brothers said.

Parents were helping children to discern and develop their different interests, strengths, and energy in different directions. They try to reduce the possibility that children develop a sense of failure and inferiority. Parents try to support them at every situations and every opportunity.

Parents have been asked what their expectations were when it comes to education of their children. Parts of the parents (three of them) were not considering a lot about results of their children's education. Mostly they were focused to the current situation, and felt that the most important for their children was to work and learn and results of this engagement will come later. The second part of parents (three of them) responded that they did not expect such a brilliant success of their children. One of them has been explained this:

*"Our expectations were more modest than he actually achieved,"* - one father said.

Two parents said that their expectations were in line with the capabilities of their children and one parent said that he had high expectations and it is mostly achieved.

Parents generally did not have too high expectations that were unfeasible for their children and that in the case of their failure to achieve it, could cause a low self-perception which could decrease their motivation. On the contrary, some of the parents had lower expectations then achieved results.

After implementing their expectations parents have expressed a high level of satisfaction in what their children found as an additional source of energy to new successes. Parent's expectations were realistic and simulative, and parents were occupied with the current work what was important to their children to maintain continuity of successful learning and perseverance, and based on that, certainly good results came. So, we found that appropriate expectations have a very positive impact on the development of mathematical talent. Our results are similar to the research results of Cvetković-Lay and Sekulic Majurec (1998) about the positive impact of parent's expectations on the development of talented children.

Parents are also asked to explain how they supported the efforts of their children. We got quite identical answers. Parents respected and appreciated the efforts of their children. This appreciation was expressed by praises, varies rewards (gifts or celebrations) e.g. The last question in this set was related to parent's feelings in the moments of extraordinary successes of their children. The answers are in this case fairly balanced. All parents felt happy and proud - that happiness was differently demonstrated (organizing celebrations, providing gifts, family outings to dinner etc.).

Diverse appreciation of child efforts and the expression of satisfaction by parents in their children's success certainly had a very positive effect on the future work and perseverance of our participants. Always parents tried to act wisely. They invested efforts that their actions do not have a restraining effect to motivation of their children. Support and praise were a constant presence.

### **9. Supervising learning of talented students and work with them on school assignments**

Any form of cooperation between schools and parents bring positive results in the academic development and the improvement of children's behavior. We asked parents of talented students in math to explain their monitoring of learning and instructin them at home.

On this question parents responded in three ways. Four of them constantly monitored and controlled learning of their children at home. One parent did that occasionally. Two parents did so only in the early grades, and one did not monitor learning at home. Father of two brothers told us that he rarely monitored learning at home and in school regularly.

When it comes to supervising learning at school parents responded similarly. All parents were supervising learning of their children in school. Three parents pointed out that it was appropriate supervising but not as an auditor or inspector.

From answers it can be understand that almost all parents at home and at school in a very deliberate manner supervised and monitored learning of their children. They did not neglect the learning of their children at home or at school. They have not even gone to the other extreme to control and supervise all activities of their children and thereby limit and take away their freedom. They took care of learning of their children but at the same time they gave a lot of freedom and the right to them in order to organize their learning on the most appropriate way for them. We find this approach's as one of the most important factors that have contributed to the exceptional development of our participants.

The next issue that we considered very important and parents are asked about it refers to the work of parents with their children at home. We wanted to know did parents help children in learning in general at home and did they specifically help them in math. Also, we asked them if they helped them to explain the way they did so. The answers are quite different. Three parents responded that

they did not help their children to learn at home. They said it was not necessary, because their children were always successful in school. The father of two of our participants said that their mother only in the early grades reviewed their notebooks, and also, one parent said his son usually worked without their help. The second part of the parents (five) answered that they helped their children in math and other school subjects. When asked to explain how they help them answers are mixed. Some of them helped children only in the lower grades, some directed children to certain sources, while some parents trained their children math tasks. So, five parents directly help their children to learn at home, and three or four of them believe it is not necessary.

Parents were asked whether our participants train other students in math at home. All parents responded positively to this question. Two of them pointed out that it was very common and parents of three participants said that it was rare. Based on these responses, we can assume that training other children contributed to the mathematical development of our participants.

Appropriate monitoring of child's learning in school and at home (not in function of authoritarian control), and appropriate parent's assistance in learning have a positive effect on the development of mathematical talent.

#### **10. Talent and freedom**

Parents were asked few questions in order to explain the presence of freedom in the development of our research participants. We wanted to investigate the connection of freedom and independence in the development of mathematical talent. We asked parents about the freedom of choice of learning materials, learning methods and planning time to learn and play.

Regarding to the first question all parents said that they did not interfere in the selection of learning subjects or learning content. The methods of learning also were not imposed by the parents. But only two parents said that they sometimes suggested some things related to the learning strategy (chart no. 3). When it comes to the question of freedom of choice of time to learn and play one parent said that in the lower grades he planned time for his son but later he did not. The other parent said that he works with his child in order to develop working habits and his son cannot play when he wants. The rest of the parents (seven including the father of two brothers) said they are liberal and allow children right to choose the time to play and to learn (chart no. 3).

From the answers we can see that our participants have the high level of freedom when it comes to choice of learning content, learning methods and planning time, and it has a very positive impact on the development of mathematical talented. That freedom has provided them the independence and creativity, but as it is known, there is no creativity without freedom. Therefore, we can conclude that for the exceptional development of mathematical skills freedom is necessary.

We asked parents whether their children were labeled by negative names or stigmatized because of extraordinary success of their children. Six parents responded negatively to this question (including father of two brothers), or they did not know that their children are labeled due to the extraordinary success in the school, and three parents responded affirmatively, and confirmed the presence of negative labeling (chart no. 3). This problem parents were solving through explanations to their children that other children only envy them because of their exceptional success, and advise them not to pay attention to such provocations. One mother explained it to us as follows:

*"We have tried to emphasize that these nicknames provide envious people, ie. those who are envious due the success and that provocations serve them as a relief for their failures."*

Although both these responses are not the best (because talented children convinced that others envy them and have a negative opinion about them may cause difficulties in terms of socializing), they have contributed to mitigate the impact of labeling on our participants.

We conclude that mostly the freedom of our participants was not violated in terms of labeling and stigmatizing. Appropriate conversation is one of ways for elimination the effects of labeling when it is expressed.

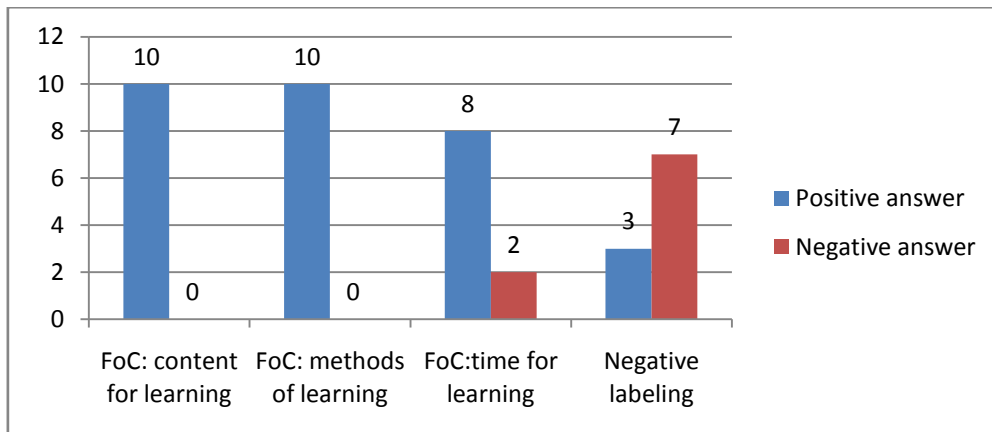


Chart No. 3: Talent and freedom

### 11. Reactions of parents to children mistakes

Parents in different ways treat mistakes of their children what also depends on the type of mistake. The reactions of parents to mistakes or fails may have negative consequences and may be used as a lesson for the future. For instance physical punishment can only have negative consequences and may not have the positive outcomes (Pehar, 2000), while appropriate conversations with children and seeking lessons from mistakes can have a positive effect on the children from emotional aspect and aspect of gaining experience. Sometimes parental understanding and adequate explanation of mistakes will facilitate to child to understand a current fault but in the future he/she will be more competent when face similar problems.

In order to obtain information on how do parents treat our participants when certain mistakes or failure occur we asked them a few questions. The first question was: How do you usually act toward your child when he/she refuses your orders?

Six parents said that such situations are rare. The answer of one of the parent was:

*"I do not remember that they refused my orders, but if it was hard to do something we have sought a compromise to mutual satisfaction".*

One parent said that such behavior is not uncommon. He explained that he tries to calmly talk with his child in such situations.

The parents, who said they had rare situation that their children refused orders, they always calmly approach this issue, and they never on autocratic manner try to solve such problems. Parents talk rationally with children and on an acceptable way try to eliminate such behavior. They did not express aggression, anger, and have not linked their talents with their asocial behaviors.

We may conclude that search for compromise, understanding and appropriate conversations are appropriate to effectively resolve problems of rejection of orders by talented mathematician and that these strategies have positive impact on their development.

The next question we asked the parents are related to verbal criticism of our participants. Parent's answers could be divided into three categories. Five of them said they rarely criticized their children. One parent told us that he never criticized his child. The parents of three of our participants pointed out that they often criticized their children and some of them enriched response as follows:

*"We criticized him whenever the opportunity arose".*

*"I have often criticized them, whenever I had opportunity to do that".*

Based on empirical data we see that parents never reacted by punishing their children to actions by which they were not satisfied. Parents used verbal critics rarely. Parents sought to improve the performance and behavior of their children through counseling. These strategies were immensely effective on the development of mathematics talent.

## **12. Conclusion**

All participants talented in math were born and grew up and were educated in urban areas. Therefore, children in urban areas have better conditions and encouraging environment for the development of mathematical talent.

Our participants have been raised in small families. This data leads us to conclude that smaller families are more appropriate for the development of mathematical talent and most of talented mathematicians were first-born.

The parents of our participants are in most cases highly educated. This data refers to both parents. Most of the parents were educated in the natural sciences. Also, all participants come from families with high economic status and all these factors had influence and contributed to the development of mathematical talent.

Participants were mostly supported by parents and teachers. Also, they got support from friends. They often talked with parents about their career. Parents advised and guarded them and ensured all the necessary learning materials and learning conditions. In the lower grades parents were training them mathematical skills. Parent's support also has been manifested through guidance, conversations, stimulation, and expression of happiness and appreciation for the success.

Most parents ensured adequate space for learning and almost all other requirements to the participants so they could effectively learn. We believe that good conditions for learning are important factors that have contributed to the extraordinary development of mathematical talent.

When participants showed some forms of curiosity parents affirmed and supported it rather than eliminated it. Parents sometimes guided participants to search for specific answers in the environment or in books. Parents build positive attitudes towards science and towards learning and work in general. They persuaded participants through various ways why is important to deal with science. They explained them that any kind of success cannot be achieved without perseverance and hard work.

Expectations of parents had positive influence to the development of mathematical talent of our participants. Their expectations were not too high and unfeasible for participants, but optimal and encouraging. If participants achieved expectations, parents expressed appreciation which further encouraged participants. A few parents did not think much about the expectations, but they have been focused to ongoing current obligations and were convinced that good work and persistence will produce good success. All these approaches contributed to a greater interest and success in mathematics.

All parents have supervised learning of their children at school. Part of parents emphasized that it was appropriate supervising and not strict autocratic control. This data leads us to the conclusion that proper monitoring of work and achievement of students talented in mathematics has a positive impact on their further development.

When it comes to mistakes or failures most of parents adequately discussed with children, and analyzed mistakes and assumed consequences. As discussions and consultations were usually presented during certain mistakes of the participants we conclude that this approach were efficient on the way of mathematical development of our participants.

Parents did not interfere in the choice of content for learning. Only two parents have suggested some methods of learning. Participants were free to choose subjects, materials, methods and time for learning and this freedom is shown as a positive factor for the development of mathematical talent.

All participants had the role of instructor to another children and it contributed to their mathematical talent. Problems with negative labeling parents were solving by proper conversations and counseling.

## **References**

1. Arslanagić, Š. (2001). *Aspekti nastave matematike za nadarene učenike srednjoškolskog uzrasta*. Sarajevo: Udruženje matematičara Bosne i Hercegovine.
2. Arslanagić, Š. (2004). *Matematika za nadarene*. Sarajevo: Bosanska riječ.
3. Bandur, V. (1991). *Sposobnosti učenja matematike*. Sarajevo: Udžbenici, priručnici i didaktička sredstva.
4. Bećirović, S. (2005a). Individualizacija i nadarenost (Individualization and Talent). *Novi Muallim*, Vol. 6.
5. Bećirović, S. (2005b). Inkluzija i darovitost (Inclusion and Talent). *Našaškola*, N. 31.
6. Bećirović, S. (2005c). Socio-emocionalni i obrazovni faktori razvoja darovitosti (Socio-Emotional and Educational Factors of the Development of Giftedness). *Novi Muallim*, V/23.
7. Bećirović, S. (2005d). Specifičnosti matematičke darovitosti (Specifics of Mathematical Talent). *Našaškola*, LI/34.
8. Bećirović, S. (2007). Razvoj profesionalizma u radu s nadarenima (The Development of Professionalism in Working with Gifted Students). *Obrazovanje odraslih*, N. 1, Vol. 7.
9. Bruni, J and oth. (1987). *Providing Opportunities for the Mathematically Gifted*, Virginia.
10. Cvetković-Lay, J. (1995). *Ja hoću i mogu više*. Zagreb : Alinea.
11. Cvetković-Lay, J.; Sekulić-Majurec, A. (2000). *Darovito je što ću s njim?* Zagreb : Alinea.
12. Čudina-Obradović, M. (1991). *Nadarenost razumijevanje, prepoznavanje, razvijanje*. Drugo izdanje, Zagreb : Školska knjiga.
13. Drašković, B. (1998). *Daroviti i obrazovna odiseja*. Beograd :ABC Grafika.

14. Engblada, P., A. (1987). *Talented and Talented Education: its Potential to Benefit all Children*, ("U-M-i" – Dissertation Information Service), The University of Michigan, University Microfilms International.
15. Eși, Marius Costel. (2010). *Legitimizing the Educational Experience in the Context of the Didactic Methodology*. In *Revista Românească pentru Educație Multidimensională*, 41-50.
16. Eși, Marius Costel. (2015). *The Model ESI in development of the Future Didactics*. In *International Journal of Social and Educational Innovation*, Volume 2, Issue 4.
17. Evert, S., L. (1986). *A Comparative Study of Personality, Values, and Background Characteristics of Artistically Talented, Academically Talented, and Average 11<sup>th</sup> and 12<sup>th</sup> Grade Students*. Minnesota: University Microfilms International.
18. Gardner, H. (1993). *Creating Minds*. New York: Basic Books.
19. Good-Scates. (1967). *Metode istraživanja u pedagogiji, psihologiji i sociologiji*. Rijeka : Otokar Keršovani.
20. Howe, M. J. A. (1990). *The Origin of Exceptional Abilities*. Cambridge, MA: Blackwell.
21. Howe, M. J. A. (1993). The Early Lives of Child Prodigies. In G. R. Bock & K. Ackrill (Eds.), *The Origins and Development of High Ability* (pp.85-105). Chichester: Wiley.
22. James, H. McMillan. (2012). *Educational Research: Fundamentals for the Consumer*, 6<sup>th</sup> edition, Pearson.
23. McCurdy, H. G. (1992). The Childhood Pattern of Genius. In R. S. Albert (Ed.), *Genius and Eminence* (pp. 155-169). Oxford: Pergamon Press.
24. Pehar-Zvačko, L. (2000). *Oduzeto djetinstvo*. Zenica : Dom štampe.
25. Rakić, B. (1976). *Procesi i dinamizmi vaspitnog djelovanja*. Sarajevo: Svjetlost.
26. Sally M. R.; Callahan, C. M. (1996). My Boyfriend, my Girlfriend, or me: the Dilemma of Talented Teenaged Girls, *Journal of Secondary Gifted Education*, Vol. 7 Issue 4.
27. Schiefele, U. & Chikszentmihalyi, M. (1995). *Motivation and Ability as Factors in Mathematics Experience and Achievement*, *Journal for Research in Mathematics Education*, Vol. 26.
28. Shavinina, L. (2013). *The Role of Parents and Teachers in the Development of Scientific Talent: Lessons from Early Childhood and Adolescent Education of Nobel Laureates*, *Gifted and Talented International*, N. 1, Vol. 28.
29. Sternberg, R. J., & Lubart, T. (1995). *Defying the Crowd*. New York: Free Press.
30. Tannenbaum, A. J. (1986). Giftedness: a Psychosocial Approach. In R. J. Sternberg & J. E. Davidson (Eds.). *Conceptions of Giftedness* (pp.21-52). Cambridge: Cambridge University Press.
31. Waugh, R. (2001). *Creating a Scale to Measure Motivation to Achieve Academically Talented: Linking Attitudes and Behaviours Using Rasch Measurement*, *Australian Journal of Educational*.
32. Winebrenner, S. (2000). Gifted Students Need an Education, Too, *Educational Leadership*.

## **Appendix**

### Interview with participants

1. Where do you grew up (describe in more detail: village, town, city, ...)?
2. How many brothers and sisters do you have?



3. Specify your born order in your family!
4. What is your father's occupation?
5. What is your mother 's occupation?
6. Which school or university did your father study?
7. Which school or university did your mother study?
8. What is the socio-economic status of the family in which you grew up?
9. List all organized extracurricular school activities that you attended?
10. Describe how your family contributed to your rapid progress in mathematics!
11. List persons who mostly influenced the development of your mathematical abilities?
12. List persons who mostly supported you in your advanced development in mathematics?
13. How often do you discuss about your career and future plans with your parents, teachers or others?
14. How would your parents feel if you persist in even greater achievement in mathmetics?

**Interview with parents of participants**

1. What do you undertake to provide favorable conditions for the education of your child?
2. Which of the following activities are undertaken in order to provide optimal development of your child: ensureing free time for learning; ensureing adequate space for learning; providing adequate learning materials (books, magazines and other necessary accessories); ensureing private instructor; ensureing the attendance to certain courses, ensureing the other forms of education?
3. If you have personally helped your child in exercise and training of various school tasks at home (in the apartment) please describe how did you do it?
4. How did you feel when your child achieved exceptional successes in mathematics?
5. How do you encourage and incite your child in order to develop his/her mathematical abilities?
6. How did you react when your child often asks different types of questions?
7. Does your child help other children in training mathematical skills?

8. How do you treat him/her when he/she did certain mistakes or failures?
9. Do you monitor and control his/her learning and work at home?
10. How often do you verbally criticize your child for certain mistakes or failures?
11. What are your expectations when it comes to education of your child.
12. How do you express appreciation for efforts of your child?
13. Do you regularly track and monitor his/her learning in school?
14. Do you determine what your child learns?
15. Do you determine how your child learns?
16. Do you determine time for learning and time to play to your child?
17. How did you act when your child refuses orders?
18. If you noticed labeling of your child with some unpleasant names how did you react in such moments?
19. If there is any other variable that contributed to mathematical development of your child and that we have not mentioned it please briefly describe!