

The Multifactor Pedagogical Model of the Development of Giftedness in Children and Youth

*Elena Efimovna Merzon, Alexey Nikolaevich Panfilov,
Valentina Michailovna Panfilova and Olga Michailovna Shterts*

Kazan (Volga Region) Federal University, Elabuga, Russia

Abstract: The article is devoted to the questions of construction and realization of the multifactor pedagogical model of the development of giftedness in children and youth. Relying on modern foreign and domestic theories of giftedness accepted by the scientific community the multifactor model of the pedagogical development of giftedness in children and youth is offered. The empirical results of functioning of the developed model in real pedagogical process are presented in the article. The scientific and methodological base of the established pedagogical model of the development of giftedness in children and youth, the implementation of modern educational technologies in the organization of work in detecting, development and support of giftedness in children and youth are presented in the article. The variant of solving empirical tasks important for the realization of the given model is offered: 1) to determine the basic concept for further empirical research of the technical giftedness; 2) to create psychological and pedagogical technology of diagnostics and forecasting of the technical giftedness of children and young people; 3) to work on the psychological and pedagogical basis for the development of technically gifted children and youth. The pedagogical technology of the development of gifted children and youth in Elabuga Institute of Kazan Federal University is presented.

Key words: Pedagogical model of giftedness • Technical giftedness • Pedagogical technology of the development of giftedness

INTRODUCTION

Early detection, training and education of gifted children is a new task of improving the educational system of the Russian Federation [1], because the development of gifted children solves the urgent problem of formation of the creative potential of society, provides opportunities for intensive social, scientific and technological progress, further development of science and culture and all areas of production and social life.

The problem of giftedness is not new for pedagogy and pedagogical psychology. The studies conducted by domestic and foreign scientists demonstrated: 1) the complexity and multilevel structure of the phenomenon of giftedness, 2) the dependence of giftedness from the conditions of education and training, social environment of gifted children.

Among the most famous of modern foreign [2] and domestic models of giftedness which were the basis

for the creation of the developed world multifactor model for working with gifted children and youth the following can be mentioned:

- The multifactor model of K. Heller, "The Munich Model of Giftedness." It includes the following components: factors of giftedness; non-cognitive personality traits, environmental factors, personal achievements. This model we use both for evaluating the effectiveness of special educational programs for gifted students and to create the programs of development of special abilities (for example, the ability to technical creativity) [3].
- The five-factor model of A. Tannenbaum [4]. This is a psychosocial model, as the author suggests to classify gifted people by society's demand for them. This requires the interaction of the following factors in the development of giftedness: general intellectual abilities, specific abilities in a particular area; specific

characteristics of nonintellectual character (personality, volitional characteristics); stimulating environment that promotes the development of these abilities (family, school, etc.), random factors. We pay special attention to the "stimulating environment" element.

- "Working concept of giftedness." In it giftedness is defined as "a systematic developing during the life time quality of the psyche, which determines the possibility to achieve higher (unusual, uncommon) results in one or more activities in comparison with other people." The fundamental importance for working with gifted students has the statement about the existence of different types of giftedness. As well as the authors of the concept, we will use the term "the characteristics of the child's giftedness" that covers two aspects of behavior - instrumental (characterizing types of activities of gifted children) and motivational (reflecting the child's relationship to the particular side of reality, as well as to his or her own activity) [5].
- The dynamic theory of giftedness (the title suggested by L.S. Vygotsky. When constructing the multifactor model of the development of giftedness of children and youth we will stick to the dynamic approach. The problem of studying the dynamic aspects of the development of giftedness, determining specific psychological mechanisms and pedagogical conditions of this development moves to the forefront.
- The model of enriching the content of education. It can be used even in usual secondary schools. Within this approach the following two levels of the enrichment are defined: "horizontal enrichment" i.e. supplementing traditional curriculum with special integrated courses. "Vertical enrichment" of the content of education presupposes revising traditional educational programs. The educational possibilities of teaching material should dominate its information richness. Educational and cognitive activities should be carried out not by a predefined logical scheme; it should be carried out in accordance with the cognitive needs of pupils. However, it should contribute to increasing the number of cognitive interests of pupils and the level of development of productive thinking should correspond to the skills of its practical use [6].

In addition to the above models of giftedness one can mention the model of human potential by J.Renzulli

[7], the model of giftedness of F. Monks, the concept of creative giftedness of Torrance.

Psychological research which we relied upon demonstrated the complexity and the multi-level structure of the phenomenon of giftedness, its dependence on the conditions of the development of education and training, the social environment of gifted children.

At present, the pedagogical science and the pedagogical practice face the most important task: developing and improving scientific and methodological base, the implementation of modern educational technologies in the organization of work in the detection, development and support of gifted children and youth.

We offer the multifactor pedagogical model of developmental environment of gifted children and youth, which is implemented in an experimental variant by Elabuga Institute of Kazan Federal University.

This model is designed to achieve the following objectives:

- Form the scientific school in the area of pedagogy of giftedness;
- Increase the effectiveness of pedagogical, psycho-pedagogical, educational and social work in the field of early detection and support of the development of gifted children and youth;
- Provide the solution of the problems of development of gifted children and youth by means of objective sociological and statistical information;
- Construct, test experimentally and implement the technology of training and education that create conditions for the development of giftedness in children and young people in educational institutions.

The main features of the offered multifactor model of teaching gifted children and youth are presented in Table 1.

We consider giftedness to be a complex dynamic system. In the empirical study some components of this model reached the level of functioning: "Stage I" and "Stage II." One of the areas of our empirical study (Stage I of the model) was to study the effectiveness of the development of children's giftedness under conditions of "vertical enrichment." This work is carried out within the functioning of "Children's University" (further - CU) for children aged 8-12 years, network research laboratories, specialized children's camps in Elabuga Institute of Kazan Federal University.

Table 1: Multifactor model of the pedagogical development of giftedness in children and youth

Stage V of the Development of Giftedness:					
Professional and life self-realization					
Stage IV of the Development of Giftedness					
Readiness for life and professional self-identification					
Professional education taking into account the skills of school leavers					
Stage III of the Development of Giftedness: Grades 10-11					
Differentiation of senior pupils according to their interests and abilities					
Diagnostics and determination of priority areas for development					
The system of additional education	Elective courses in the educational institution (school, grammar school, etc.)	Scientific and practical seminars and conferences	Network profile groups, classes	Network laboratories (science, engineering, technology)	Subject Olympiads and competitions
Stage II of the Development of Giftedness: Grades 7-9					
Pre-specialization according to interests, abilities					
The system of additional education	Elective courses in the educational institution	Network profile groups, classes	Network laboratories (subject areas)	Subject Olympiads and competitions	The profile camp for teenagers (by the type of giftedness)
Intermediate forecasting of results					
Diagnostics of actual giftedness			Diagnostics of potential giftedness		Types of giftedness
Differentiation by the type of giftedness			Technical giftedness		
Stage I Of The Development Of Giftedness: Grades 1-6					
The system of work in training and education					
Children's University	Specialized laboratories	The specialized children's camp "IntelLeto"	The specialized children's camp "Hiyal"	Psycho-pedagogical and educational support (children, parents)	
The diagnostics of general giftedness					
The diagnostics of characteristics of special abilities					
Artistic giftedness	Objective and practical giftedness	Technical giftedness	General intellectual abilities	Social giftedness (leadership talent)	
Propadeutical Stage: Preschool Education					
The diagnostic minimum of detection of giftedness					
Psycho- pedagogical support of natural development of children					

From the students of grades 2-4 of secondary schools of neighboring to the institution human settlements groups of students of CU are formed. Diagnostic procedures involving children, parents and teachers are carried out on the basis of secondary schools. Education follows the annual cycle:

- Lessons in CU;
- Lessons in network laboratories in different subject areas;
- Developmental programs in specialized summer camps "IntelLeto" (for children with characteristics of the intellectual and technical giftedness) and "Hiyal" - "The Dream" (for children with characteristics of the linguistic giftedness);
- Group and individual psychological and educational support for children and parents (in-depth psycho-diagnostics, training sessions, psychological and pedagogical education, counseling parents, etc.).

The vertical enrichment is carried out in the following way.

- The area of the cognitive development: the complexity of the content of training activities through deeper and more abstract nature of the offered material (mini-lectures read by the leading specialists of the Institute), the priority of educational tasks of divergent type (open discussions - dialogues and polylogues are used), the developmental nature of teaching material; the implementation of educational activities in accordance with the cognitive needs of children (ongoing pedagogical monitoring of cognitive interests of children), the development of productive thinking skills is combined with the skills of its practical use (experiments in network laboratories); maximum expansion of interests (choosing topics for the lessons from different scientific fields).
- The area of the development of creativity: the dominance of the research practice; sticking to the intellectual initiative. Lessons for children in the network laboratories basing on the individual trajectories: the chemical laboratory - entertaining experiments; the physical laboratory - experiments

with electricity and magnetism, the study of the laws of motion, the physical properties of materials, the laboratory of robotics - building robots, controlling robots etc.

- The area of psycho-social development: high autonomy of educational activities ("students" of CU get specially designed teaching materials for self-study, the use of IT-technologies); the formation of abilities to be critical and loyal in the evaluation of ideas - the discussion nature of the content and interactive forms of organization of discussions, focusing on competitiveness (successful "students" after lesson are encouraged and receive prizes).
- Organizational and pedagogical area: the information enrichment of environment (the use of IT - technologies); combining individual educational and research activities with its collective forms.

Children's University has been operating in Elabuga Institute of Kazan Federal University for two years already. The number of junior "students" in 2010/11 academic year was 210 people, in 2012/13 - 250 people. This is an indirect indicator of the relevance of the functioning of Stage I of the multifactor pedagogical model of the development of giftedness.

Children who completed "the curriculum" of Children's University and teenagers who passed special testing are invited to specialized camps for children (SCC) "IntelLeto" and "Hiyal" where the work on the development of giftedness is continued. It includes: using various forms and methods of work with children (role-playing games, training, competitions, etc.); creating favorable psychological climate; the formation of the developmental heuristic environment. Conditions are created in SCC for versatile development of intellectual, academic, creative, artistic, technical and social skills. To make it possible activities in several areas in the work with gifted children and teenagers are organized.

The first area of work includes the development of cognitive and intellectual abilities and skills. In this area the activity is aimed at the development of the following qualities: criticality, independence, divergent thinking, observation, cognitive interest, the ability to analyze and draw conclusions. The work in SCC is organized in such a way that children and teenagers learn how to be a researcher. It is from this position that they will study an interesting scientific problem or a practical question.

The second area includes the development and the realization of creative talents, the development of

imagination. Children and young people are involved in creative activities: arts festivals, amateur arts festivals, competitions, role-playing games, training, etc.

The third area includes the development of communication skills and interpersonal interaction skills, the skills of reflection, the development of positive "self-concept", adequate self-esteem, the development of skills of collective creative thinking, the enrichment of social experience. An important condition in this direction is the use of different forms of work: role-playing games, free and thematic discussions, trainings in creativity and critical thinking, social and psychological trainings, etc.

The work of SCC "IntelLeto" and "Hiyal" in the development of the giftedness in children and teenagers is carried out according to specially designed educational programs. The programs provide the organization of heuristic developmental environment for children and teenagers, gifted in different areas (creative, linguistic, mathematical, technical skills), the effective methods of pedagogical and psychological work taking into account specific characteristics of gifted children and teenagers are selected. We believe that a specialized camp for children is an effective form of work with gifted children and teenagers because in camps it is possible to solve the problem of intensive observation of the dynamics of their development. One more important factor is that the participants are selected according to the criteria of giftedness (high intellectual abilities; creativity; quick digesting of information and a good memory; interest for new things; quest for knowledge; high personal responsibility, positive "self-concept") and mere communication between them is already developmental. Psycho-pedagogical atmosphere created in the camp is filled with the spirit of creativity, contributes to continuous scientific search and discoveries.

The interest to the programs implemented in specialized camps increases in children and parents. 2010 – 80 people, 2011 – 130 people, 2012 - 2 shifts with 100 people each; 2013 - 2 shifts with 130 people each.

On the basis of the ideas of giftedness of A. Tannenbaum and the needs of the Russian society in technically gifted people let us analyze "Stage II" of the development of giftedness in the model given above.

In recent years, the Russian society had a general tendency to growing prestige of engineering and technical professions. It is favorable for the revival and the development of industrial production and high-end technologies that are of key importance for the sustainable development of the Russian economy. From

this perspective, the development of children's technical giftedness plays an important role in the creation of new personnel reserve in engineering and technology for the industrial sector.

Our surveys taken from students, parents, representatives of industries show a change in the social order for engineering and technical training, which cannot be satisfied with the current condition of the development of scientific and technical creativity of children and young people.

At the enterprises of Russia today there is a shortage of engineering and design personnel and workers. The average age of engineers and highly skilled workers is 45 and older. Therefore, there is a great need in training and education of new young technically gifted working and engineering personnel to solve the most difficult high technology tasks.

In the process of practical implementation of the offered multifactor model, we solve the following interrelated tasks: 1) to determine the basic concept for further empirical studies of the technical giftedness; 2) create a psycho-pedagogical technology of diagnostics and forecasting the technical giftedness in children and young people; 3) to develop the psycho-pedagogical basis and to create the system of the development of technically gifted children and youth.

Solving the first problem, we rely on the following theoretical statements:

- The psychological model of the technical giftedness of Y.A. Shevchenko. It is compositionally and substantially resonates with the general model of giftedness of J. Renzulli [8] and includes such things as technical intelligence, technical creativity, activity-related components of technical abilities and the specific motivation of the individual [9].
- M.G. Davletshin found out that to solve professional tasks the engineer needs such qualities as observation, the development of eye estimation, spatial imagination, advanced technical thinking, rational approach to problem solving, skillful hands [10].

On the other hand, we rely on the list of qualities that ensure the success of professional activities of the engineer (based on the analysis of profессиogram of engineering specialties): technical abilities; mathematical abilities; the ability to apprehend a lot of information; the ability to compare and analyze multiple scattered facts;

the flexibility of thinking (the ability to change plans, ways of solving tasks under the influence of changes of the situation); visual and creative thinking; high level of concentration, distribution and stability of attention (the ability to be engaged in certain activities for a long time, to pay attention to several objects at the same time); a good memory (long, short); spatial imagination, the ability to accept and implement new things in practice; good eye estimation.

To select children for training programs in network laboratories of Elabuga Institute of Kazan Federal University the diagnostics by "potential technical giftedness" was held. The sample consisted of 180 students of grades 7, 8, 9 of secondary schools of Elabuga. On the basis of empirical data (using "Differential diagnosis questionnaire of E.A. Klimov") a focus group of 60 people was constructed. The focus group consisted of students who chose the profession of "man-techniques" type.

The battery of diagnostic techniques to detect "potential technical giftedness" includes:

- Bennett mechanical comprehension test;
- Intellectual lability test;
- Amthauer's intelligence structure test (subtests 7, 8, 9);
- Eye estimation and the peculiarities of attention (were diagnosed using the hardware-software system "Aktivatsiometr - AC-9K" Y.A. Tsagarelli).

The diagnostic data is presented in Tables 2,3,4,5.

The test subjects belonging to the category of "potentially technically gifted" in our study should have: high performance indicators in the test of mechanical comprehension; high lability; average and high results in subtests; good eye estimation.

The analysis of the received empirical data showed that we can consider that only 4 test subjects belong to the category of "potentially technically gifted" in our study. It means 6.6 %. The conclusion can be made that it is unreasonable to expect spontaneous development of technical giftedness in children in the process of their study at school. Therefore in addition to the actualization of the motivational factor (I want to be an engineer) the development of technical creativity and technical intelligence etc. are necessary for full development of the technical giftedness of the individual. Then the development of the technical abilities of children and young people at all levels of education becomes relevant.

Table 2: Bennett mechanical comprehension test

	Very low	Low	Average	High	Very high
Total	28%	35%	26%	12%	0%

Table 3: Intellectual lability test

	Low success	Low	Average	High
Total	10%	20%	50%	20%

Table 4: Amthauer's intelligence structure test

	Subtest 7 Spatial imagination	Subtest 8 Spatial generalization	Subtest 9 Memory, mnemonic abilities
Low	60%	100%	20%
Average	40%	0%	40%
High	0%	0%	40%

Table 5: Eye estimation

	Unsatisfactory	Below average	Average	Good	Excellent
Total	0%	10%	45%	45%	0%

We offer a solution to this problem based on multi-factor model of teaching gifted children and youth. In the network laboratories of Elabuga Institute of Kazan Federal University, children and teenagers have the opportunity for self-realization in the field of technical thinking. The training programs in sciences and technology aimed at creating conditions for full development of technical abilities in children. They will allow children to obtain new scientific knowledge and to acquire experience in realization of this knowledge; to develop interest to techniques, rationalization and inventions; to form the skills of work with complex technical and information devices; to contribute to professional self-identification.

Thus, the theoretical approach developed in the course of the research and the analysis of existing teaching practices allows to make the following conclusions: the complexity and multi-level structure of the phenomenon of giftedness in solving theoretical and practical tasks of the development of giftedness in children and youth needs to rely on multifactor models; to expect spontaneous development of a particular type of giftedness in children is pedagogically unreasonable and economically unprofitable; the models of regional social and pedagogical environment of the development of giftedness in children and youth and the technology of their realization may differ.

REFERENCES

1. The Federal Law of the Russian Federation from December 29, 2012 of No. 273-FZ "About Education in the Russian Federation". Date Views 09.07.2013 www.rg.ru/2012/12/30/obrazovanie-dok.html.
2. International Handbook on Giftedness, Date Views 07.06.2013 www.amazon.com/International-Handbook-Giftedness-Larisa-Shavinina/dp/1402061617.
3. International Handbook of Giftedness and Talent (2nd Edition) K. Heller, F. Monks, R. Sternberg and R. Subotnik, Date Views 09.07.2013 www.elsevier.com/wps/find/bookreview.cws_home/621018/review.
4. Tannenbaum, A.J., 1983. Gifted Children: Psychological and Educational Perspectives. NY: Macmillan.
5. Bogoyavlenskaya, D.B., V.D. Shadrikov, Y.B. Babaeva, A.V. Brushlinskiy and V.N. Drujinin, 2003. Working Definition of Giftedness. Moscow, pp: 95.
6. Babaeva, Y.D., 2013. The Main Approaches to the Problem of the Formation of the General Giftedness. Date Views 19.07.2013 www.zaoisc.ru/proekti/inf_podderj/babaeva-osn-podhod.html.
7. Renzulli, J.S., 1986. The Three-Rings Conception of Giftedness: A Developmental Model for Creative Productivity. R.J. Sternberg and J.E. Davidson (Eds.), Conceptions of Giftedness, Cambridge University Press, pp: 53-92.
8. Renzulli, J.S., 2002. Expanding the conception of giftedness to include co-cognitive traits and to promote social capital. Phi Delta Kappan, 84: 33-58.
9. Shevchenko Y.A., 2013. Psychological Model of Technical Giftedness as the Basis of Professional Selection and Training. Date Views 11.06.2013 www.edu.rosprav.ru/tezis/490.doc.
10. Davletshin, M.G., 1971. The Psychology of Technical Abilities, LSU, pp: 84.