Giftedness and its Development

Eva Trnová

Josef Trna

The authors:

doc. RNDr. Eva Trnová, PhD.

Faculty of Education,

Masaryk University

Brno

doc. RNDr. Josef Trna, CSc.

Faculty of Education,

Masaryk University

Brno

Podpořeno projektem FRMU, 1061/2015:

Vytvoření anglické verze předmětu „Nadání a jeho rozvoj“.

Content

Úvod

Foreword

Education of students with special educational needs including gifted is now in the spotlight. Today's schools are supposed to create an open, creative, encouraging and safe environment where all children can get an adequate level of education according their ability. But it is necessary to create conditions and appropriate approach that facilitate their successful education and satisfy their special educational needs. Especially adequate education of gifted students is important, not only for students but for society as well because they are the source of its development.

Traditionally, children with superior cognitive abilities (gifted) were identified as those who scored very high on intelligence tests and who performed exceptionally well on achievement measures. Today there is added emphasis on identifying children who may not score high on tests but who show superior gift and creative abilities. Also, there is greater concern for finding more suitable methods to identify those children in whom extraordinary potential may be suppressed because of environmental factors and/or lack of opportunity. Contrary to popular belief, children with areas of giftedness are found in all ethnic, racial, social, and economic groups.

The basic curricular document in the Czech republic, Framework Educational Programme for Elementary Education require schools to assist students to realise their full potential, to identify and remove barriers to achievement, and to identify and support those students with special needs including gifted. Framework Educational Programme for Elementary Education require all schools to identify gifted children and to develop and implement teaching and learning strategies to meet their needs.

An important factor for quality education of gifted students are teachers appropriately prepared to work with them. So the vocational preparation of teachers for this challenging work should start at the pre-servis education of future teachers. The aim of this work is to provide these students with basic information about the problems of education of gifted students.

1. Definition of Basic Concepts

1.1 Definitions of 'giftedness' and 'talent'

There are many different definitions of giftedness and talent. Some experts who are interested in this area understand the thesis of concepts in different way. In everyday communication these terms are often used identically. But some scholars in the field commonly use these two terms as synonyms, just like in the common expression: 'the gifted and talented are…'. Occasional distinctions between the two terms will take many forms, and give rise to a diversity of views and theories (Gagné, 2004).

There are differences in the use of these terms in different countries – in some of them both terms are used as synonyms, and in some of them these terms are perceived differently. Usually giftedness and talent are defined in following way.

Giftedness

Giftedness can be described as a natural aptitude or ability in any area, significantly in advance of what could be typically expected. In early childhood, giftedness involves advanced development beyond age-typical expectations, and a potential for advanced learning and achievement in one or more areas. The level of advancement is significant enough to require specific planning for the child's learning and care that accounts for their advanced capacities, so that they can experience wellbeing and achieve their full potential in all areas of development.

Talent

Talent is defined as achievement or performance at a significantly advanced level. Talents are linked to specific domains or areas of expression, such as musical or artistic talent, athletic skill or academic talent. In the early childhood period, however, development is very holistic and fluid, and rarely specialised in a particular domain.

Giftedness leads to talent

The implication of the model is that while very young children may have gifted potential that may be later expressed as specialised talents, it is not usually possible or useful to identify specific domains where a young gifted child may end up developing talent. For example, a four-year-old child may show a capacity to create elaborate paintings that show a strong sense of colour and form. These may be based on abilities such as perceptual sensitivity, creativity and imagination, capacities to observe and focus, and to learn. Such abilities could potentially form the basis of talent in a number of domains such as music, science, writing, architecture, and technical skills.

To identify this child as 'artistically talented' may lead to narrowing the focus of the development of this child's potential. This is not to say that families and educators would not encourage and support this child's development in art. Rather, it is to emphasise that we should be careful of saying in regard to a young child "This is their talent". Young children should be supported in all areas of their development, and as they mature the child's own interests and motivations should naturally lead into the appropriate areas of specialisation in the school years.

This means that giftedness is the potential for high achievement, and talent refers to the development of that potential into performance. Gifted children in the early childhood period and the first years of school will have the potential for high-level achievement. They will

usually be at the stage where this potential can be nurtured and supported to begin to develop their talent or talents in specific areas.

Authors of this text understand both terms 'giftedness' and 'talent' in accordance with National Association for Gifted Children in following meaning: (http://www.nagc.org/resources-publications/resources/definitions-giftedness):

"Gifted individuals are those who demonstrate outstanding levels of aptitude (defined as an exceptional ability to reason and learn) or competence (documented performance or achievement in top 10% or rarer) in one or more domains. Domains include any structured area of activity with its own symbol system (e.g., mathematics, music, language) and/or set of sensorimotor skills (e.g., painting, dance, sports)."

1.2 Basic definitions

The problem with determination the only valid definition shows the fact that the in US there are own definition of giftedness in every State and these definitions also change over time (*http://www.freepatentsonline.com/article/Exceptional-Children/59017865.html*).

Furthermore, federal definition is determined:

US Federal Definition of Gifted and Talented

"The term gifted and talented, when used with respect to students, children, or youth, means students, children, or youth who give evidence of high achievement capability in such areas as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services or activities not ordinarily provided by the school in order to fully develop those capabilities." (No Child Left Behind Act, P.L. 107-110 (Title IX, Part A, Definition 22) (2002); 20 USC 7801(22) (2004))

In 1957, American educators DeHaan and Havighurst ((1961) identified six fields in which high ability may occur:

- *intellectual ability,*
- *creative thinking, scientific ability;*
- *social leadership;*
- *mechanical skills;*
- *talent in the fine arts.*

DeHAAN, R. F., HAVIGHURST, R. J. *Educating Gifted Children*. Revised edition. Chicago : University of Chicago Press, 1961.

It was in response to the Russians who had just launched Sputnik. The United States passed the National Defense Education Act, which encouraged and supported the identification and encouragement of young people with special talent in science and maths. In 1971, three years after the Americans put a man on the moon, the United States Office of Education, under its Commissioner of Education, S. Marland, altered and expanded DeHaan and Havighurst's categories of giftedness and talent to reflect the changed priorities. This has become known as the Marland definition:

'Gifted children are those capable of high performance with demonstrated achievement and/or potential ability in any one of the following areas, singly or in combination:
general intellectual ability
specific academic aptitude
creative or productive thinking

visual and performing arts
leadership ability
psychomotor ability' (Marland, 1972, p. 2).

Marland, S. P. (1972). *Education of the gifted and talented, Volume 1, A report to the Congress of the United States by the US Commissioner of Education*. Washington, DC: US Government Printing House.

In the following text a selection of definitions created by the recognized experts is presented.

J. Freeman (1998), one of the founders of the International Society ECHA (European Council for high ability, their research and development) gives following definitions of giftedness:

"Talented are those who have an extremely high level of activity, whether in the whole range or in a limited area, or those whose potential has not yet been through tests or experts recognized. There is a difference between the apparent talent of children, adolescents and adults. Talented children are usually perceived as faster development compared to their peers. Adult's talent is seen in the high level of activity, based on many years of hard work in their chosen fields. Talent may apply simultaneously to several areas, such as intellect, art, creativity, movement and social skills, or may be limited to one or two of them. But the potential, whatever it may develop into an extremely high level of activity only in terms of providing adequate equipment and psychological learning opportunities. Discussion on the precise definition and identification of such children have been running for nearly a century and will no doubt continue. For education is more productive (and more scientific) to assess success in terms of the dynamic interaction between the individual and educational opportunities, which he received in his life. Children who have the potential for extremely high level of activity may need such training conditions as non-specialized schools cannot offer."

FREEMAN, Joan. *Educating the Very Able.* Ofsted, London, 1998.

Other world-renowned expert J. S. Renzulli defines talent following way:

"Giftedness consists of an interaction among three basic clusters of human traits - these clusters being above average general abilities, high levels of task commitment and high levels of creativity. Gifted and talented children are those possessing or capable of possessing this composite set of traits and applying them to any potentially valuable area of human performance. Children who manifest or are capable of developing an interaction among the three clusters require a wide variety of educational opportunities or services that are not ordinarily provided through regular instructional programs." (Renzulli, 1986, p. 54).

Renzulli, J. S. (1986). The three-ring conception of giftedness: A developmental model for creative productivity. In R. J. Sternberg & J. E. Davison (Eds.). *Conceptions of giftedness* (pp. 53-92). New York: Cambridge University Press.

A. J. Tannenbaum (1983) defines talent as:

> *"If we consider that the developed talent exists only in adults, then the proposed definition of talented children were formulated to indicate their potential to become established artists or major producers of ideas areas of activities that enhance the moral, physical, emotional, social, intellectual and aesthetic life of humanity."*

A. J. Tannenbaum also suggested five factors that determine and define giftedness. It is necessary the presence of all five factors to manifest giftedness.

These are:

- *superior general intelligence;*
- *unique special abilities (exceptional special attitudes);*
- *no intellective facilitators;*
- *effects of the environment (Environmental Influences);*
- *chance or luck.*

It is necessary the presence of all five factors to manifest giftedness and the absence of only one of them can cause that giftedness does not manifest.

TANNENBAUM, Abraham J. Gifted children: Psychological and educational perspectives. New York: MacMillan, 1983. p. 86.

Organization the Javits Act (NAGC, 2012) looks up on talented from a different perspective, because it provides grants to educational programs for bright children from poor families. Therefore talented children are understood as individuals, which need extra services for their own development:
"The terms talent or gifted children refer to children and adolescents who demonstrate the ability of higher performance in areas such as intellectual, creative, artistic, or leadership talent, or in certain theoretical areas. These are students who are to fully develop their capabilities necessary to provide services or activities for further development, which are not commonly provided in mainstream schools. "

NATIONAL ASSOCIATION FOR GIFTED CHILDREN. *The Javits Act* [online]. [quote 2012-04-07]. Dostupne na: http://www.nagc.org/

F. Gagné (1985, pp 105) is one of experts who distinguish giftedness from talent:

"The concept of giftedness means the ownership or use of untrained and spontaneous natural ability in at least one dominant area to level among the top 10 percent of their peers. On the other hand, talent points to greater mastery of systematically developed abilities, skills and knowledge in at least one area at a level between 10 percent of those peers who are actively engaged in the area. This model represents the five areas of talent: intellectual, creative, socio-affective, sensorimotor and „others" (i.e. extra-sensory perception). These natural skills that have a clear genetic basis, are reflected in the performance of all the tasks with which the child is struggling in school. "

Gagné, F. (1985). Giftedness and talent: Reexamining a reexamination of the definitions. Gifted Child Quarterly, 29, 103–112.

It is also necessary to mention how Czech and Slovak experts define talent and giftedness. V. Dočkal (1987, pp 16) defines giftedness very shortly: *"Giftedness is the complex of all the properties that are involved in the implementation of activities is relatively stable component of personality that regulates the performance of the activity."*

Dočkal, Vladimir a kol. *Psychológia nadania.* Bratislava: SPN, 1987.

J. Škrabanková (2012, pp 14) prefers the term talented pupil and uses it in the following meaning:

"The term talented pupil indicates the student diagnosed with potential features and capabilities in intellectual, social, sensorimotor or aesthetic area in which exhibits a repeated performance beyond the normal population and this potential is able to develop and apply."

Škrabánková, J. (2012). Žijeme s nadáním. Ostravská univerzita v Ostravě, Pedagogická fakulta.

According to the authors' opinion gifted individual means the child with demonstrated potential abilities of high performance capability and who needs differentiated or accelerated educational services. It is necessary to create appropriate educational opportunities for him/her. The child, who meets these criteria is estimated to constitute 3 to 5 percent of the school population. The gifted children with superior cognitive abilities are usually identified as those who score very high on intelligence tests and who perform exceptionally well on achievement measures. There is great concern for finding more suitable methods to identify those children in whom extraordinary potential may be suppressed because of environmental factors and/or lack of opportunity. It should be emphasized that, children with areas of giftedness are found in all ethnic, racial, social, and economic groups.

So who are the gifted? We can conclude:
• Briefly, the gifted are those with exceptional abilities compared to most other people of the same age.
• Those individuals have certain learning characteristics that give them the potential to achieve outstanding performance.
• Children who exhibit characteristics of giftedness have learning needs that are significantly different from those of other children.
• They require different opportunities and may need emotional and social support to realise their potential.

Questions:
1. Is talent synonymous with giftedness?
2. Who of experts distinguishes giftedness from talent?
3. How many definitions of giftedness exist (approximately) in the US?

GIFTED AND TALENTED EDUCATION -
http://www.det.act.gov.au/__data/assets/pdf_file/0011/587306/Giftedness-and-Talent.pdf

Models of giftedness

There are more models of giftedness but they are not all universally known and accepted by teachers. Three of the best known models of giftedness will be introduced in the following

text: Gagné's Differentiated Model of Giftedness and Talent (DMGT), Renzulli's 'three-ring' model and Tannenbaum's 'sea star' model.

Gagné's Differentiated Model of Giftedness

The Gagné model was first published in 1985 and it has gained wide acceptance internationally, because according to experts it is practical, research-based and teacher-friendly. This model underlines that development of giftedness is not automatic and that, unfortunately, many gifted children fail to develop their high ability into high achievement. How mentioned above, F. Gagné distinguishes giftedness from talent, which is also evident from his model. Gagné defines, as gifted, children or adolescents who have the potential to perform, in some area of human ability, at a level more usually achieved by learners some years older. It defines as talented learners whose achievement or performance is already at this higher level. The model alerts teachers to the further learning needs of learners who are already talented achievers but even more importantly it draws their attention to the needs of gifted underachievers - learners who certainly have high ability but who, for some reason, have not yet been able to translate their potential into performance.

A diagram of Gagné's Differentiated Model of Giftedness is below (Figure 1). It has three columns, with gifts on the left hand side, talents on the right hand side and catalysts that impact the developmental process in the centre. A child's gifts are turned into talents through the developmental process. Gifts are divided into two groups: mental (intellectual, creative, social and perceptual) and physical (muscular and motor control). Talents are in the fields of: academic, technical, science and technology, arts, social service, administration/sales, business operations, games, sports and athletics. Gifts are developed into talents through the developmental process. The developmental process, designed to nurture and develop gifts into talents, has six main elements:

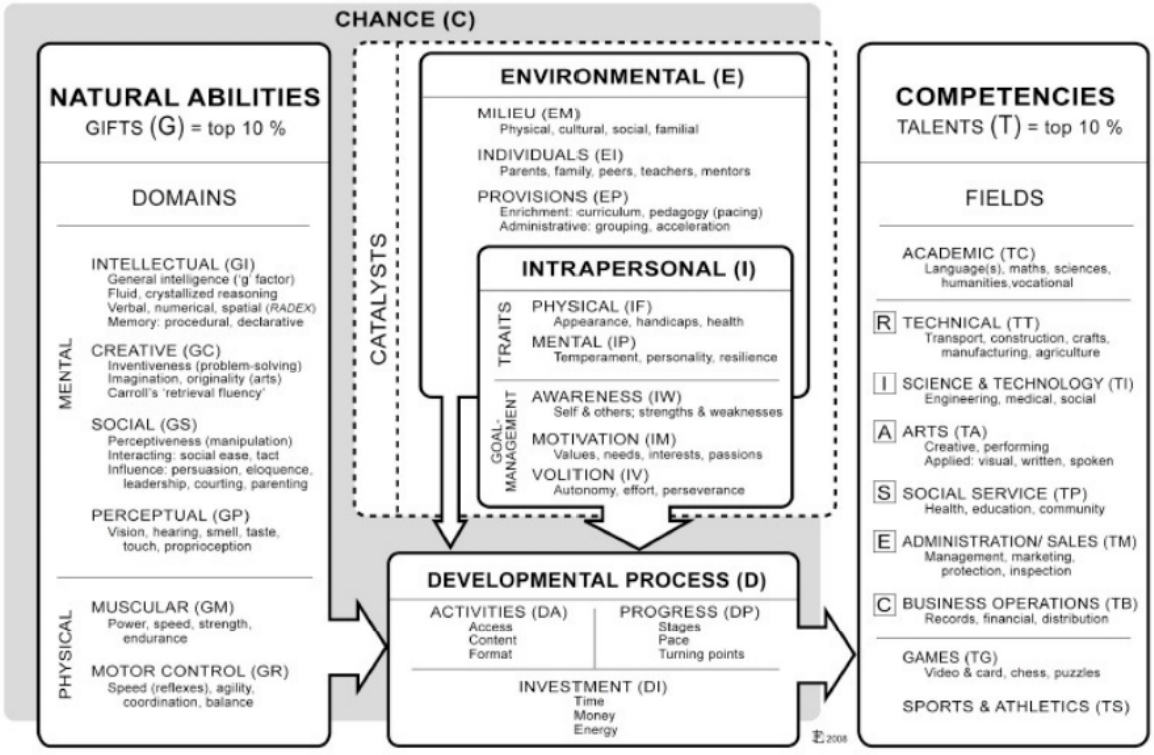
1. Enriched curriculum or training program
2. A clear and challenging excellence goal
3. Selective access criteria
4. Systemic and regular practice
5. Regular and objective assessment of progress
6. Personalized accelerated pacing (Gagné, 2008).

The poor development process can be reason, why a gifted student may not become talented. Learners performing at very high levels exhibit innate gifts that if nurtured and developed often lead to the manifest of talent. Gagné's Differentiated Model of Giftedness shows where the child – and the child's family – can be influential.

In the centre of the model, between gifts and talents, are the catalysts. Catalysts are the important aspects of the learner's environment, both external and internal, that impact their development. The developmental process can be influenced through the way catalysts are managed either directly or indirectly by the child's family; for example, a child's potential can either be developed or hindered by environmental and intrapersonal catalysts. Nurturing and developing gifts into talents involves a complex, structured program of activities over a period of time and depends on the individual child's level of giftedness and need.

By placing the child's learning at the heart of his model, Gagné puts teachers, in the driving seat. Gagné makes it clear that a child's learning will not progress optimally unless he/she has the ongoing support of the school. Teachers have the opportunity - and the obligation - to identify the abilities of the gifted students in their classes and schools and to assist these young people to develop these high abilities into high achievements.

Further information on Gagné's Model of Giftedness and Talent can be found at http://gagnefrancoys.wix.com/dmgt-mddt.



Fifure 1 Gagné's Differentiated Model of Giftedness is below (http://gagnefrancoys.wix.com/dmgt-mddt).

Renzulli's 'three-ring' model

This module was developed in 1975. At the time when Renzulli came to develop his own model the emphasis on the development of science giftedness had gone. Educators were now encouraged to identify and foster all areas of specific academic ability. He wisely affirmed that giftedness was multi-dimensional and could be sited in any area of human ability. However, he placed a new and strong emphasis on the role of creativity and introduced a third factor, which he termed 'task commitment' - 'perseverance, endurance, hard work, dedicated practice, self-confidence and a belief in one's ability to carry out important work' (Renzulli, 1986, p. 69). Task commitment is a very specific form of motivation focussed on the task in hand (see Figure 2).

It might appear that this model has the potential for identifying a wider range of children as gifted than does the Gagné model. But it's not as clear cut as it seems. According to Renzulli's later writings, when he is talking about 'above average' general abilities, he is not referring to the upper 50% of children. He is referring to the top 15- 20% of people in any area of human effort (Renzulli, 1986). That's not very different from Gagné's 10-15%.

What is important, Renzulli underlines that none of the three 'clusters' of traits mentioned above is by itself sufficient to define a child as gifted. Above average ability isn't enough by

itself, nor is creativity, nor is task commitment. Only the interaction among the three clusters can lead to creative/productive accomplishment (Renzulli, 1987, p. 182).

The strong disadvantage of the Renzulli model is its ambiguity. For teachers in schools it is very difficult according to Renzulli model indentify a giftedness. Maybe the reason is, that according to the Renzulli model, gifted children are 'those possessing or capable of possessing' the three clusters of traits - but 'potential possession' of motivation or creativity is by no means easy to assess. The premise that gifted children have all three characteristics (ability, creativity and commitment) has been based on observation of successful, creative adults hence the model completely ignores gifted children with great potential who are demotivated and/or underachieving for whatever reason. An added difficulty is Renzulli's assertion that a child 'earns the right' to special services by displaying the above-average ability, high levels of task commitment and high levels of creativity that are the 'necessary ingredients' of giftedness (Renzulli & Smith, 1980, p. 10). Should a child have to earn the right to an appropriate education? If it is the interaction between the three 'necessary ingredients' that makes giftedness, what about a child who has extraordinary ability but who is seriously demotivated and not performing in the classroom? Equally, what about the child who is very bright, academically successful and highly motivated but who has very little creativity - certainly not the 'high levels' prescribed by Renzulli. Are these students gifted or aren't they?

It needs to remember that Renzulli does not built his model on the characteristics of gifted children but on the characteristics of 'creative/productive' adults (three groups of architects studied by MacKinnon in the 1950s). The Renzulli model was developed in the United States at a time when information about underachieving gifted students was not so known. But demotivated, bored gifted children who are required to work, in school, at levels far below their ability are not necessarily task committed. It's difficult to commit to a task if it doesn't engage their interest. It's hard to become excited about engagement in work they was adequate for their capability months or years before.

When we copare the models mentoioned above, Renzulli and Gagné differ in view on talent and gifttedness. Renzulli has described children who are intermittent producers as 'moving in and out of giftedness'. Gagné would say they are gifted but moving in and out of talent. Renzulli's 'three-ring model' may be most successful in identifying children whom Gagné would call talented; young people who are successful, motivated achievers who have also been able to bring a creative feel - something new - to their work. Perhaps the three-ring model should be seen as a model of something to work towards; the synthesis of high ability, an enthusiastic commitment to work at something that is genuinely worthwhile committing to, and the capacity to contribute to one's field of talent as well as take from it.

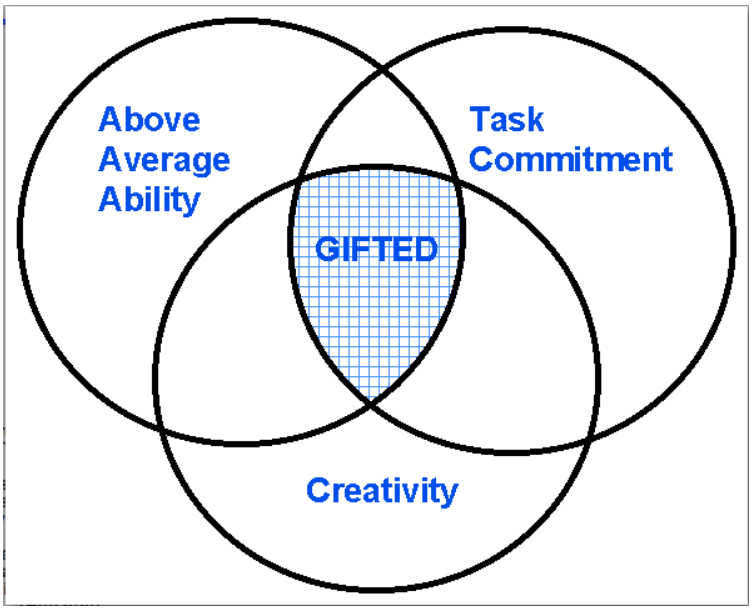


Figure 2 Joseph Renzulli's 'three-ring' model of giftedness (Renzulli, 1986, p. 69)

Abraham Tannenbaum's 'sea star' model of giftedness

This model developed by A. Tannenbaum in 1983. Model was described in the book 'Gifted children: Psychological and educational perspectives' (Tannenbaum, 1983) which presented one of the best analytical reviews of the research literature in gifted education available at that time. Tannenbaum's model was solidly grounded in psychological and educational research on the characteristics of gifted individuals. This model aims to identify children and adolescents who have the potential for 'becoming critically acclaimed performers or exemplary producers of ideas'. The specificity of this view of giftedness means the model is designed to be fairly restrictive. The model is holistic because it goes beyond identifying general and specific abilities, to include personality attributes and environmental interactions.

Tannenbaum's model is illustrated in a sea star design (Figure 3). It allows for potential as each arm of the sea star has both a static (child as they are currently) and dynamic (learning/changing) element. This model does not attribute more value to any one area and allows for infinite combinations of each but all five must be present for an area of giftedness to develop. Tannenbaum chose five internal and external variables that when combined produce giftedness: general ability, special aptitude, nonintellective requisites, environmental supports and chance.

Similarly to Renzulli's model this model aims to the interaction of several variables and all must be present in order to facilitate giftedness. Tannenbaum suggests that while different areas of giftedness may require different combinations of mentioned factors a serious deficiency in any one element cannot be compensated for by the other four factors.

Like Gagné's Differentiated Model of Giftedness and Talent, which it preceded by only two years, Tannenbaum's sea star model of giftedness deals with the relationships between ability and achievement - 'the links between promise and fulfilment' (Tannenbaum, 1983, p. 95) - and clearly identifies the roles of both the child's personality and the environment in which

he/she is brought up and educated. Unlike the Renzulli's model, which was derived from the characteristics of creative, productive adult achievers, Tannenbaum's model is firmly based on the characteristics of highly able children and adolescents.

Tanennbaum (1983, p. 86) states:
*"Keeping in mind that developed talent exists only in adults, a proposed definition of giftedness in children is the **potential** for becoming critically acclaimed performers or exemplary producers of ideas in spheres of activity which enhance the moral, physical, emotional, social, intellectual or aesthetic life of the community."*

Tannenbaum believes that children and adolescents who have the potential to be successful gifted adults not only require the general and specific abilities mentioned in some of the earlier definitions of giftedness, but also must have facilitative personality attributes and some 'special encounters with the environment' to foster the emergence of giftedness. The five internal and external variables that 'mesh into excellence' are illustrated by mentioned sea star design with giftedness produced by the overlap of all five factors.

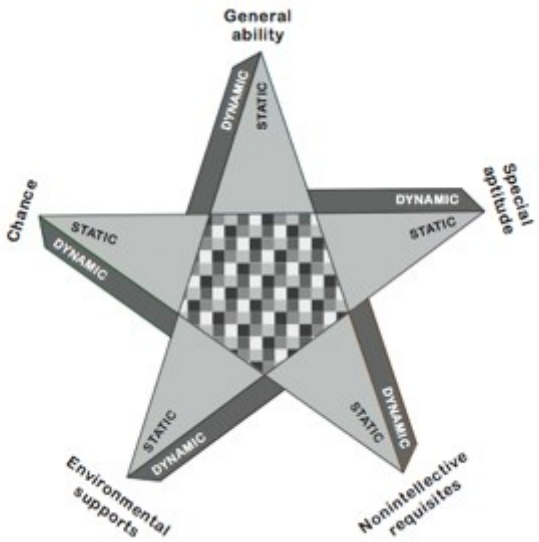


Figure 3 Abraham Tannenbaum's 'sea star' model of giftedness (Tannenbaum, 1983)

Tannenbaum explains five internal and external variables in following way (Gross et al, 2005, p.17-18).

General ability
Tannenbaum points out that the 'g' factor, or testable general intelligence, features to some degree in all talent areas. He adds, however, that different levels of intellectual ability are required for various kinds of accomplishment. Very high levels of abstract reasoning ability may be required for certain activities - certain areas of academic study, for example – while somewhat lesser degrees may be required for other activities.

Special ability
For an individual to emerge as gifted, his reasoning ability must be anchored in some specific aptitude. As well as the capacity to think well, gifted people must have special capacities and affinities for particular kinds of work. Some special abilities can be identified in

children in the very early years; others do not become apparent until much later in childhood.

Non-intellective factors
Ability alone will not produce outstanding accomplishment. Tannenbaum points out that this requires a confluence of various non-intellective facilitators such as motivation, a secure self-concept, the capacity to stay on task, 'the willingness to sacrifice short-term satisfactions for the sake of long-term accomplishment' (p. 88), sound mental health, the desire to show and share one's talent, and many others.

Environmental factors
Tannenbaum identifies many environmental influences which dictate not only the degree to which the child's ability will be permitted to develop but even the kinds of talent that a society is willing to honour (or tolerate?) and the amount of investment that the society is willing to make in the cultivation of these talents. These environmental influences include not only the child's family, peer group, school and community, but also the economic, legal, social and political institutions of the country in which the child is being brought up and educated.

Chance factors
The influence of chance can be crucial to the emergence of an individual's talent, yet it had not been addressed by previous researchers in gifted education. Chance factors are those entirely unpredictable events in a person's life which can be critical in permitting exceptional potential to be recognised or encouraged. It may be that the student finds exactly the right teacher at exactly the right stage of her talent development. It may be, on the other hand, that the job market in a young person's area of talent unexpectedly closes up, so that there is no opportunity for him to fulfil his promise. As Tannenbaum points out, 'The unexpected can originate anywhere, in the economy, the social milieu, the workplace, the family, and even within the body itself when there is a sudden change in a person's health status that can affect a career'.

The Tannenbaum's model has both static and dynamic elements. Static elements describe the child as she is at the moment - how she stands in comparison to others at a particular stage in time. However, her level of maths, science or reading achievement, her state of health, and her relationships with family or classmates may well change over time. Dynamic elements, therefore, refer, among other things, to the processes of learning and the social and educational processes, which effect the child and which cause, or may lead to, change.

While earlier definitions such as those of DeHaan and Havighurst, Marland, and, to some extent, Renzulli, were, in the main, listings of the traits or constituents of giftedness, Tannenbaum's model reveals the complex and subtle interweaving of the individual's general and special abilities with personal and environmental variables, moderated by random factors which can support or defend the overturning of promise into fulfilment.

In later versions of the Tannenbaum's model (Tannenbaum, 2003) Tannenbaum expands on the characteristics of the two broad types of gifted people he identifies as producers and performers. Producers are people who develop either things or ideas. Performers interpret or recreate these things or ideas. Both producers and performers can operate either creatively (bringing something original or new to the process) or proficiently (operating with high levels of skill). Tannenbaum identifies four main areas of human productivity and proficiency: thoughts and ideas and tangibles (something physical that can be seen, heard, tasted, etc.)

which are developed by producers; and staged artistry and human services which are provided by performers.

In the context of Abraham Tannenbaum's 'sea star' model of giftedness it is necessary to have in mind especially (Gross et al, 2005, p.19):
• *Firstly, the four categories of activity listed above are not intended as a hierarchy. Tannenbaum does not view any one of the four as more valuable than the others to human society; nor does he rate producers above performers (or vice versa) or creativity above proficiency (or vice versa).*

• *Secondly, Tannenbaum's view of giftedness is the **potential** for **adult** productivity as either a producer or performer. Very few individuals would completely fulfil their potential in any area, as either a producer or performer, in their childhood or adolescent years. The sea star serves as a guide to the qualities and interventions that the child must possess or experience if her potential is to be translated into performance in later years.*

Questions:
1. Which model do you believe would be most useful and practical in your school setting?
2. What are the main similarities between the Tannenbaum, Renzulli and Gagné models of giftedness and in what ways do they differ?
3. What are the main criticisms that have been levelled at the Renzulli 'three-ring' model of giftedness?

Renzulli, J. S. (1986). The three-ring conception of giftedness: A developmental model for creative productivity. In R. J. Sternberg & J. E. Davison (Eds.). *Conceptions of giftedness* (pp. 53-92). New York: Cambridge University Press.

Renzulli, J. S. (1987). What makes giftedness ? Re-examining a definition. *Phi Delta Kappan*, 60, 180-184, 261.
Renzulli, J. S. & Smith, L. H. (1980). The revolving door

Tannenbaum, A. J. (1983). *Gifted children: Psychological and educational perspectives*. New York: Macmillan.
Tannenbaum, A. J. (2003). Nature and nurture of giftedness. In N. Colangelo & G. A. Davis (Eds.) *Handbook of gifted education* (3rd edition) (pp. 45-59). Boston: Allyn and Bacon.

(Gross, M. U. M., MacLeod, B., Bailey, S., Chaffey, G., Merrick, C., & Targett, R. (2005). Gifted and talented education: Professional development package for teachers)

Gagné, F. (1985). Giftedness and talent: Reexamining a reexamination of the definitions. Gifted Child Quarterly, 29, 103–112. Gagné, F. (1998). A proposal for subcategories within the gifted or talented populations. Gifted Child Quarterly, 42, 87–95. Gagné, F. (1999). The multigifts of multitalented individuals. In S. Cline, & K.T. Hegeman (Eds.), Gifted education in the twenty-first century: Issues and concerns, (pp. 17–45). Delray Beach, FL: Winslow Press. Gagné, F. (2003, November). Self-management: A crucial catalyst. Paper presented at the 50th annual conference of the National Association for Gifted Children, Indianapolis, IN. Gagné, F. (2004). Transforming gifts into talents: The DMGT as a developmental theory. High Ability Studies, 15, 119–147. Gagné, F. (2009). Building gifts into talents: Detailed overview of the DMGT 2.0. In B. MacFarlane, & T. Stambaugh, (Eds.), Leading change in gifted education: The festschrift of Dr Joyce VanTassel-Baska. Waco, TX: Prufrock Press. Gagné, F., & St Père, F. (2002). When IQ is controlled, does motivation still predict achievement? Intelligence, 30, 71–100.
Gagné, F. (1998). A proposal for subcategories within the gifted or talented populations. Gifted Child Quarterly, 42, 87–95.

Gagné, F. (2003). Transforming gifts into talents: The DMGT as a developmental theory. In N. Colangelo & G. A. Davis (Eds.), Handbook of gifted education (3rd ed.), pp. 60-74. Boston: Allyn and Bacon. Gagné, F. (2005). From gifts to talents: The DMGT as a developmental model. In R. J.

Sternberg and J. E. Davidson (Eds.), Conceptions of giftedness (2nd ed.), pp. 98-119. New York: Cambridge University Press. Gagné, F. (in press). The differentiated model of giftedness and talent (DMGT). In J. S. Renzulli, E. J. Gubbins, K. McMillen, R. D. Eckert, & C. A. Little (Eds.), Systems and models for developing programs for the gifted and talented (2nd ed.). Mansfield Center, CT: Creative Learning Press.

2. Characteristics of Gifted Children

The gifted children are not a homogeneous group, and every child possesses a unique blend of traits. However, when we look at gifted children as a group, we can see clusters of common characteristics. The last century has seen a significant shift in how theorists view giftedness in children and subsequently how practitioners should identify it. During the 20th century gifted children were solely identified by academic achievement i.e. those who scored within the top 1% on the Stanford-Binet Intelligence Scale. But the last 30-40 years of research into gifted education has shown that performance based definitions of giftedness are insufficient. Traditional approaches fail to identify three main groups of gifted children:

1. Children who have not managed to translate their above average ability into above average achievement for a variety of possible reasons.

2. Children whose above average ability is masked by a learning or physical disability, known generally as Twice Exceptional Students.

3. Traditional approaches only value academic intelligence and generalise performance, masking peaks and troughs due to specific abilities - alternative intelligences are not respected.

That why practitioners need to know characteristics of gifted children, what allows to them identification of a range of their special abilities and potential abilities. Many teachers are unwilling to recognize some children as 'gifted' because they believe it implies these children have more worth than others and they fear elitism. This common opinion arises from a basic misunderstanding about the purpose of gifted education. Unless developing of giftedness, society loses a great value. There are common myths and misconceptions concerning to giftedness. The best known of them are:

- We don’t have any gifted students at our school.

Gifted students are present in every school. Children are not homogenous! In any school regardless of gender, ethnicity or socioeconomic class there will be stand out students. Giftedness may vary from school to school and is not specific to one area of intelligence.

- We believe that every child has special abilities

Everyone has a personal strength, an area where they excel, but this is not the same as having a gift. Equally a personal weakness does not characterize a disability.

- Gifted students should excel in everything they do

Often a students gift may be specific to one area, for example talented runners are not necessarily good at rugby, just as talented poets don't necessarily have good handwriting.

- Special programs for gifted students are elitist

As explained above catering for the gifted is a matter of need not worth.

- Gifted students will make it on their own without any extra help

Without support gifted students can fail due to a wide variety of factors including boredom.

The stereotype of the child who is gifted as a puny, bespectacled, shy, retiring type has not been confirmed in studies. In fact, children who are gifted tend to be physically superior, outgoing, and well liked by their peers. Although most will not exhibit all the characteristics that follow, many will show evidence of several.

Common characteristics of gifted:

1. Children who are gifted usually have very long attention spans. They can remain absorbed in study much longer than most children. In fact, they may rebel against time limits that characterize most educational design.
2. Most seem to learn basic skills faster and with less practice.
3. Most possess a large vocabulary. Personal histories usually reveal that, as infants, they began to talk earlier and used complex sentences earlier than the average child.
4. They are extremely curious and continually question not only who, what, where, and when, but why and how at a very young age.
5. Their sense of humor favors puns and riddles.
6. They often exhibit moral and social concerns (e.g., foreign policy, economics, and environment) typical of much older individuals.
7. Their ideas are often considered to be "far out."
8. They usually show aptitude in one or more areas of artistic endeavor.
9. They have a need to work independently on some projects.
10. They prefer discovery and creative approaches to learning. Those who are reading oriented often demonstrate almost total recall of information learned through this medium.
11. Their leadership abilities tend to surface quite early. They will often dominate ideas and procedures in group projects.
12. At a very early age, many have demonstrated empathy for the handicapped and those less fortunate than them.

Pupils who fit into this group are more likely to:

- think quickly and accurately;
- work systematically;
- generate creative working solutions;
- work flexibly, processing unfamiliar information and applying knowledge, experience and insight into unfamiliar situations;
- communicate their thoughts and ideas well;

- be determined, diligent and interested in uncovering patterns;
- achieve, or show potential, in a wide range of contexts;
- be particularly creative;
- show great sensitivity or empathy;
- demonstrate particular physical dexterity or skill;
- make sound judgements;
- be outstanding leaders or team members;
- be fascinated by, or passionate about, a particular subject or aspect of the curriculum; and
- demonstrate high levels of attainment across a range of subjects or within a particular subject or aspect of work.

Gifted learners differ not only from standard population but also among themselves. The designations of the learner as 'moderately', 'highly' or 'exceptionally' gifted is not a matter of 'labelling' the student. Rather it is a recognition that a group of gifted students can differ as much, or even more, among themselves as would a group of average ability students, and that different levels of ability require different types and levels of response. There are many different classifications of levels giftedness. Bellow some of them are presented. Gagné (1998) Gagné, F. (1998). A proposal for subcategories within the gifted or talented populations. Gifted Child Quarterly, 42, 87–95 regards children as gifted, if their ability levels are located in the top 15% of the population for their age. In terms of intellectual ability, this means IQ of 115 or above.

In Table 1 levels of giftednees together with prevalence and programming options prepared by Feldhusen and Jarwan (2000) are introduced. Feldhusen, J.F. & Jarwan, F.A. (2000). Identification of Gifted and Talented Youth for Educational Programs. In K.A. Heller, F.J. Mönks, R.J. Sternberg & R.F. Subotnik (Eds.),

Table 1 Levels of giftedness according to Feldhusen and Jarwan (2000)

Levels of giftedness (IQ)	**Prevalence**	**Programming Options**
Mildly (115 – 129) (basically)	1:6 to 1:40	• Enrichment in regular classroom • Modified curriculum • Curriculum compacting
Moderately (130 – 144)	1:40 to 1:1,000	• Advanced work • Challenges within content • Some form of ability grouping • Mentorships • Single subject acceleration • Single grade skip or early entrance to school
Highly (145 – 159)	1:1,000 to 1:10,000	• Fast-paced content work in talent area • Ability grouping at least in talent area • Acceleration options • Challenging academic

		• enrichments, e.g. Latin • Mentorships
Exceptionally (160 – 179)	1:10,000 to 1:1 million	• Highly individualised programs • High school / university level programs • Advanced placement • Radical acceleration (3+ carefully spaced grade skips) • Ability grouping in specific talent areas • Specific counselling services
Profoundly (180+)	Fewer than 1:1 million	• Radical acceleration • Early admission to university • Highly individualised programs • Special program searches • Special counselling services • Ability grouping in specific talent areas

Children who are **mildly intellectually gifted** appear in the population at a ratio of somewhere between *1 in 6 and 1 in 40* in the population. It follows that every class is likely to have at least a small group of such children. These individuals are not too far from the central (average) group of learners of their age for whom the 'standard' curriculum is designed and as long as the teacher modifies curriculum and teaching in response to these children's learning characteristics, which include a faster pace of learning, a more retentive memory, a preference for complex and abstract questions and ideas - they should thrive in a regular classroom setting. All other things being equal, mildly gifted children tend to be popular with their classmates; they are bright enough to be admired but not so bright that they threaten other students' self-image. Often they become class leaders

Children who are **moderately intellectually gifted** occur less frequently in a population, at a ratio of somewhere between 1 in 6 and 1 in 40. It means, that preschool or primary school teacher can expect to educate moderately intellectually gifted from the lower end of the range, every year or every two years. Secondary school teachers will encounter them rather more often. Children toward the top of the range with IQ of 140-145 appear rarely, they occur between 1 in 200 and 1 in 1000 in a population. Moderately gifted learners often consider the curriculum set for age-peers rather unrewarding. Children at the top end of the range often find it irrelevant; they may have to acquire the learning content of their grade years before. From the viewpoint of children's learning characteristics, intellectually gifted learners are usually more emotionally mature than their age-peers. Moderate acceleration, in the form the subject acceleration in their main area of giftedness or a grade-skip, gives them access to learners who, although older in chronological age, could be at similar academic and emotional developmental stages as intellectually gifted learners.

Influence learning characteristics**, highly gifted** learners clearly require significant curriculum modification and it is extremely difficult to provide such degrees of differentiation in the regular classroom. Todays the inclusion of all gifted is preferred in the Czech Republic and is supported by government through special attitudes to these learners. But ability grouping in at

least their areas of special ability of highly gifted individuals is virtually essential. Where this is not practicable, grade advancement or at least subject acceleration in the learners' area of special giftedness is strongly recommended. With children at this level of ability, and at levels above, it is very hard to attempt to provide an individually differentiated curriculum within the regular classroom and it needs enthusiastic and educated teachers in issues of giftedness. If the highly gifted learner stays with their classmates, he can get in the form of forced-choice dilemma. He can work on the advanced material which excites challenges and rewards him - but he has to do it on his own as the work is far beyond the capacities of even the brightest of his classmates. Alternatively he can work with his classmates on material which is accessible to them but which he probably passed through years before. It could be stressful for him to choose between companionship and intellectual stimulation.

Exceptionally and **profoundly** gifted learners are a tiny minority (look at table 1). Therefore like many minorities, they are learners at risk. Indeed, they can be placed seriously at risk if the school requires them to move through the grades in lockstep progression with age-peers. These individuals most definitely require thoughtfully structured and carefully monitored individualised programs of acceleration.

Below are presented two very important finding of research concerning exceptionally and profoundly gifted learners conducted by L. Hollingworth and P. Janos in the United States. Already ninety years ago, L. Hollingworth conducted a longitudinal study of a group of exceptionally and profoundly gifted individuals, tracing their development from childhood through to adulthood. From her research with these and other groups of gifted children she came to describe the IQ range of 125-150 as *socially optimal intelligence* (Hollingworth, 1926). She found that children scoring within this range were well-balanced, self-confident and outgoing individuals who were able to win the confidence and friendship of age-peers. L. Hollingworth claimed, that above the level of IQ 160 the difference between the exceptionally gifted child and his/ her age-mates is so great that it leads to special problems of development which are correlated with social isolation, and that these difficulties appear particularly acute between the ages of four and nine (Hollingworth, 1931). Even more recent studies confirm her findings.

P. Janos conducted two studies which commenced in the 1980s and they have made valuable contributions to what is known about the social and emotional development of exceptionally and profoundly gifted learners. The findings of this research show how these young people can most effectively be educated. P. Janos compared the socio-affective development of 32 children aged 6-9 with IQs in excess of 164, with that of 49 mildly and moderately gifted age-peers of moderately superior intellectual ability (Janos, 1983). Although the exceptionally gifted were generally rated higher in terms of their academic performance, they were more isolated than their age peers, had greater problems of social development and, in the case of a substantial minority, seemed to lack the motivation to develop their intellectual giftedness. P. Janos emphasised, however, that the social isolation experienced by these children was not the clinical isolation of emotional disturbance, but was caused by the absence of a suitable peer group with whom to relate. There are virtually no points of common experience and common interest between a 6-year-old with a mental age of 6 and a 6-year-old with a mental age of 12. L. Hollingworth would have agreed with Janos's conclusion. She herself emphasised that when exceptionally gifted children who have been rejected by age-peers are removed from the inappropriate grade-placement, and are permitted to work and play with intellectual peers, the loneliness and social isolation disappear and the child is accepted as a valued classmate and friend (Hollingworth, 1942).

Hollingworth, L. S. (1926). *Gifted children: Their nature and nurture*. New York: Macmillan.
Hollingworth, L. S. (1931). The child of very superior intelligence as a special problem in social adjustment. *Mental Hygiene*, 15 (1), 3-16.
Hollingworth, L. S. (1942). *Children above IQ 180*. New York: World Book
Janos, P. M. (1983). The psychological vulnerabilities of children of very superior intellectual ability. Unpublished doctoral dissertation. Ohio State University.

It is important to be aware that the borders of these levels of giftedness are not 'cut-off points'. It is clear that probably there should not be considerable differences in the way teachers respond to students of IQ 129 - the upper end of the mildly gifted range - and IQ 130 - the lower end of the moderately gifted range. However, there should be significant differences in the way how teachers should respond to the student of IQ 120 (1 in 10 in the population) and the student of IQ 140 (1 in 200).

Radical acceleration is very suitable for these learners because they are extremely bright and, almost without exception, very emotionally mature - although this maturity may not be immediately obvious if they are lonely and miserable at school. Radical acceleration refers to any sequence of accelerative procedures which results in a learners graduating from high school three or more years earlier than usual. A single three-year grade skip is not recommended. A more practical procedure is a series of three grade advancements each separated by a period of consolidation; however there is various forms of acceleration procedures that can be used.

It is important to recognise that many able pupils underachieve. Their potential is masked by factors such as frustration, low self-esteem, lack of challenge, and low teacher/parent expectations. To enable these pupils to fulfil their potential, it is vital to create a climate where every pupil has the opportunity to excel.

It is needed to say that a common mistake of teachers is that sometimes they are not able to differentiate between the bright and gifted learners. And even some teachers prefer bright children to gifted children because of they do not require individual attitude and different instructional strategies. In Table 2 main characteristics of bright and gifted learners created by National Association for Gifted Children are introduced.

Table 2 Characteristics of bright and gifted learners (according to National Association for Gifted Children)

Bright learner	***Gifted learner***
Knows the answers	*Asks the questions*
Is interested	*Is highly curious*
Is attentive	*Is mentally and physically involved*
Has good ideas	*Has wild, silly ideas*
Works hard	*Plays around, yet performs well in tests*
Answers the questions	*Discusses in detail, elaborates*
Works in "top groups"	*Level of ability "beyond the top groups"*
Listens with interest	*Shows strong feelings and opinions*
Learns with ease	*Already knows*
Takes six to eight repetitions for mastery	*Takes one or two repetitions for mastery*
Understands ideas	*Constructs abstractions*

Enjoys peers	*Prefers adults*
Grasps the meaning	*Draws inferences*
Completes assignments	*Initiates projects*
Is receptive	*Is intense*
Copies accurately	*Creates a new design*
Enjoys school	*Enjoys learning*
Absorbs information	*Manipulates information*
Is technically adept	*Is an inventor rather than technician*
Is good at memorising	*Is good at guessing*
Enjoys straight forward sequential presentation	*Thrives on complexity*
Is alert	*Is keenly observant*
Is pleased with own learning	*Is highly self critical*

Questions:

1. Do you know common myths and misconceptions concerning to giftedness, say at least six the most known.

2. What levels of giftedness according to Feldhusen and Jarwan do you know?

3. For what levels of giftedness is an individually differentiated curriculum appropriate?

3 Identification of gifted children

The identification of gifted children is complex, especially because it must not overlook gifted underachievers, disadvantaged pupils, the exceptionally gifted, students with disabilities, those with learning difficulties or from culturally diverse populations.

Překlad z ČJ

4 Typology of Gifted

The specification of the types of giftedness can pose a problem because gifted children are not a homogenous group as was said before. People usually imagine a gifted child as the highly able child or a hardly working pupil who assiduously completes work and very often is known as the class “swot” or “brain box”. In reality the picture of gifted children is more complex. Except the gifted achievers, are those who (despite their gifts and talents) persistently underachieve due to boredom, lack of interest or enormous perfectionism. Similarly they are threatened other groups of children - young people who are cognitively advanced enough to play games with complex rule structures and yet not socially mature enough to deal with the frustration that occurs when their peers cannot grasp their game; or children whose giftedness may be masked by the fact that they are not being educated in their first language or also who have a disability.

There is interesting identification methodology which can help teachers, educators and parents to educate gifted children. Betts and Neihart (1988) developed six profiles of gifted and talented individuals which explain how each kind of gifted and talented child manifests itself in the traditional teaching environment. Based on research, in 2010 Betts and Neihart (2010) made a revision of their first typology and presented a modified version of the typology - the revised profiles of the gifted and talented. This typology is based on many years of empirical research and belongs to highly regarded ones. The knowledge about the learning styles and characteristics of academically gifted students may help teachers to understand, more fully, some of the causes of underachievement in these groups. The following presentation can provide information about the behaviour; feelings; needs; identification; adult and peer perceptions; home support and school support. It is important to remember that this is a theoretical concept that can provide insights for facilitating the development of the gifted and talented, not diagnostic classification model.

The various profiles will now be examined individually in order to enrich understanding of the needs of gifted and talented children and to highlight and justify the strategies that could be used during teaching/learning process (Betts and Neihart, 2010).

In following text the typology of the revised profiles of the gifted and talented (Betts and Neihart, 2010) is presented primarily in points, because this form more corresponds to the purpose of this publication.

Type 1 The Successful

According to Betts and Neihart (1988, p. 248), the vast majority of the gifted fall into this category. The NCCA Guidelines (2007) state that "Exceptionally able young adults who may underachieve in college and later in adulthood come from this group" (p.42). National Council for Curriculum and Assessment. 2007. *Draft Guidelines for Exceptionally Able Students.* Dublin: DES.

- *They are successful at school.*
- *They want to appeal to teachers and get good grades.*
- *They are conformist and dependent.*
- *They tend to choose safe activities and avoid possible risk.*
- *They are mostly loved by their parents and teachers and admired by their peers.*

Common Support

- *Supply them with more complex problems to solve.*
- *Accelerate the learning process.*
- *Encourage the development of the giftedness.*
- *Encourage systematically the willingness to take risks and to become more independent.*

Feeling and attitudes

- *Complacent*
- *Dependent*
- *Good academic self-concept*
- *Fear of failure*
- *Extrinsic motivation*
- *Self-critical*
- *Works for the grade*
- *Unsure about the future*
- *Eager for approval*
- *Entity view of intelligence*

Behaviours

- *Achieves*
- *Seeks teacher approval*
- *Avoids risks*
- *Doesn't go beyond the syllabus*
- *Accepts and conforms*
- *Chooses safe activities*
- *Gets good grades*
- *Becomes a consumer of knowledge*

Needs

- *To be challenged*
- *To see deficiencies*
- *To take risks*
- *Assertiveness skills*
- *Creativity development*
- *Incremental view of intelligence*
- *Self-knowledge*
- *Independent learning skills*

Identification

- *Use many multiple criteria*
- *Grades*

- *Standardised test scores*
- *Individual IQ tests*
- *Teacher nominations*
- *Parent nominations*
- *Peer nominations*

Adult and peer perceptions

- *Liked by teachers*
- *Admired by peers*
- *Generally liked and accepted by parents*
- *Overestimate their abilities*
- *Believe they will succeed on their own*

Home support

- *Parents need to let go*
- *Independence*
- *Freedom to make choices*
- *Risk-taking experiences*
- *Allow child to be distressed*
- *Affirm child's ability to cope with challenges*

School support

- *Subject and grade acceleration*
- *Needs more than AP, IB and Honors*
- *Time for personal curriculum*
- *Activities that push out of comfort zone*
- *Development of independent learning skills*
- *In-depth studies*
- *Mentorships*
- *Cognitive coaching*
- *Time with intellectual peers*

Type 2 The Creative

This type is divergently gifted individuals and was described as the “challenger” in before typology. The child belongs to this type is usually creative, but can be rebellious and challenging if their creativity is not recognised. Many school system fail to identify this type.

Characteristic:

- *They have a strong intrinsic motivation.*
- *They are androgynous.*
- *They have reduced self-control.*
- *They are emotionally unstable.*
- *They are full of energy.*
- *They might be less motivated to meet the expectations of others.*
- *They may have disagreements with their peers.*

It is important to ask in what areas they are creative, not how creative they are!

Common Support:

- *Reward fresh thinking.*
- *Reward them for overcoming obstacles and prod them into performing difficult tasks.*
- *Provide mentoring.*
- *Arrange education (and a teacher) in the field of giftedness.*
- *Tolerate personality traits significantly different from the average (in the adulthood there is a higher risk of mental disorders compared to the average population. The risk increases especially in case of an artistic and literary talent).*

Feeling and attitudes:

- *Highly creative*
- *Bored and frustrated*
- *Fluctuating self-esteem*
- *Impatient and defensive*
- *Heightened sensitivity*
- *Uncertain about social roles*
- *More psychologically vulnerable*
- *Strong motivation to follow inner convictions*
- *Wants to right wrongs*
- *High tolerance for ambiguity*

- *High energy*

Behaviours:

- *Expresses impulses*
- *Challenges teacher*
- *Questions rules and policies*
- *Is honest and direct*
- *Emotionally liable*
- *May have poor self-control*
- *Creative expression*
- *Perseveres in area of interest (passions)*
- *Stands up for convictions*
- *May be in conflict with peers*

Needs:

- *To be connected with others*
- *To learn tact, flexibility, self-awareness and self-control*
- *Support for creativity*
- *Contractual systems*
- *Less pressure to confirm*
- *Interpersonal skills to affirm others*
- *Strategies to cope with potential psychological vulnerabilities*

Identification:

- *Ask: In what ways is this child creative?*
- *Use domain specific, objective measures*
- *Focus on creative potential rather than achievement*

Adult and peer perceptions:

- *Not liked by teachers*
- *Viewed as rebellious*
- *Engaged in power struggle*
- *Creative*
- *Discipline problems*
- *Peers see them as entertaining*

- *Want to change them*
- *Don't view them as gifted*
- *Underestimate their success*
- *Want them to conform*

Home support:

- *Respect for their goals*
- *Tolerate higher levels of deviance*
- *Allow them to pursue interests (passions)*
- *Model appropriate behaviour*
- *Family projects*
- *Communicate confidence in their abilities*
- *Affirm their strengths*
- *Recognise psychological vulnerability and intervene when necessary*

School support:

- *Tolerance*
- *Reward new thinking*
- *Placement with appropriate teachers*
- *Direct and clear communication*
- *Give permission for feelings*
- *Domain specific training*
- *Allow nonconformity*
- *Mentorships*
- *Direct instruction in interpersonal skills*
- *Coach for deliberate practice*

Type 3 The Underground

Betts and Neihart claim that recently there have been changes in the understanding of this type of giftedness. Generally, these are middle school girls although boys may also want to hide their giftedness. "Underground" girl often feels anxious and insecure because of a conflict between social and academic success. A typical underground girl begins to deny their giftedness in the late primary and early post primary stage when the need to belong and feel included takes precedence. If a gifted boy goes underground, it tends to happen later, in high school, and typically in response to the pressure to participate in athletics.

Characteristic:

- *They deny their talent I order to fit in.*
- *They may feel others "force" them to abandon their ambitions.*
- *They may feel other people disagree with their objectives.*
- *When they succeed, they perceive it as a betrayal of their group.*
- *They cease developing their talent and they are not interested in using it.*

Common support:

- *Create helpful environment for education.*
- *Help them cope with their internal contradictions.*
- *Teach them social skills so they can succeed*
  in a variety of situations in the society in which they live.
- *Discuss openly what success costs.*
  (It is immensely important to discuss
  a wide range of topics – e.g. gender issues. It is also advisable to watch movies together and talk about them...)

Feeling and attitudes:

- *Desire to belong socially*
- *Feel unsure and pressured*
- *Conflicted, guilty and insecure*
- *Unsure of their right to their emotions*
- *Diminished sense of self*
- *Ambivalent about achievement*
- *Internalise and personalise societal ambiguities and conflicts*
- *View some achievement behaviours as betrayal of their social group*

Behaviours:

- *Devalue, discount or deny talent*
- *Drops out of GT and advanced classes*
- *Rejects challenges*
- *Moves from one peer group to the next*
- *Not connected to the teacher or the class*
- *Unsure of direction*

Needs:

- *Freedom to make choices*
- *Conflicts to be made explicit*
- *Learn to code switch*
- *Gifted peer group network*
- *Support for abilities*
- *Role models who cross cultures*
- *Self-understanding and acceptance*
- *An audience to listen to what they have to say (to be heard)*

Identification:

- *Interviews*
- *Parent nominations*
- *Teacher nominations*
- *Be cautious with peer nominations*
- *Demonstrated performance*
- *Measures of creative potential*
- *Nonverbal measure of intelligence*

Adult and peer perceptions:

- Viewed as leaders or unrecognised
- Seen as average and successful
- Perceived to be compliant
- Seen as quiet/shy
- Seen as unwilling to risk
- Viewed as resistant

Home support:

- Cultural brokering
- Normalise their dissonance
- College and career planning
- Provide gifted role models
- Model lifelong learning
- Give freedom to make choices
- Normalise the experience
- Don’t compare with siblings

- Provide cultural brokering
- Built multicultural appreciation

School support:

- Frame the concepts as societal phenomena
- Welcoming learning environments
- Provide role models
- Help develop support groups
- Open discussions about class, racism, sexism
- Cultural brokering
- Direct instruction of social skills
- Teach the hidden curriculum
- Provide college planning
- Discuss costs of success

Type 4 The At-Risk

This kind of giftedness, which was first described in 1989, is substantially influenced by friends and family. It was called the "dropout" in before typology. This child has a long history of underachievement, possibly because of inappropriate teaching programs, and needs a lot of support to reach her/his potential. The NCCA Guidelines claim that dropouts feel angry towards "adults and with themselves because the system has not met their needs for many years and they feel rejected" (NCCA Guidelines, 2007, p.48).

Characteristic:

- *There are two main subgroups.*
- *While majority of such students tend to have pro-social behavior, there is also minority with criminal tendencies.*
- *It might be very difficult to help to such antisocial type - especially when the help comes too late!*
- *They tend to be disruptive. They also create crisis situations.*
- *They may struggle with serious mental problems.*
- *They have behavior problems.*
- *They are not motivated by the reward and feedback that teachers provide them.*
- *They are resentful, angry and irresponsible.*

- *They entertain unrealistic expectations from themselves.*
- *They seek exciting entertainment.*
- *They cannot cope with everyday failure.*

Common Support:

- *Provide support and rules (these are necessary!).*
- *Provide professional help - individual, group or family councelling is absolutely essential.*
- *Feel empathy.*
- *Offer confrontation and responsibility.*
- *Don´t make concessions on the standard you set earlier. This could be interpreted as a loss of confidence in their abilities!*
- *Don´t underestimate the importance of their relationship with mentors.*

Feeling and attitudes:

- *Resentful and angry*
- *Depressed*
- *Reckless and manipulative*
- *Poor self-concept*
- *Defensive*
- *Unrealistic expectations*
- *Unaccepted*
- *Resistive to authority*
- *Not motivated for teacher driven rewards*
- *A subgroup is antisocial*

Behaviours:

- *Creates crises and causes disruptions*
- *Thrill seeking*
- *Will work for the relationship*
- *Intermittent attendance*
- *Pursues outside interests*
- *Low academic achievement*
- *May be self-isolating*
- *Often creative*

- *Criticises self and others*
- *Produces inconsistent work*

Needs:

- *Safety and structure*
- *An "alternative" environment*
- *An individualised program*
- *Confrontation and accountability*
- *Alternatives*
- *Professional counselling*
- *Direction and short term goals*

Identification:

- *Individual IQ testing*
- *Achievement subtests*
- *Interviews*
- *Auditions*
- *Nonverbal measures of intelligence*
- *Parent nominations*
- *Teacher nominations*

Adult and peer perceptions:

- *Adults may be angry with them*
- *Peers are judgemental*
- *Seen as troubled or irresponsible*
- *Seen as rebellious*
- *May be afraid of them*
- *May be afraid for them*
- *Adults feel powerless to help them*

Home support:

- *Seek counselling for family*
- *Avoid power struggles*
- *Involvement in extracurricular activities*
- *Assess for dangerous behaviour*

- *Keep dialogue open*
- *Hold accountable*
- *Minimise punishment*
- *Communicate confidence in ability to overcome obstacles*
- *Preserve relationships*

School support:

- *Don't lower expectations*
- *Diagnostic testing*
- *Non-traditional study skills*
- *In-depth studies and mentorships*
- *G.E.D.*
- *Academic coaching*
- *Home visits*

Type 5 Twice/Multi Exceptional

This type is called "double labelled" as well. Betts and Neihart highlight this group of children who are exceptionally able, but may have a physical, emotional or learning difficulty which can cause their exceptional ability to remain unidentified. Often the impairment is recognised but the giftedness is not. These children can feel emotions of powerlessness and may have low self-esteem. The vast majority of gifted programs do not identify these children, nor do they offer differentiated programming that addresses and integrates their special needs.

Characteristic:

- *They are often unsuccessful at school.*
- *They have social and emotional problems.*
- *They have behavioral problems.*
- *They are prone to anxiety and depression.*
- *They have low self-confidence (e.g. at school).*
- *They are not satisfied at school. They seem bored and annoyed.*
- *They are immature in comparison with other types of gifted students.*
- *It is essential to support and develop social and emotional competences of these students.*
- *From the intellectual point of view they are always ahead of their peers.*

- *However, they tend to be socially and emotionally immature and seem usually about 3 or 4 years "younger" than their peers.*

Common Support:

- *Use different criteria when measuring their success.*
- *Find out how they act and work in their classes.*
- *Ensure they are evaluated within their curriculum.*
- *Ask THEM.*
- *Emphasize their talent and show consideration for their disability.*
- *Supply them with sufficiently difficult tasks in the main area of their interest.*

Feeling and attitudes:

- *Learned helplessness*
- *Intense frustration and anger*
- *Mood disorders*
- *Prone to discouragement*
- *Work to hang on*
- *Poor academic self-support*
- *Don't see themselves as successful*
- *Poor academic self-concept*
- *Don't know where to belong*

Behaviours:

- *Makes connections easily*
- *Demonstrates inconsistent work*
- *Seems average or below*
- *More similar to younger students in some aspects of social/emotional functioning*
- *May be disruptive or off-task*
- *Are good problem solvers*
- *Behaviour problems*
- *Thinks conceptually*
- *Enjoys novelty and complexity*
- *Is disorganised*
- *Slow in information processing*
- *May not be able to cope with gifted peer group*

Needs:

- *Emphasis on strengths*
- *Coping strategies*
- *Monitoring for additional disorders – especially ADHA*
- *To learn to persevere*
- *Environment that develops strengths*
- *To learn to self-advocate*

Identification:

- *Measure of current classroom functioning*
- *Achievement test scores*
- *Curriculum based assessment*
- *Examine performance over time*
- *Look for pattern of declining performance paired with evidence of superior ability*
- *Do not rely on IQ scatter analysis or test discrepancy analysis*

Adult and peer perceptions:

- *Requires too many modifications because of accommodation*
- *Seen as "weird"*
- *Underestimated for their potential*
- *Viewed as helpless*
- *Seen as not belonging in GT*
- *Perceived as requiring a great deal of structure*
- *Seen only for disability*

Home support:

- *Focus on strengths while accommodating disability*
- *Develop will to succeed*
- *Recognise and affirm gifted abilities*
- *Challenge in strength areas*
- *Provide risk-taking opportunities*
- *Assume college is a possibility*
- *Family involvement*
- *Nurture self-control*

- *Teach how to set and reach realistic goals*

School support:

- *Challenge in area of strength is first priority*
- *Acceleration in area of strengths*
- *Accommodation for disability*
- *Ask: What will it take for this child to succeed here?"*
- *Direct instruction in self-regulation strategies*
- *Give time to be with GT peers*
- *Teach self-advocacy*
- *Teach SMART goal setting*

Type 6 Autonomous Learner

Betts and Neihart describe this type of learner as being independent and self-directed. Few gifted children demonstrate this style at a very early age although parents may see evidence of the style at home. Appropriate educational programmes can encourage children in this direction. This type is actually the ideal which should be achieved in all gifted children. Teachers should think and plan their activities towards learners' independency.

Characteristic:

- *They are persistent and are able to set goals themselves.*
- *They search for challenges.*
- *They are powerful and efficient.*
- *They are courageous.*
- *They have good self-control.*
- *They may (but do not have to) consider academic education as one of its priorities.*
- *They are able to get over disappointment and failure.*

Common Support:

- *Support them more. They need it no matter how successful they are.*
- *Help them address social and psychological difficulties associated with their success.*
- *Teach them how to manage themselves.*
- *Set up a supportive team.*
- *Find a mentor.*

Feeling and attitudes:

- *Self-confident*
- *Self-accepting*
- *Hold incremental view of ability*
- *Optimistic*
- *Intrinsically motivated*
- *Ambitious and excited*
- *May not view academics as one of their highest priorities*
- *Willing to fail and learn from it*
- *Shows tolerance and respect for others*

Behaviours:

- *Appropriate social skills*
- *Works independently*
- *Set SMART goals*
- *Seek challenge*
- *Strongly self-directed*
- *Follows strong areas of passion*
- *Good self-regulators*
- *Stands up for convictions*
- *Resilient*
- *A producer of knowledge*
- *Possesses understanding and acceptance of self*

Needs:

- *More support, not less*
- *Advocacy for new directions and increasing independence*
- *Feedback about strengths and possibilities*
- *Facilitation of continuing growth*
- *Support for risk-taking*
- *On-going, facilitative relationships*
- *Become more adept as managing themselves*
- *A support team*

Identification:

- *Demonstrated performance*
- *Products*
- *Nominations*
- *Portfolios*
- *Interviews*
- *Standardised test scores*
- *Awards*

Adult and peer perceptions:

- *Admired and accepted*
- *Seen as capable and responsible by parents*
- *Positive influences*
- *Successful in diverse environments*
- *Psychologically healthy*
- *Positive peer relationships*

Home support:

- *Advocate for child at school and in the community*
- *Provide opportunities related to passion areas*
- *Allow friends of all ages*
- *Remove time and space restrictions for learning*
- *Help them build a support team*
- *Include in parents' passions*
- *Include in family decision making*
- *Listen*
- *Stay out of their way*

School support:

- *Allow development of long-term, integrated plan of study*
- *Remove time and space restrictions*
- *Develop multiple, related in-depth studies, including mentorships*
- *Wide variety of accelerated options*
- *Mentors and cultural brokers*
- *Waive traditional school policies and regulations*
- *Stay out of their way*

- *Help them cope with psychological costs of success*

These profiles of gifted and talented children are useful in so far as they help teachers to get an insight into the mind of the more able children with whom they are working. It is very interesting that the presence of these types of gifted and talented children is different in countries all over the world. A child that is considered gifted in Europe would not be judged the same way in Asia. In Asia there are many autonomous gifted students (type 6) but successful gifted students (type 1) occur there rarely.

References

- BETTS, George T., NEIHART, Maureen. Profiles of the gifted and talented. Gifted Child Quarterly, 32(2), 1988. ISBN 0 642 77487 0. p. 248–253.

Creativity

In the educational concepts for 21st century, the creativity is highlighted and that´s why there is necessary to develop it within educational process. As models of talent include creativity at various level (Reznulli three ring model of giftedness, Monks triadic model, Gagne differentiated model of giftedness and talent), there is important to support creativity at gifted pupils.

Due to the fact there are more than 100 definitions of creativity, it is difficult to state only one of them. Professionals engaged in creativity have a very different point of view on creativity. Lokša, Lokšová (2003, p.14) stated a general definition of creativity used in research practice very often: "Creativity is a generation of **new**, **unusual** but acceptable, **useful** ideas, solutions".

Even one author uses various definitions as e.g. Szobiová – she defines creativity in a different way in various time periods:

Szobiová (2001, p-15) defines creativity as a self-realization – updating of human potential to create, invent something **new**, valuable, beyond traditional things.

Szobiová (2004, p.21) – creativity is a manifestation of personality characteristics, abilities and motivation tendencies of a man in a social context which is **new**, **unusual**, **acceptable** and innovative for the subject, reference group or a company.

The concept "creativity" was implemented by J.P. Guilford in 1949 – he defined a specific extraordinary ability or a group of abilities that are used during creation of something **new**, **unusual**, **original** that cannot be explained only by intelligence. Guilford understood the creativity as a part of intelligence (kind of thinking – divergent) because it brings more than one variability of problem solution. The creativity consists of these divergent operations: **fluency, flexibility, originality, redefinition, elaboration, sensitivity**. These ones are possible to describe:

- **Fluency** – rapid production of ideas and images, their richness

- **Flexibility** – ability to create various solutions, to have various approaches to issues
- **Originality** – genesis of new, unusual ideas or solutions
- **Redefinition** – change of meaning or reorganization of information (using specific subject for the other than common purpose)
- **Elaboration** – ability to develop idea and to work up the solution into interesting details
- **Sensitivity** – ability to notice problems even when the others cannot see it, ability to perceive deficiencies of solution and possibilities of improvement

A very important question that has to be solved by teachers is "*Who is creative*?" The professionals say that everybody is creative in a way! The creativity is not just the privilege of genius. Beside the exceptional creativity of genial individuals, we can speak about **an everyday creativity** that is used in common everyday life. For specification who is creative, the professionals try to find characteristics of a creative personality. Dacey and Lennon (2000) created a **generalized picture of a creative personality:**

The list of creative personality attributes:

1. *Tolerance to ambiguousness* – it is an unclear situation without right orders
2. *Stimulation freedom* – enables to get around the rules that collide with creative potential
3. *Functional freedom* – ability to use subjects for different purpose than for the original one, i.e. to overcome functional fixation
4. *Flexibility* – openness for changes, world, readiness to do changes, focus on all the aspects of the issue
5. *Willingness to risk* – adequate risk leads to creativity
6. *Preference of chaos* – in Barron and Welsch test of the picture preference, the creative people prefer complicatedness and symmetry, so there is no confusion, chaos or unreliability of creative individuals
7. *Delay of satisfaction* – to endure a long-term effort to get bigger pleasure
8. *Leaving the stereotype of sexual role* – freeing ourselves of underestimation of woman creativity (S. Bemová)
9. *Persistence* – persistence despite obstacles, autotelic personality leading itself to the target, importance of self-control that enables systematic work, reasonable using of time and persistence
10. *Courage* – resulting from the love for own work

Kirst and Dieckmeyer (in Smékal, 2002) similarly defined **components of creative personality:**

1. *Movability* – ability to quick switching to new models
2. *Fluency* – ability to fast and easily find suitable ideas and images
3. *Originality* – ability to create extraordinary, new in contents, rich and unusual ideas and solutions
4. *Analysis* – ability to describe, define and specify contents of mutual connection
5. *Productivity* – ability to give ideas and sequences of solutions
6. *Construction* – ability to connect known ideas with new conditions
7. *Re-creation* – ability to disrupt stabilized mutual connections and implement new ones among associations (bissociations)
8. *Arranging* – ability to find sorting criteria and to arrange by them
9. *The power of expression (ability of expression)* – ability to formulate and tell experiences and feelings in a new way

10. *Realization* – ability to workout the plans purposefully and to realize them
11. *Combination* – ability to find solution by discovery of new relations and ways of comparison
12. *Transformation (transfer)* – ability to replace statements and data by other signs
13. *Decision making* – ability to compare different points of view, consider them and determine new advance from them
14. *Assigning (adaptation)* – ability to systematically harmonize ideas with given conditions
15. *Organizing* – ability to deal respecting the target, sense and purpose

C.Rogers (in Dacey, Lennon, 2000) was engaged in characteristics of creative personality and he determined three characteristics of this personality.

1. Openness to experience – tolerance to ambiguousness, openness to criticism, openness to new impulses (x rigidity)

2. Evaluation of the situation according to own standards – valuation of other opinions but the final result is created by the creative person itself

3. Ability to experiment with unsure situations and to take part in them – ability to search possibilities and play with theories, hypothesis and to re-create concepts

The initiator of the research of children creativity was Torrence (1972) that defines characteristics of creative children – *acceptation of disorder, courage, ambitiousness, dominance, introversion, sincerity, naivety, humour, playfulness and constructiveness in criticism*. Other professionals say that creative children are very **curious, playful, open-minded, humorous and with a very rich fantasy**.

L. Mihálik (1989 in Lokša, Lokšová, 2003) states that the personality of creative child has these characteristics: *leading type, agile, dynamic, non-conformist, interest and desire to know, courage to solve new, demanding and unconventional tasks, independence, originality, fantasy, initiative, application of various orders, aversion to mechanical learning, work even without direct order, frequent questions.*

It is interesting that according to Dacey and Lennon (2000, p.79, tab.4.1) there are **periods of top creativity** (see tab.1).

	Age – women	**Age – men**
1.	0-5	0-5
2.	10-13	11-14
3.	18-20	18-20

4.	29-31	29-31
5.	(37?)40-45	40-45
6.	60-65	60-65

The opinion of Robert Sternberg is interesting. According to it, the creativity is mostly for the reason the people want it. He defined 12 basic sequences that cause creativity.

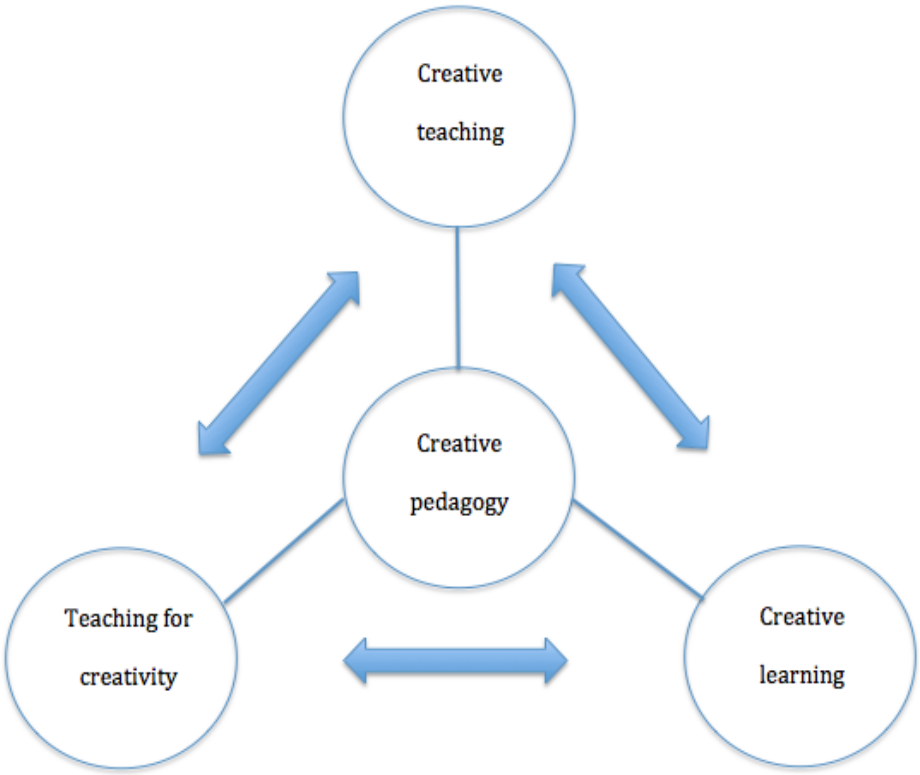
1. Ability to define a problem in a different way.
2. Analysis of own ideas.
3. Presentation of ideas.
4. Understanding of knowledge in a context.
5. Obstacles overcoming.
6. Acceptation of acceptable risks.
7. Desire to get better.
8. Believe in oneself.
9. Admission of ambiguousness.
10. Searching for own interests.
11. Finding the time to work.
12. Tolerance of mistakes.

In connection with various concepts of creativity, there are popular – but false – characteristics of creativity:

Prejudice	***Reality***
1. Creativity means creation of something quite new.	Creative people usually come from existing ideas or basic principles.
2. Only professional can create something useful.	There is often useful to be outsider because he is not limited by traditional imagination.
3. Creativity is just a present that belongs to just a small part of people.	Motivation and desire to create is more important than an innate talent.
4. For people to be creative, there is necessary to be emotionally unbalanced.	For the success of a creative person, it is necessary to have a big self-confidence, inquisitive mind and not to lose control.

5.	If the person is really creative, it occurs.	For maturing your ideals, you have to diplomatically push them.
6.	Ideas are the result of an inspiration, not an effort.	The flashes of geniality are exceptional, not as a rule, an inspiration comes usually after effort, probably in a form of an idea and usually step by step.
7.	Creativity needs advanced technology.	Complexity can destroy creativity; all should be done as simply as possible (but not more simply – Einstein).
8.	It cannot be done better.	There does not exist the best solution but there are a lot of good ones. There is not possible to use the same methods for all the problems solutions.

In connection with development of creativity during education at school, there is important to mention differences between creative education and education supporting creativity. Linn states a relation between creativity of the pupil and the teacher.



On the base of this scheme, there is obvious that **for the creativity development, we have to use a creative approach to education – creative pedagogy**. Mainly, the teacher has to choose suitable methods of education (Trnová, 2012). There is not possible to present the list of methods that develop creativity because it depends on their placement into education. Even good method cannot fulfil the target if it is used in an unsuitable way. There are stated two the most important obstacles for creativity development:

- **Transmissive way of teaching that prefers passive information receiving and the total passive role of the pupil in the process of education;**
- **Directive teaching** where the pupil has no possibility to use ideas, to discuss and change opinions with schoolmates, he has to work directly according to the instructions and he has no possibility to choose the steps for solution.

For the development of pupil's creativity, the creativity of the teacher is very important! Ken Robinson says that the school kills creativity! Creativity is a crucial factor in the multidimensional development of teacher professional competencies. It is necessary to examine the role of creativity in partial dimensions of development of teacher professional competencies. Development of creativity takes place within the entire CPD and leads to the formation of ownership. Hvozdík at al. (1994) defined the rules for creative teaching:

The teacher

- Regulates more than reprimands, creates alternatives for teaching and behaving of pupils,
- Does not presume what the pupil knows and does not know but he replaces the presumes by knowledge, diagnosis,
- Works with tasks that are at the limit of pupil´s possibilities,
- Encourage independence and activity of pupils,
- Uses humour and relaxedness during work, he creates optimistic atmosphere and he is oriented on the future,
- Opposes openness, initiative, independence but even reliability,
- Teaches pupils to create solution and alternatives,
- Teaches pupils to thing in a critical and evaluative way,
- Regulate pupils to put questions and find answers to them.

François Taddei (2009) states in Training creative and collaborative knowledge-builders: a major challenge for 21st century education, OECD Innovation Strategy, 28 February 2009 ten summarizing recommendation supporting creativity in education:

1. General recommendation
   "Do not do it, it´s not a thing to do." This phrase used by teachers at all levels of education sounds very often. In a community oriented to the future, this kind of conservatism challenging trying of new advances is quite unacceptable.
2. Recommendation to students
   The biggest obstacle of your success is in yourself – in your head, in self-censorship. As soon as students are able to open their horizons, they dare to be creative and they took initiative and they succeed to get ahead very often. They work very hard, fight with conservatism around and mostly they find what Sir Ken Robinson calls Element or fulfilling of natural abilities and interest for what they do. Ken Robinson himself explained it at the conference TED by an unbeatable way: Schools destroy creativity!
3. Recommendation to parents
   Create caring background where the children can build their creativity and believe in their abilities. Help them to find such school and university where their abilities can be developed and they can be prepared for the future where big changes are definitely awaited.
4. Recommendation to teachers
   Try to be at disposal to the pupils if they need your feedback. Set the education in the way for realization of own projects, join colleagues with similar approach regardless of their teaching specialization.
5. Recommendation to the school management
   Support creativity of our teachers and pupils (students). Provide them such space, time and administrative support so they could develop the educational programme focused on creativity where pupils could work on individual or collective projects. If there is not possible to implement such programme globally, offer it at least to those interested in it.
6. Recommendation to universities
   Implement inter-subject approach and build such educational programmes where the students will prepare projects supporting their creativity. Open creative rooms where is possible to realize students projects. These rooms should become incubators of creative ideas.
7. Recommendation to foundations
   Foundations (or non-profit organizations) are the most flexible financed organization at all. Mostly they are able to quickly react to the situation and so they are the most creative. They can support new projects arising on the base of creative ideas. The example can be a range of

contemporary extraordinary successful businessmen that began to make by makeshift means in their youth (in the garage) and maybe they did not finish their universities thanks to incompatibility of their intent and the education contents.

8. Recommendation to governments
   Try to support creativity in your country. Build the environment for creative individuals and their self-assertion. Organize i.e. discussions, finance suitable books and translations, support arising of new corresponding TV PROGRAMS. Create national programme for the support of creativity in education and produce the arising of the expert´s, teacher´s and other interested one´s network.
9. Recommendation to OECD
   It would be good to compare approach of individual countries for building creative culture, e.g. by comparing programmes for it support. Data should be related to other unknown indicators. It is suitable to cause international discussion about the methods supporting creativity as the most effective.
10. Recommendation to communities of creative makers of knowledge
    Develop activities supporting opinion changes, produce new ideas and story-telling. Such activities can be done as in real as in virtual environments. Put them down and give them to all the capable creative people. They become a natural part of educational source that develop creativity.

Source: Ken Robinson – The Element: How Finding Your Passion Changes Everything, Allen Lane, Feb. 2009

It is important to overcome obstacles during creativity development. Provazník (1999) states that the most often obstacle of creativity and innovation is a preconception. It is one of the worst characteristics that consists of ignorance, mistrust, envy and arrogance. Sometimes – as a cover of preconceptions – we use the word “caution”, “healthy scepticism”, “long-time practical experience” or “long-time study”. Barriers of creativity are possible to divide. The basic group of barriers is:

- **Cognitive barriers**

Cognitive barriers come mainly from our passive acceptance of old habits and transfers of the template mental orders. We often use old and confirmed orders. It can lead to problem solving failure. Basic demonstration of cognitive barriers:

- Tendency to define the issue too narrowly.
- Stereotypes of perception, inability to see the problems from various points of view, problem with recognition of the closest or distant relations.
- Difficulties with segmentation of defined issue into individual basic files.
- Inability to notice or recognize the seemingly unessential matter could be very important factor in solution.
- Mistakes in distinguishing among causes and consequences.
- It is evident that in this group there is not lack of intellect abilities but rather psychical lethargy, inertia, stereotypes and professional blindness.

- **Intellectual barriers**

Individuals at lower level of intellect characters have also lower creative invention. There is inability to apply adequate intellectual strategy in stated case, inability to choose adequate tools

for the problem. Another intellect characteristic is using not all the information or lack of information or inability (unwillingness, uninterest) to verify reliability and impartiality of information used for the problem solution.

- **Emotional barriers**

Emotional barriers go for the whole human personality. They are less evident and also they are difficult to identify. Even the individual that can define the issue and choose adequate strategy for the issue solution can be afraid of making mistake, eventual failure and unsuccess, to be afraid of fall to the complete loss of position.

One of the most evident and frequent emotional barrier is:

- Fear of making mistake or even to show oneself as a fool
- Desire to have social security and safety
- Mistrust to colleagues and superiors and fear of the subordinate before the superior.

In bases of stated obstacles, there are often e.g. disproportionately increased desire for safety, security and order, increased aversion to chaos etc.

The group of barriers includes also tendency or inclination of the opposite character: excessively, uncontrollable enthusiasm that can often bring more harm than good. Excessive desire for safety cause ignorance of the necessary time for the problem solution and it shouldn´t be rushed.

Another barrier is a tendency to prefer consideration of ideas against the solution, production of ideas. Critical consideration is much easier.

- **Cultural barriers**

Cultural barriers consist of facts that come from the long-term social development. There are mainly:

- Some traditions (e.g. “This is done like this for twenty years and we have been always content of it.”)
- Some social norms (”Playing games is only for children.”)
- Sometimes excessive orientation to rationality (“Do not fantasize and do something!”)

These cultural barriers can limit people earlier than they have opportunity to apply creative approach to work, in a family life, in a life at all. We bring it in ourselves, in our subconscious or unconscious mind. Cultural barriers can also become inseparable part of company culture and so an important inhibitor of innovative ability of the company.

- **Background barriers**

Barriers include lack of outer conditions of creativity. There are:

- Technical obstacles
- Organizational obstacles
- Social obstacles
- Overestimating of competiveness or cooperation

All stated barriers have to be considered by the teacher during planning of forms and methods for creativity development.

Another question of the interested professionals is the issue of creativity development. Due to professionals, we can develop the level of creativity. How to develop creativity at school? We can support creativity by many ways:

- We put time limited tasks.
- We keep the encouraging contact with pupils.
- We reward each pupil for his/her performance by a positive evaluation.
- We define targets of pupils' effort.
- We respect changing of active and latent creativity, "relaxing".
- We tolerate unsuccess.
- We let the children have enough freedom and space.

Torrance state 20 advices of the teacher how to increase creativity effectiveness of pedagogical activities:

1. Appreciate the creative thinking, support original ideas.
2. Increase percipience to the problems.
3. Encourage mistrust to authorities, closed solutions, given facts.
4. Learn to evaluate all ideas, the avant-garde ones including.
5. Cultivate tolerance and love to the unknown.
6. Avoid the press of routine.
7. Cultivate creative atmosphere.
8. Teach children to note ideas, have an idea diary.
9. Teach tolerance to opposed ideas.
10. Inform pupils about the mechanism of creative thinking.
11. Weaken the fear of the new things.
12. Support initiative, inclination to own choice of activities.
13. Put a bee in their bonnet, let them still to think about something.
14. Create situations that stretch the creative potential beyond the bound of possibility.
15. Change the period of active and passive creation, e.g. latent creation.
16. Make the tools for creative ideas realization accessible.
17. Teach children to transform ideas into reality, as consistently as possible.
18. Teach children to critize constructively.
19. Support wide view.
20. Pass children your creativity.

Holešovský states a little different set:

1. Curriculum must develop fantasy.
2. At school we try to enrich the supply of imagination.
3. Children have to learn to dream (due to statistics, cca 60% important inventions and discoveries were done during the day dreaming).
4. We support courage at children for realization of own ideas.
5. All creations – artistic or the others – have concrete use.
6. Accent on individuality.
7. Creativity is a game.
8. Children can see the things unconventionally, excessive experience is an obstacle to creativity.
9. The teacher must love the children and show them this feeling.

Other sources add the importance of the creative atmosphere, possibility to communicate among children during creativity, impact on divergent ideas, sensitivity to problems growing, adaptability to situation, ability to re-arrange ideas or pictures, ability to process more issues together etc. Exercise of non-dominant hemisphere has a favourably effect (right handed ones work with left hands), uncertain stimulus demanding individual interpretation, possibility of variations, disorderliness, the state that needs changes, development.

It is important to remove factors that hinder creativity development. It is:

- Fear of mistakes, ridicule, bad mark
- Stiffness, inability of the operation system flexion
- Compulsion to work – negative emotions
- Anger, fear, scare
- Stress – this can be caused by overload, noise, even overpopulation in contemporary "companies of education", smog, extremely strong impulses and also during watching dramatic scenes on TV. Work done under pressure, "for marks" has a very little chance that it would be done with a creative spirit and that it would enrich the child.
- Creative abilities should be used and practised. If we have to be able to solve demanding creative problems we have to meet them constantly. It is like with a jet plane: if it slows down, it falls down. Even our ideas – if they slow down they fall down into shallowness.

In general we can say that any task and any issue can be assigned in the manner of creativity development. It means that it has to enable individual solving, individual approach of every pupil and there is no forcing to the only one possible solutions. Even at schools where they do not want to leave routine methods, there is proved – if we determine one or two lessons a week in a timetable – when they can do what they need.

Particular rate of freedom is an essential condition of creativity, perfect plan doesn´t admit creativity. M.I. Sten states a couple of tools that we have for the creativity development, let´s name at least the practice of relaxation and autogenous training, dreaming support, hypnability development at children, roles playing etc. Beside other things, even the game called Arcturus N. It is the name of the planet with three times bigger gravitation than in the Earth, special atmosphere and six-fingered inhabitants. The teacher can outline it very lightly and the task is to get ideas into all the details.

Tasks, games and exercises stated in a container of games and methods are intentionally chosen as creative, so they can stimulate the children´s creativity positively.

How to develop creativity in a family

As it was said, **the influence of the family is the most powerful on creativity.**

What can be done for the favourable development?

1. **Every child should have one long-term hobby,** especially suitable are artistic hobbies – playing instruments, artistic interest group and very stimulating are also natural-scientific interest groups – contact with live animals, trips to the nature, plants growing. The most excellent people had very permanent, often unusual hobbies and interests from their childhood that later became a profession.

2. **The children should be praised for every creative activity,** they should feel trust in their activities and they should be lead to independence, initiative work and to be responsible for the results. They must feel interest of parents in results of their work.
3. **The child should not be overload by information** that don´t have possibility of own interpretation. There belongs not only a big part of education plans of contemporary school but also the most of movie and TV programmes. For healthy psychological development, there should not be exceeded the upper limit of time spent at TV that is 20-30 minutes daily for younger children, 1 hour for older children.
4. **The child shouldn´t be overstrained.** Do not give him own ambitious. Creative abilities of the child should not respond to marks that he receives at school. If he attends five various interest groups, maybe he would not be able to do anything properly and he would feel tired. It is better to let the child to choose what he wants to do and after to encourage him not to change one hobby into another one.
5. **Don´t try to organize the time of the child,** even in the best possible way and the best ideas. The child must learn to manage all his time from the childhood. The perfect plan does not admit any creative inventions.
6. **Give the child free time,** let him have dreams, playing and doing seemingly useless things while "he should learn".
7. **Support his activity,** adequate self-confidence, feel of good evaluation of himself. Only human that has trust in himself is able to develop and create his ideas and thoughts.
8. **Supress all the factors hobbling creativity development:**
    a. Fear of mistake, bad mark and unsuccess. The person who is afraid of the risk does not invent and create anything.
    b. Fear to adopt somebody else´s solution or at least to verify "if he can do what he wants" and if he can use some work order.
    c. Passive attitude, satisfaction with given things and relations. Low ambitions.
    d. **Work that was forced to do is a scourge** both for creativity and for work at all. If we still force the child to work that he hates, there is a big probability to create a person whose biggest delight will be laying on the sofa and gazing at the ceiling.

All the negative emotions – anger, stress, scare, unease, supress creativity and ability to think at all. Permanent stress or unease exposing can sign children permanently. We have to realize that for this it is enough to watch dramatic scenes on TV or videos. Perhaps it is comical when we pronounce: happy children are whose parents do not have video player or at least they choose what to watch.

Diagnostics of science gifted students

1. Diagnostics of giftedness

To motivate and develop pupils´ giftedness effectively it is necessary to **diagnose giftedness**. The situation is complicated because the initial form of giftedness is hidden and the pupil, parent or teacher is not able to reveal pupil´s extraordinary disposition. Comprehensive diagnostics of pupil´s giftedness is a necessary input into the process of its controlled development. Without this diagnosis it is not

possible to motivate gifted pupils and develop their giftedness effectively. A detailed initial diagnosis of pupil´s giftedness is crucial especially for the effective use of cognitive motivational teaching techniques.

It is necessary to establish special techniques and tools for diagnosing individual components of giftedness, including abilities. When creating them, it is necessary to consider for what stage of diagnostics, the techniques and tools are intended. The **diagnostic process** itself can be divided into several stages:

1. indication (signalling and detection of occurrence)
2. identification (analysis and description of characteristic features)
3. classification (recognition and categorization)
4. assessment (determination of the level compared with the standard)
5. interpretation (search for and explanation of the causes and conditions of the state)
6. prognosis (prediction of the development)
7. regulation (suggestion of the development control)

The prognosis and regulation can be considered as initial or transitional stages of therapeutic intervention that should follow after the diagnosis.

Science giftedness consists mainly of personal dispositions as inclinations for specific expressive skills that need to be diagnosed. This also includes the ability to observe analytically and to form preconceptions of natural objects and phenomena. We have discovered a close relation between the two abilities that could be of great importance for the diagnostics itself and for the interventional educational effect on the giftedness development. Our research tried to find a method and a diagnostic tool for the two phenomena of science education in gifted students, which are the abilities to:

- *observe analytically*
- *form preconceptions.*

First, we will try to give a brief definition of both investigated phenomena.

2. Analytical observation

Natural sciences (physics, chemistry, biology) use experiment as a basic method of researching nature. Although scientific and school science experiments differ in their aims, the substance of both of them is observation of natural phenomena in specific (laboratory) conditions. The advantage of laboratory experiments is controlled experiment simulation in clearly defined parameters and conditions. The core of the observation is perception, which includes the use of multi-sensory activities in connection with intellectual activity. We identified the observation of natural phenomena that brings the most relevant information as analytical observation. **Analytical observation** can be understood as the cognitive ability of individuals to choose significant (phenomenon-forming, system-forming) elements

of the observed natural phenomenon and define their relations that reveal the substance of the observed natural phenomenon. We divided the analytical observation into several activities in relation to the observed object or phenomenon as a system:

- holistic perception,
- analysis of individual elements,
- selection of system-forming elements
- looking for relations between system-forming elements.

Analytical observation can be regarded as one of the precursors of abstract thinking.

3. Formation of preconceptions

Children from birth perceive themselves through their senses, observe phenomena, manipulate objects and perform simple experiments. Gradually they create and fix their own ideas and interpretations of natural objects and phenomena. This creates a set of self-learning products in the form of intuitive ideas and interpretations. We use the term **preconceptions** for these constructs. We found out that the main components of science preconceptions are ideas and interpretations of natural objects and phenomena. The basic characteristics of preconceptions are their permanence and durability, which has been verified many times. For example, results of the didactic mechanics test, that we repeatedly used in our research with almost identical results, have proved that. Because there is usually interaction between preconceptions and curriculum in instruction. Preconceptions may be corresponding with the presented curriculum or uncorresponding with the curriculum (i.e. misconceptions). Children´s own concept of the curriculum is initiated even in the classroom. Here we are talking about conceptions. Preconceptions and conceptions influence the cognitive process to a large extent.

4. Didactic test of analytical observation

The subject of our research were pupil´s skills of analytical observation and formation of preconceptions in their relationship. We chose two research questions:

- *Could partial diagnostics of analytical observation skills and creation of preconceptions contribute to the diagnostics of science giftedness?*
- *What are the appropriate tools to diagnose analytical observation skills and creation of preconceptions?*

The first question is general and the other one is directed to specific diagnostics.

When seeking answers to our research questions, we applied a combination of theoretical and empirical research methods. The method of empirical research was a didactic test of analytical observation skills in children aged 5 -11 years with preconception elements. We assumed that the inclination for analytical observation and preconceptions develops from birth as children explore the

outside world and their own bodies. The target group for the diagnostics were children in the late preschool age and pupils at primary schools. Children aged 5 to 11 years were chosen because their giftedness shows little influence of knowledge and skills created in primary school instruction. But there are still enough developed skills and preconceptions at this age.

The diagnostic tool was a didactic test with items such as:

1. *Paul tried to build three block towers (Fig. 1). He managed to finish just one, the two other towers collapsed. Which tower remained standing?(Correct solution: C).*

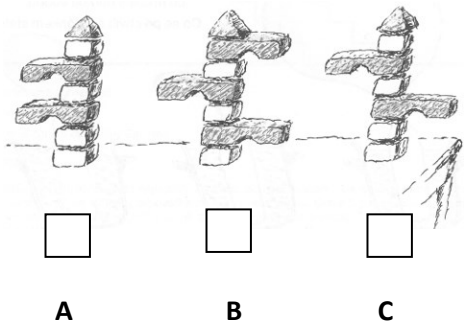


Figure 1. Three towers

2. *There is a brick at the longer end of the swing (Fig. 2). How many bricks must David stack at the shorter end of a half length to balance the swing? (Correct solution: B).*

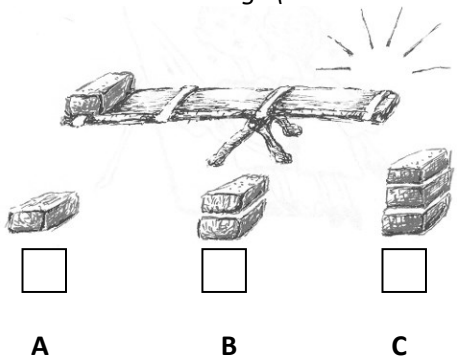


Figure 2. Swing

3. *Mum poured hot tea into three mugs (Fig. 3). The first mug was made of metal, second one was ceramic and the third one plastic. Where does the tea get cold first? (Correct solution: A).*

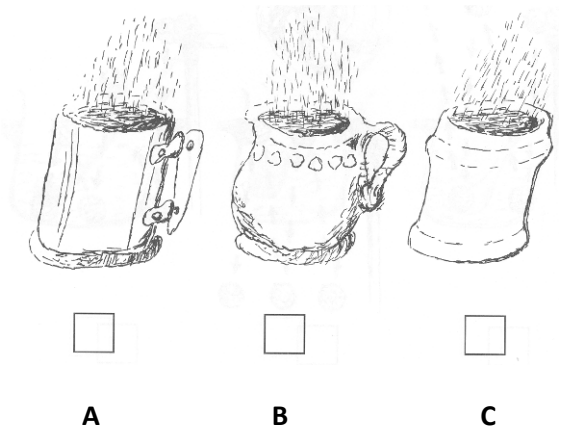


Figure 3. Mugs

The didactic test contained 20 items (tasks) with a choice of three answers (A, B, C) and just one correct solution. The content of the didactic test covered quite a wide age range of children - from 5 to 11 years. The principle was to balance the content items with the age and gender of tested children. The test tasks were presented in a graphic and verbal form to enable illiterate children (preschool age) to participate and also to promote clarity and evoke associated images in children. Pilot testing took place in the Czech Republic in 1998 on a sample of 200 children aged 5 years, 7 years, 9 years and 11 years and a total of 800 respondents. It was standardized within an extensive Czech-Polish research on a sample of 5,000 respondents in 1999. In 2007, the test was repeatedly distributed to 100 children in the Czech Republic: 25 five-year-old, 25 seven-year-old, 25 nine-year-old and 25 eleven-year-old, each age group was from a different school. During all the applications of the didactic test, we tried to distribute it in various kinds of schools, from small rural schools and to large urban ones. A part of the test was to verify the ability to form preconceptions of presented objects and phenomena.

The objectives of the didactic test were identified as follows:

(a) to determine the presence and level of analytical observation skills and corresponding giftedness
(b) to determine the presence and level of analytical observation skills according to the age of children
(c) to determine the dependence between the presence and level of analytical observation skills and gender of children

The didactic test was anonymous with the indication of the respondents´ gender. A standard statistical procedure (correlation, regression lines, etc.) was applied for the evaluation of the test results.

The frequency distribution of responses in the didactic test could be considered as normal. Both the original research (1998-1999) and its repetition (2007) showed significant differences between standard and gifted individuals. The research results corresponding to the partial test objectives were following:

(a) Analytical observation skills and corresponding dispositions occur in the population in normal distribution. Our setting of a relatively wide range for analytical observation skills showed 10-15% of gifted individuals. For accurate detection of occurrence and determination of the limit levels of giftedness it is necessary to conduct additional research.
(b) Calculated regression lines (girls, boys, everyone) rise steeply with pupils´ age. This fact demonstrates the significant dependence between the level of analytical observation skills and children´s age (5-11 years). Pupils´ skills grow in direct proportion to their age.
(c) The differences in the occurrence and level of analytical observation skills in boys and girls did not appear (were not statistically significant).

When analysing the research results, we discovered more interesting facts. For example, weak correlation between items of the same content. This means that pupils solved items of the same content both successfully and unsuccessfully. This corresponds to a low development level of abstraction and generalization, which is characteristic for pupils´ age.

When analysing the test results, we researched the relation between analytical observation skills and the ability to form preconceptions. We came to the conclusion that it will be necessary to develop a method and an additional and more sensitive diagnostic tool for the diagnostics of preconceptions and their connection with analytical observation. We assume that the appropriate diagnostic tool will be an expanded didactic test that could diagnose both analysed skills and their connections.

Our research enabled to answer the key research questions:

- *Could partial diagnostics of analytical observation skills and formation of preconceptions contribute to the diagnostics of science giftedness?*

The research results enable us to answer this question affirmatively. The analysis of essential prerequisites for science education showed that analytical observation skills and formation of preconceptions are two very important skills necessary for success in science education. The frequency distribution of pupils' performance in the didactic test of analytical observation shows that there is a relatively steady group of pupils who are much more successful than the others. We assume that these are science-gifted pupils. Future research of other abilities should confirm and complement our findings.

- *What are the appropriate tools to diagnose analytical observation skills and creation of preconceptions?*

Our didactic test proved to be a useful tool for the diagnostics of pupils´ analytical observation skills and it will be developed further as a combined test for diagnosing the ability to form preconceptions. We are seeking and developing other diagnostic tools that could confirm and expand our findings.

5. Prospects for the diagnostics of science-gifted pupils´ skills

We created a standardized didactic test that proved to be an appropriate tool for diagnosing analytical observation in preschool and early school-age children. This diagnostic tool can help teachers to detect children´s science giftedness and lead to its development.

In combination with other diagnostic tools, the following pedagogical-psychological research questions can be answered:

- *What dispositions are the basis of certain skills?*
- *What factors influence (and to what extent) the development of certain skills?*

The above-mentioned problematic issues are particularly important for gifted pupils and their development.

From the pedagogical point of view there are additional research application questions that are important:

- *What is the structure of the skill set in science-gifted pupils?*
- *What teaching techniques can develop science skills of gifted pupils?*
- *What is the skill development in particular individuals? What factors determine this development?*
- *What impact on skill development has motivation, especially in the form of interest?*

Those questions should be answered in further research of science-gifted students.

An important issue is the role of ability to form preconceptions in gifted pupils. The **diagnostics of preconceptions and ability to form preconceptions** can help us here. We created a working hypothesis that the development of the ability to form preconceptions (and later conceptions in instruction) is an important part of giftedness development and is closely related to creativity. We intend to verify this hypothesis.

The diagnostics of preconceptions is also important for education of both standard and gifted pupils, because in the case of affirmative (positive) preconceptions it is the basis of constructivist educational practices. Even more important is the diagnostics of disapproving (negative) preconceptions, because it is effective prevention of successful learning. We believe that there is a very close link between analytical observation skills and ability to form preconceptions and conceptions of natural objects and phenomena. This hypothesis should be verified. As a basis for appropriate diagnostics seems to be a diagnostic tool in the form of a didactic test that we use for diagnostics of analytical observation. Due to the research efficiency we are considering the creation of an integrated didactic test.

The research issue of preconceptions is quite broad. It would be necessary to answer the following research questions:

- *What factors affect the ability to form preconceptions of natural objects and phenomena?*
- *To what extent is forming preconceptions of natural objects and phenomena influenced by individual creativity?*
- *How do quality and quantity of preconceptions and ability to form preconceptions differ in standard and gifted individuals?*
- *What teaching techniques can affect the ability to form preconceptions (conceptions) in gifted pupils?*

Within the future research of this issue it will be appropriate to compare our research data with the data from alternative diagnostic methods, including for example video studies. An equally important task is to research how skills of gifted and standard pupils develop at higher levels of education in different subjects.

The diagnostics of gifted pupil´s skills is one of the important areas of basic and applied special education research. It can contribute to spreading theoretical knowledge of these important pedagogical and psychological issues and in applied research it seems to support the formation of educational techniques for developing pupils´science giftedness through the development of their individual skills.

Science-gifted pupils are unquestionably individuals with special educational and behavioural needs. These educational needs of gifted pupils have been of marginal interest to both formal and informal education, as well as relevant research. This bad situation needs to be changed. The importance of science-gifted pupils´ care for the development of today's technology-driven society is quite indisputable. Relatively rare science giftedness can not be left undeveloped for the benefit of individuals and the whole society.

Training questions and tasks

(a) Create items into similar didactic test in your teaching subject(s).

(b) Identify important factors as the analytical observation in your teaching subject(s).

(c) Create a sample of diagnostic methods of giftedness in your teaching subject(s).

Recommended literature

FREEMAN, J. Gifted Lives: *What Happens when Gifted Children Grow Up*. New York: Routledge Chapman and Hall, 2010.STERNBERG, R. J. Giftedness According to the Theory of Successful Intelligence. In N. Colangelo & G. Davis (eds.) *Handbook of Gifted Education*. Boston MA: Allyn and Bacon, 2003, pp. 88-99.

TRNA, J. *Objevte v sobě Einsteina*. Brno: PAIDO, 1999.

TRNA, J., & TRNOVÁ, E. Diagnostics of the Analytical Observation and Preconceptions in Science Education Particulary Focused to Gifted Students. In *Proceedings of XIII. IOSTE Symposium the Use of Science and Technology for Peace and Sustainable Development.* Izmir, Turkey: Buca Fafulty of Education, Dokuz Eylul University, 2008. pp. 1240-1246.

Motivational School Science Experiments in Learning Tasks

1. Science and school science experiments

Experimentation, alongside observation, analyzation, comparison, generalization, creation and verifying hypothesis etc. is one of the basic activities of scientists. The experimental part of science is the basic source of scientific information. The theoretical part of science uses experiments for confirming theoretically deduced conclusions. The science experiment can be characterized as an artificial natural process (or state) evoked in pre-adjusted and controlled laboratory conditions. The aim of the science experiment is the discovery of a new natural relation and its formulation in the form of a natural law.

The school science experiment has a completely different aim. It is the effective understanding of a natural phenomenon by students. Through this experiment the student learns the formerly discovered natural relations and he or she tries to understand the natural law. It is sometimes didactically effective to let the student work as a scientist while detecting the natural relation but only in a shortened form. The identification that discovery is not always direct but full of impasses and that sometimes it is a matter of law is also very valuable.

The school science experiment can play several roles: educational aim (e.g. the skill to measure temperature), educational content (e.g. Mendel's genetic experiments), the basis of the experimental educational method and an educational material tool.

The current experimental educational methods are based on constructivist educational theories (J. Piaget, G. Bachelard etc.) and they lead to learning through an activity. The student learns the natural phenomenon through their own active cognitive activity (especially through experimentation). This approach leads to the fulfilment of current innovative educational aims, especially skills and competences.

2. Simple school science experiments

One important kind of school science experiment is the simple experiment. The valuable educational meaning of these simple experiments was confirmed by educational-psychological research. The most important characteristic of each simple experiment is the transparency of the basis of the natural phenomenon. Moreover, a simple experiment with simple tools has a series of important characteristics that classify it with a very prominent place in the teaching technology of science education.

- The repressiveness of other natural phenomena that may appear during the experiment and distract the student's attention from the main tested natural phenomenon.
- Qualitativity of the experiment where there is no need to implement difficult measurements that distract the students' attention instead of focussing on the centre of the phenomenon.
- The ease of educational application of an experiment by the teacher and above all the effectiveness of cognition by the students, who perceive the natural phenomenon through the majority of their senses.
- The troubleness, where the students' cognitive needs for solving the problem and their following activity leading to an endeavour to solve the problem are awoken. Extreme activation of these cognitive needs is invoked principally by paradoxical experiments.
- The unpretentiousness and safety of the technical realization of an experiment that can be realized by the student either in a lesson or at home in terms of home training.
- The economical unpretentiousness (low price and easy accessibility) that is an important factor in the conditions of effective usage of limited financial sources.
- The creation of students' skills for experimentation and developing their own creativity.

The usage of each simple tool (materials and things) that the students know from everyday life is very important from the pedagogical-psychological constructivist point of view. Then we can very effectively use the students' positive pre-competences and ground them in the lesson. On the other hand it is possible to fight with natural misconceptions using these simple experiments.

3. Motivational effectiveness of school science experiments

The school science experiment has noticeable input when applied in a lesson, but also in informal education; it arouses several cognitive and psychological needs at the same time. These include in particular: solving problems, sense and muscle activity and modelling the natural phenomenon. The evidence of the motivational effectiveness of these experiments is their successful commercial usage in making toys either for children or for adults ("yo-yo", wooden toys, etc.)

The simple school science experiment has an especially motivational effect because its main characteristic is the transparency of the basis of the presented natural object or phenomenon. A prominent group of simple experiments are "hands-on" experiments, which use tools in the shapes of everyday things and materials used by students. Their attention is focusses on investigation of the separate phenomenon, not on the tools used within the experiment. This area of science education is given huge attention in the wider world.

The cognitive and motivational teaching techniques that are based on the usage of school science experiments effectively affect both gifted and ungifted students. The question is how much the school science experiment is important for the development of students' giftedness. If yes, then it is necessary to prepare and apply suitable motivational techniques, especially focused on gifted students.

The school science experiment as a prominent and maybe crucial educational tool is not correctly used in terms of practice and methodology. For this reason it is quite difficult to identify and measure its real function and importance.

Cognitive motivation is crucial for a student while using an experiment. Next to cognitive motivation there are also output and social motivations that we cannot influence especially in e.g. science competitions, where the students verify the level of their gift. The experience of success with praise in such a competition leads to noticeable secondary training to reach distant aims such as high school or university education focused on a scientific or technical field of study. Multiplication of the motivational effectiveness can be reached by a combination of two or even all three types of school motivation: cognitive, achievement and social. This combination of cognitive, achievement and social motivational educational techniques was used in learning tasks with experiments.

4. Research into the effectiveness of school science experiments

Our research into gifted students' motivation supports the opinion that science giftedness of a student strongly depends on the student's motivation with the huge role of experimenting. We focused on the following research question:

Is the school science experiment an important instrument for the motivation of gifted students?

The research by means of a questionnaire was preceded by an introduction in the form of observation and discussions with gifted students and their teachers. The questionnaire consisted of a set of opened and closed items. We supposed that the gifted students for one chosen science subject, which was chemistry, were a sufficiently representative sample of science gifted students. The age of the students was between 14 to 15 years. The questionnaire was applied in January 2009 to 26 respondents (gifted students in chemistry) from lower secondary schools in the Blansko district in the Czech Republic. A part of the research results is presented in Tables 1 and 2:

Question 1: *What attracts and interests you most about chemistry?*

The frequency of students' answers is introduced in Table 1:

Table 1. The frequency of students' answers on question 1

1	Experiments	17	65.4 %
2	Problems solving	13	50.0 %
3	New discoveries	5	19.2 %
4	Chemistry all around us	3	11.5 %

Question 2: *What activity should definitely be included in chemistry school competitions for gifted students (e.g. Chemistry Olympics)?*

The frequency of students' answers is introduced in Table 2:

Table 2. The frequency of students' answers on question 2

1	Experiments	9	34.6 %
2	More rapid chemical reactions	2	7.7 %
5	Chemical calculations	1	3.9 %

6	Assembling chemical formula	1	3.9 %
8	Production of chemical models	1	3.9 %

We dare to state on the basis of the statistical processing of the established facts that school science experiments significantly motivate science gifted students. Since this research was conducted on a small sample of students gifted in chemistry, we proved it in the following research with similar results.

This meaning of the school science experiment has long been known to teachers, but unfortunately it is often omitted. It is possible to find a row of objective, and subjective reasons, for this unsatisfactory state. However, none of them warrant the limit of the development of students' giftedness through insufficient use of school science experiments.

5. Learning tasks with experiments

It is necessary to create products of applied research usable in school practice for the development of gifted students. Those educational technologies must be put into practice on completely typical tasks. Thus, the results of the research work are transmittable to the following stage – into the development of circulatory materials, directly applied in teaching at schools and in the area of school science education.

As an example our research outcomes of the role of learning tasks with experiments suitable for the development of gifted students in physics are presented:

5.1 Motivating learning tasks with a problem experiment

Problem teaching is a respected and proved innovative educational method. The psychological basis of problem teaching is the evocation of a need to solve a problem that is strongly developed by gifted students. There appears to be a cognitive conflict in the students' mind that meets an input for awakening a strong cognitive motivation. The student starts to resolve the problem actively. We used this cognitive conflict in the inclusion of problem experiments into the learning task. Thus, we combined two cognitive motivational educational techniques: solving a problem and an experiment (particularly simple). Both the social and output motives led to the problem being solved. An example of learning tasks based on a problem experiment is the following learning task:

Cork with a coin

There is a coin attached to the pedestal of a cork. The diameters of the coin and the cork are identical. The cork is so high that only the coin sticks out when the cylinder is stuck into the water (see Fig. 1).What will the situation be after overturning and resticking the cork with the coin back in the water?

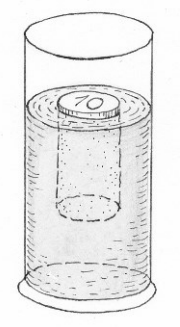


Figure 1. The floating cork with a coin

The correct solution: The height of the protruded cork is the same as the height of the coin. The weight of the cork and the coin does not change after turning it over. According to Archimedes' principle, the lifting force impacting on the cork is identical and the submerged volume of the cork does not change.

5.2 Motivating learning tasks with a toy-experiment

A didactic toy that can serve in science education is defined as an object that has a certain quality that is noticeably different from other objects (e.g. shape, colour, elasticity) and that attracts the attention of a student and also an adult. The people then conduct unintentional as well as aimed experiments. Toy-experiments awaken several needs from the motivational point of view at the

same time: movement activities, problem solution, and relaxation through a game. They contain a combination of cognitive and social needs. We used the toy in the learning task to arouse motivation. The gifted student is motivated by working out the causes of the toy's behaviour; possibly, he or she predicts its future behaviour. An example of a learning task based on a toy-experiment is the following task:

Balancing egg

A polystyrene (wooden, plastic) egg with an adjusted centre of gravity (this adjustment is not visible at first sight) paradoxically does not turn from its unstable position standing on its spike into a stable lying position (see Fig. 2). Explain why.

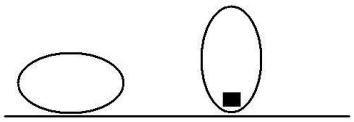


Figure 2. Balancing egg

The correct solution: The weight adjusted egg's centre of gravity is located just above the pad. Consequently, the stable position of the egg is the standing position from which the egg can not be turned.

5.3. Motivating tasks with modification of an experiment

The experience from the action research showed that strong motivation and support of the development of a gifted student's creativity are developed by learning tasks when the student's task is to create a modification of an experiment or to assemble an experiment that demonstrates an additional natural phenomenon. The cognitive, social and achievement needs are awakened by solving this task and creativity is developed. We introduce a task as an example of modification learning task whose aim is to demonstrate an additional natural phenomenon to the known phenomenon:

Over pressured bottle:

Experiments in a hypotonic room (water object of vacuum pump) are often demonstrated. There is a bend in the vacuum pump under the membrane by the creation of a vacuum. Create a mechanism that demonstrates the additional phenomenon in a hypotonic room. How would this phenomenon be manifested on the human organ of hearing?

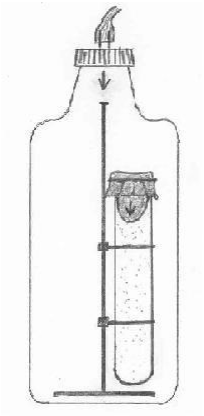


Figure 3. Over pressured bottle

The correct solution: The test tube fixed in the over pressured bottle is covered by a rubber membrane that bends due to overpressure (Fig. 3). The overpressure is created by the help of a tyre valve in the gland of the bottle and inflator. The rubber membrane simulates the behaviour of an eardrum while bathing or diving. The danger rests upon an incidental failure of the eardrum due to a bump on the water surface or due to the pressure of the water column when diving.

Training questions and tasks

(a) Create your own learning task suitable for the development of gifted students in your teaching subject(s).

(b) Identify other important educational elements for the development of giftedness in your teaching subject(s).

(c) Create a sample of implementation of the motivational element in your teaching subject(s).

Recommended literature

BERLYNE, D. E. (1977) Notes on Intrinsic Motivation and Intrinsic Reward in Relation to Instruction. In: Clarizio, H. F. Craig, R.C., Hebrens, W. A.: *Contemporary Issues in Educational Psychology*. London.

NĚMEC, J., TRNA, J. (2007) Edutainment or Entertainment. Education Possibilities of Didactic Games in Science Education. In THE EVOLUTION OF CHILDREN PLAY - 24. ICCP Word Play Conference. Brno: Pedagogická fakulta, Masarykova univerzita, Brno, P. 55-64.

TRNA, J. (2000) Teacher Training in Elementary School Experiments. In *Science and Technology Education in New Millennium. 3rd IOSTE Symposium for Central and East European Countries.* Prague: PERES Publishers, P. 201-206.

TRNA, J., TRNOVÁ, E. (2006) Cognitive Motivation in Science Teacher Training. In *Science and Technology Education for a Diverse Word.* Lublin (Poland): M. Curie-Sklodovska university press, pp. 491-498.

ICT-based collaborative action research in the motivation of gifted students

1. In-service science teacher training for giftedness

Improvement of professional science teachers' competences is the base for the motivation of students towards science education and especially for the improvement of science giftedness of students. Science teachers need new teaching/learning strategies for gifted students. One of these strategies is ICT-based collaborative action research.

It is possible to identify two main barriers in promoting the use of innovative science education technology within school practice: the efficient dissemination of information to science teachers and the motivation of science teachers to learn and use innovative science educational technology. We try in this study to alleviate these barriers. It is proposed that a web-based environment can provide very effective technology for science teachers' collaboration. High-quality professional development should reflect the best available research and practice in teaching and enable teachers to develop further expertise in subject content, teaching strategies, and uses of ICT, and it has to be planned collaboratively by teachers and those who will facilitate that development. In-service science teachers are learners who actively construct their own understanding about teaching and learning preferably in the context of professional learning communities. This is achieved through building on their personal teaching experience and is determined by their attitudes and beliefs. Action research and full utilization of ICT including web–based education are important parts of this process.

2. ICT-based collaborative action research

Action research in education is defined and described by modified conditions. Action research is also known as participatory research, collaborative inquiry, emancipator research, action learning, and contextual action research. In the case of this research the following simple structure is applied (Figure 1).

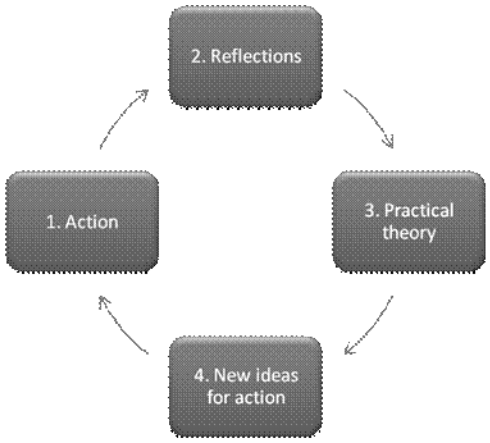


Figure 1. Action research scheme (Elliot, 1997).

Our new core idea is to use action research in a web-based environment realised through the international collaboration of science teachers. The expected positive outcomes are targeted in two developmental directions: in-service science teacher training and students' learning of science. Improvement of science giftedness of students is stressed.

Action research is mainly undertaken by one teacher in one class. We applied and explored action research in modified conditions with two collaborating teachers, working on-line in two classrooms, in two different countries, using English in addition to home languages, and on-line instruction by use of ICT. That is why we call it "**ICT – based collaborative action research**" (ICT-BCAR). An important aspect of this approach is that participants in collaborative action research are co-researchers. The principle of collaborative co-research presupposes that each participant's ideas are equally significant as a potential resource for creating interpretive categories for analysis, as negotiated among the participants.

The "action" factor of action research (see Figure 1) is ICT-BCAR in action among teachers and students from Portugal and the Czech Republic. This collaboration is intended to upgrade

teaching and learning using motivational methods and the introduction of innovative school experimentation. Students are involved both cognitively and attitudinally in the process of learning and are encouraged to play a teaching role with respect to their peers.

We identified the following ICT-BCAR setting steps:

1. Selection of topic

2. Selection of students

3. Use of information and communication technologies (ICT)

4. Collaboration schedule

5. Elaboration of materials for teaching and learning

The examples of these steps are in the form of both specific materials and examples drawn from e-portfolios.

2.1 Selection of topic

Not all science topics are equally suitable for ICT-BCAR, so the following topic-selection criteria were applied: position of the topic in the national curricula, importance of topic for students' development, and interest for students. The relevance of the position of the topic in the national curricula was a particularly important factor as it should belong to the science curricula of both countries i.e. the location with respect to the students' age range should be similar. It was on this basis that through comparisons of both the Portuguese and Czech curricula the topic "photosynthesis" was selected (see Table 1).

Table 1. Selection of topic

Extract from the Portuguese curriculum	***Extract from the Czech curriculum***
Unit 1 - GENERAL MATERIAL 1. Collection of material by heterotrophic beings. 1.1 Single-cell vs Multi-cellular organisation. 1.2 Ingestion, digestion and absorption. 2. Collection of material by autotrophic beings. **2.1 Photosynthesis.** 2.2 Chemosynthesis.	*GENERAL BIOLOGY* *Expected Outcomes* The students shall: - distinguish living from non-living systems on the basis of their typical properties. - compare significant hypotheses on the origin and evolution of living systems on the Earth. - explain the arrangement and function of the structural components and life manifestations of prokaryotic and eukaryotic cells. - explain the significance of the differentiation and specialisation of cells for multicellular organisms. - deduce the hierarchy of recent organisms based on their knowledge of their evolution. - explain the principle of photosynthesis and evaluate plants as the primary producers of biomass.

2.2 Selection of students

The main conditions for the selection of students are comparable age and ability. They need to be approximately the same age because of the requirement for cooperation. Students also need to have a reasonable capacity to both communicate in English and use ICT. Portuguese students from the first year of level III and the Czech students of the first year of grammar school were selected for being most suitable for this work; both groups are at the beginning of the secondary school and aged 15-16 years (see Table 2).

Table 2. Selection of students

Information	The Czech students	The Portuguese students
Age	15-16 years	15-16 years
Position at school	first year of grammar school	first year of level III
Ability to communicate	English	English
Ability to use ICT	PC, Skype, ICQ, e-mail	PC, Skype, ICQ, e-mail

2.3 Use of information and communication technologies (ICT)

Effective communication strongly influences collaboration between teachers and students. In the case of international collaboration it is necessary to use 'on-line' technologies. Consequently, most communication for both teachers and pupils was through email, Skype, ICQ or similar technology (see Table 3).

Table 3. An example of Skype communication between students

"[11:07:20] Andre: Yes I already told you that we are making some experiences with plants.

[11:08:13] André: We put some plants on a cup and we smash them, and we add some alcohol!

[11:08:59] André: We filter the mixture to another cup and put some chromatography paper.

[11:09:15] Martin: Can you send a photo of that..?

[11:09:21] Martin: Please!

[11:09:31] André: And we watch the results, the colours that were formed on the paper.

[11:10:03] Martin: Ah, that's quite interesting :)"

2.4 Collaboration schedule

Teachers have to prepare a schedule of their and their students´ activities in ICT-BCAR. The table below provides some indication of both the periodicity and purpose of the joint contact; not all details are included (see Table 4).

Table 4. Collaboration schedule

Date	Objectives/ Questions	Contents	Activities
2. 3.	*What does each student already know about this topic?* *What strategies are used to obtain material for autotrophic beings?* *How do autotrophic beings get the matter responsible for their growth?*	*Collection of material by autotrophic beings.*	***Activity 1*** *Pre-test.* ***Activity 2*** *Analysis, interpretation and research, discussion and debate; paper and pencil exercises.*
3. 3.	*What are the main autotrophic beings?* *Which characteristics of photoautotrophic beings enable them to convert the radiant energy into chemical energy?* *What photosynthetic pigments exist in plants?*	*The plants and other autotrophic beings.* *The chloroplasts are the organelles where photosynthesis takes place.*	***Activity 3*** *Analysis, interpretation and research, discussion and debate; laboratory work: Observation of chloroplast.* ***Activity 4*** *Analysis and interpretation of information, laboratory work: "Extraction and separation of photosynthetic pigments.*
5. 3.	*What is the significance of different visible light radiation on photosynthesis?*	*Details omitted.*	*Details omitted.*
9. 3.	*What is the importance of autotrophy's beings at the ecosystems level? –* *What is the relationship between the materials used in photosynthesis and the resulting products?*	*The process of photosynthesis: an overview*	***Activity 6*** *Analysis, interpretation and research, discussion and debate; paper and pencil exercises (worksheet).*
10. 3.	*Starch formation and photosynthesis - what is the relationship?*	*Details omitted.*	*Details omitted.*

12. 3.	*Which factors influence the rate of photosynthesis?*	*Factors that influence photosynthesis.*	***Activity 9*** *Analysis, interpretation and research, discussion and debate; investigative path.*
16. 3.	*How does chemosynthesis occur?* *Chemosynthesis vs. Photosynthesis - What are the similarities and differences?*	*Details omitted.*	*Details omitted.*
17. 3.	*What does each student knows about this topic?*	*Details omitted.*	*Details omitted.*

2.5 Elaboration of materials for teaching and learning

All the materials were prepared by the two cooperating science teachers as part of their engagement with the ICT-BCAR process. It is possible to create a wide variety of resources such as power-point presentations, videos and worksheets, one of which is provided below. This level of detail is necessary to convey a sense of the high levels of commitment and cooperation required (see Figure 2).

Ministério da Educação
Direcção Regional de Educação do Centro
Centro de Área Educativa de Viseu

ESCOLA SECUNDÁRIA DE VIRIATO 02977

GYMNÁZIUM BOSKOVICE

10th year of schooling **Academic Year 2008/2009**
Biology and Geology
Name: _____No. ___ Class B

Worksheet

How do autotrophic beings get the matter responsible for their growth?

Introduction

Acquiring matter and energy is carried out in many ways by living systems. Autotrophic beings, living beings capable of producing the organic matter they need for their survival, can perform this production activity by using light or chemical energy as an energy source to synthesize organic matter from mineral matter.

Autotrophy, therefore, involves two processes: photosynthesis, used by photoautotrophic beings (for example green plants), and chemosynthesis used by chemosynthetic beings (for example sulphur bacteria).

Activity 1

As long ago as ancient Greece, it was known that fertilized soil allowed the growth of plants, believing that this only depended on nutrients that they get from the soil.

In a posthumous publication (1648) Van Helmont describes an experiment which attempts to explain this hypothesis.

He placed a small 2.268 kg sprig of willow in a vessel containing 90.718 kg of dry soil (both weighed very precisely). He put water (pure rainwater) on the young plant regularly over five years. After this time he weighed the plant again, after properly cleaning the plant (get rid of all the earth - soil). He found that it weighed 74.389 kilograms. Weighing the earth (soil) in the pot, he found that it had only decreased by approximately 56.7 g. From these results he concluded tha the total increase in the weight of the plant was mainly due to the water that plant received, which would have made all other elements necessary for the growth of the small willow.

Tasks:

1. *Do you think the data supports the original hypothesis? Justify your answer.*

2. *Van Helmont inferred from the data he collected that the growth of plants is solely due to the addition of water. Examine critically the conclusion drawn by Van Helmont.*

3. *Identify the variables that were not monitored during this experiment.*

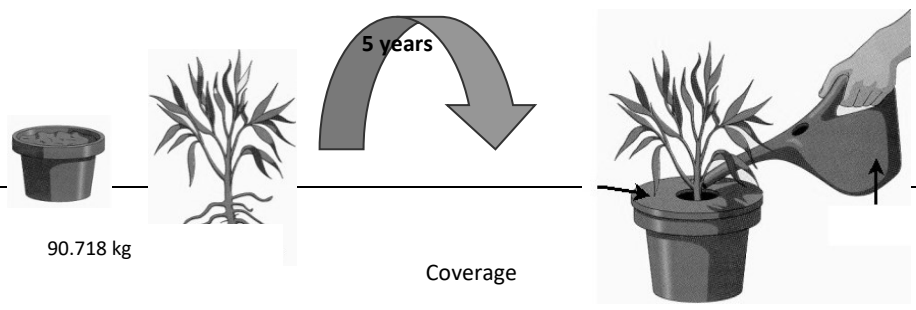


Figure 2. Van Helmont experiment

Activity 2

A Quercus spp., a eucalyptus plantation (Eucalyptus spp) and a pasture (Vicia spp.; Bromus spp. are all being assessed by Portuguese investigators to identify which of these offers the best carbo dioxide retention (CO_2), the gas which most contributes to the greenhouse effect.

The forest's ability to retain CO_2 has been called a "carbon sink" under the Kyoto Protocol to combat climate change. Plants (trees) absorb CO_2 by photosynthesis carried out by plants that, unlike humans and animals, retain carbon dioxide and release oxygen.

(Adopted from http://www.agroportal.pt/x/agronoticias/2005/02/14d.htm)

Analyse Fig. 3 and 4.

Primary Production is the amount of organic matter that is produced by autotrophic beings from solar energy (photosynthetic organisms) or chemical energy.

Gross primary production (PPB) - is the conversion rate of CO_2 into organic carbon per unit are The Net Primary Production (PPL) - is all the energy that producers store from the photosynthes (PPB) minus what they spend on respiration (R) PPL = PPB – R.

The efficiency of photosynthesis is converted to radiation incident to PPL divided by the total incident radiation.

The general formula of photosynthesis is: $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$ and for eac gram of C assimilated, 39 kJ of energy are stored.

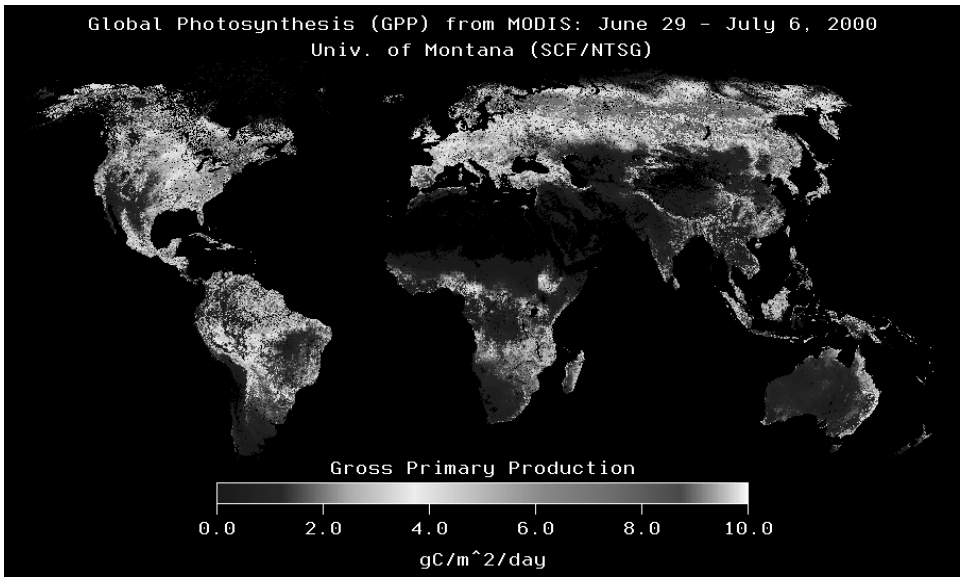


Figure 3. Gross Primary Production (PPB) worldwide registered between June and July 2000.

Figure4. Portugal and the Czech Republic geographical location.

Tasks:

1. *Compare the PPB in the countries of the world registered in Figure 3.*

2. *Mention some of the factors that could explain the differences observed in the Northern and the Southern Hemispheres*

3. *Analyse the Portuguese and Czech cases specifically. Collect, organize and analyze critical information on the similarities and/or differences in PPB for the period considered in the picture.*

4. *It was found that CO_2 absorption of 3-4 times higher in eucalyptus forests in Portugal Howeve researchers believe that Portugal should choose to have various types of forest.*

Discuss the appropriateness of the measures that are being put into practice by Portuguese scientists.

Figure 2. Worksheet

3. The inquiry of effectiveness of the ICT-based collaborative action research

Our inquiry tries to answer a specific research question aimed at the efficiency of science education. The questionnaire, while it has both advantages and disadvantages, is a useful tool for gathering a wide range of pre-determined areas of interest. Students completed such a questionnaire that focussed on their reflections on this innovative bilateral collaboration. Their answers indicate very high levels of both motivation and engagement with the educational process; they learnt a great deal (see Tables 5 and 6).

Table 5. Questionnaire results 1

Responses by Portuguese/Czech students (from the questionnaire for students):

Do you believe that the online environment influenced your teacher's performance? N=27/21	
Yes	52% / 67%
No	48% / 33%

Responses by Portuguese/Czech students (from the questionnaire for students):

Do you believe that the online environment influenced your performance and learning? N =27/21	
Yes	89% / 90 %
No	11%/ 10 %

Table 6. Questionnaire results 2

Responses by Portuguese/Czech students (from the questionnaire for students):

In the statements listed below are some of the aspects related to the activities shared with your Czech colleagues. Choose the option which best expresses your opinion.					
N=27/21	*Disagree*	*Partially Agree*	*Agree*	*Strongly Agree*	*No opinion*
The partnership helped you to better understand certain aspects on this topic.	*7%* *0%*	*33%* *29%*	*42%* *47%*	*14%* *19%*	*4%* *5%*
You would have achieved the objectives of this topic better by interacting only with your classroom classmates.	*33%* *29%*	*52%* *29%*	*4%* *29%*	*4%* *0%*	*7%* *13%*

4. Conclusions

The main outcomes of the implementation and the research of the ICT-BCAR are as follows:

1. Strong motivation of students and teachers especially in communication with colleagues in another country, new information, application of new knowledge from abroad, new personal contacts, etc.

2. Exchange of experiences between teachers (teaching methods) by comparing curricular material (textbooks, learning tasks, experimentation, etc.).

3. Inserting new educational methods based on research through teachers' application of action research monitored by science educational experts.

4. Teacher training in the use of action research.

5. Teachers' and students' improvement of skills to use ICT.

6. Teachers' and students' development of English language and partner country languages.

7. Acquisition of subject (biology) knowledge and skills (e.g. Van Helmont experiment).

8. Gaining collaboration competencies between teachers and among students (needed more than normal communication).

9. Team collaboration among teachers inside the partner schools (support with ICT, English, organisation of lessons etc.).

10. Team collaboration among students within the partner schools (support with ICT, organisation of lessons etc.).

The international dimension of science education provides a good opportunity for the development and dissemination of ideas and curricular materials among teachers through the use of ICT. A web-based environment can be very effective technology for science teachers' and students' collaboration leading to the upgrading of science education.

These research outcomes support the notion that ICT-BCAR is important for improving ungifted and especially gifted students in science.

Training questions and tasks

(a) Select the topic for ICT-BCAR suitable for development of gifted students in your teaching subject(s).

(b) Create a part of a worksheet for ICT-BCAR in your teaching subject(s).

(c) Try to identify other ICT applications for the development of giftedness in your teaching subject(s).

Recommended literature

ELLIOT, J. (1997). *Action Research for Educational Change*: Open University Press.

HAMMERSLEY, M. (2002). *Educational Research. Policymaking and Practice.* London: Paul Chapman Publishing.

HOLBROOK, J., RANNIKMAE, M. (2009). Meaning of Scientific Literacy. *International Journal of Environmental and Science Education*, Vol. 4(3), pp. 275-288.

TANNENBAUM, A. J. (1983). *Gifted children: Psychological and educational perspectives*. New York: MacMillan.

Attachments

Attachment 1: Resources of Definitions Talent

List where is possible to find definition of giftedness:

1. National/State Policies Regarding Education of the Gifted (Passow, 1993)

- Passow, A.H. (1993). National/state policies regarding education of the gifted. In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..
- Passow, A.H., Monks, F.J. & Heller, K.A. (1993). Research and education of the gifted in the year 2000 and beyond. In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..

2. Structural Tendencies and Issues of Research on Giftedness and Talent (Heller, 1993)

- Heller, K.A. (1993). Structural tendencies and issues of research on giftedness and talent. In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..

3. Constructs and Models Pertaining to Exceptional Human Abilities (Gagne, 1993)

- Gagne, F. (1993). Constructs and models pertaining to exceptional human abilities. In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..

4. Developmental Theories and Giftedness (Monks & Mason, 1993)

- Monks, F.J. & Mason, E.J. (1993). Developmental theories and giftedness. In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..

5. Thinking Processes: Being and Becoming Gifted (Shore & Kanevsky, 1993)

- Shore, B.M. & Kanevsky, L.S. (1993). Thinking processes: Being and becoming gifted. In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..

6. Research and Education of the Gifted in the Year 2000 and Beyond (Passow, Monks & Heller, 1993)

- Passow, A.H. (1993). National/state policies regarding education of the gifted. In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..
- Passow, A.H., Monks, F.J. & Heller, K.A. (1993). Research and education of the gifted in the year 2000 and beyond. In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..

7. Creative Giftedness: A Multivariate Investment Approach (Sternberg & Lubart, 1993)

- Sternberg, R.J. (1993). Procedures for identifying intellectual potential in the gifted: A perspective on alternative “Metaphors of Mind”. In K.A. Heller, F.J. M?nks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..
- Sternberg, R.J., Ferrari, M., Clinkenbeard, P. & Grigorenko, E.L. (1996). Identification, instruction, and assessment of gifted children: A construct validation of a triarchic model. In Gifted Child Quarterly 40(3), 129-137.
- Sternberg, R.J. & Lubart, T.I. (1993). Creative giftedness: A multivariate investment approach.In Gifted Child Quarterly 37(1), 7-15.
- Sternberg, R.J. & Zhang, L.F. (1995). What do we mean by giftedness? A pentagonal implicittheory. In Gifted Child Quarterly 39(2), 88-94.

8. A Conception of Giftedness (Feldhusen, 1986)

- Feldhusen, J.F. (1986). A conception of giftedness. In R.J. Sternberg & J.E. Davidson (Eds.), Conceptions of gifted. New York: Cambridge University Press.
- Feldhusen, J.F. (1982). Meeting the needs of gifted students through differentiated programming. Gifted Child Quarterly 26(1), 37-41.
- Feldhusen, J.F.. Saturday and summer programs. In N. Colangelo & G.A. Davis (Eds), Handbook of gifted education. Boston: Allyn and Bacon.
- Feldhusen, J.F. & Baska L.K. (1989). Identification and assessment of the gifted. In J.F. Feldhusen, J.L.Van-Tassel-Baska & K.R. Seeley (Eds.), Excellence in educating the gifted. Denver: Love.
- Feldhusen, J.F. & Jarwan, F.A. (1993). Identification of gifted and talented youth for educational programs. In K.A. Heller, F.J. M?nks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..
- Feldhusen, J.F. & Kolloff, P.B. (1986). The Purdue Three-Stage enrichment model for gifted education at the elementary level. In J.S. Renzulli (Ed.), Systems and models for developing programs for the gifted and talented

9. Definitions, Ideologies, and Hypotheses in Gifted Education (Nevo, 1994)

- Nevo, B. (1994). Definitions, ideologies, and hypotheses in gifted education. In Gifted Child Quarterly 38(4), 184-186.

10. Gifted Education at a Crossroads: The Program Status Study (Purcell, 1995)

- Purcell, J.H. (1995). Gifted education at a crossroads: The program status study. In Gifted Child Quarterly 39(2), 39, 57-65.

11. What Makes Giftedness? Reexamining a Definition (Renzulli, 1978)

- Renzulli, J.S. (1978). What makes giftedness? Reexamining a definition. In Phi Delta Kappan 60,180-184.
- Renzulli, J.S. & Reis, S.M. (1994). Research related to the schoolwide enrichment triad model.In Gifted Child Quarterly 38(1), 7-20.

12. What Do We Mean By Giftedness? A Pentagonal Implicit Theory (Sternberg & Zhang, 1995)

- Sternberg, R.J. (1993). Procedures for identifying intellectual potential in the gifted: A perspective on alternative "Metaphors of Mind". In K.A. Heller, F.J. Monks & A.H. Passow (Eds.), International handbook of research and development of giftedness and talent. Oxford: Pergamon Press Ltd..
- Sternberg, R.J., Ferrari, M., Clinkenbeard, P. & Grigorenko, E.L. (1996). Identification, instruction, and assessment of gifted children: A construct validation of a triarchic model. In Gifted Child Quarterly 40(3), 129-137.
- Sternberg, R.J. & Lubart, T.I. (1993). Creative giftedness: A multivariate investment approach. In Gifted Child Quarterly 37(1), 7-15.
- Sternberg, R.J. & Zhang, L.F. (1995). What do we mean by giftedness? A pentagonal implicit theory. In Gifted Child Quarterly 39(2), 88-94.

13. A Rounded Version (Gardner, 1993)

- Gardner, H. (1993). Multiple intelligences: The theory in practice. New York: Basic Books.

Attachment 2: Case studies

Case Study 1

Teddy may or may not be a cute little child. He may or may not be well coordinated and early to walk and turn somersaults. Likewise, he may or may not always have his hand up when the teacher asks something in pre-school or kindergarten, but one thing teachers have noticed about Teddy is that his answers, when he gives them, are usually well developed and thought out. When his teacher or parent suggests a new point of view or something new to be learned, everything about Teddy perks up. He gets intensely interested in people who have unusual ideas or have done extraordinary things and especially wants to know about their lives and motivations. Even in these early years, Teddy seems willing to think things through, to work hard to learn, and does not obviously see himself as 'smarter' than others around him.

Teddy has both endearing and aggravating behaviours in school. He may appear very slow and deliberate at times, especially when quick answers are being sought to low level

questions. He sometimes seems ***to make too much of what was a simple question, coming up with very*** *unusual connections that may seem weird or strange to other children. He runs on his own timelines, which means there are times when he is irritated because he has to stop working on something he is engrossed in and start something new. He is often very systematic and logical, which can make him very uncomfortable with a parent's attempts at creativity. He is not a willing risk-taker and wants structure so that he can almost guarantee how things will turn out. Teddy often feels quite comfortable working on his own and seeks opportunities to create a personal space for himself whenever he begins to feel 'crowded' by others around him. Not only does he answer deep questions fully, but he poses his own deep questions, about God, nature, life, justice, and always with a 'why'. He understands complicated answers to his questions and appears to absorb and remember information as quickly as it can be given to him. Teddy scores very highly on almost every aptitude and achievement test, and will usually be rated positively in his school performance. Yet, he may be a serious underachiever because he is not being offered enough content nor enough complexity to that content, nor has compacting of his curriculum taken place. Anywhere from 3 to 6 years of Teddy's school life will be spent without being exposed to a single new idea or concept that he does not know already. The only characteristic that may keep Teddy from pure disillusionment with school may be his own perseverance and patience, waiting for the day when school will be 'hard and fun'.*

Case Study2

Kate, aged 4, was very lonely in pre-school. She was very bright and socially mature and she had little interest in the games the other girls liked playing. She was fascinated by number and loved counting and finding numerical relationships between things. She noticed one morning that her teacher's coat had buttons in pairs and she spent the next two hours finding

other 'pairs' of things in the pre-school. She announced to Ms Foufounis, her teacher, that some pairs were alike, like drumsticks, while other pairs were different - shoes weren't exactly the same because they were curved on different sides, and knives and forks went in pairs but looked, and were used, differently. Ms Foufounis was intrigued by Kate's unusual enthusiasms and surprisingly long attention span. She suggested to Kate's mum that the little girl be IQ tested. The test showed that Kate was in the moderately gifted range with an full scale IQ of 138. Ms Foufounis arranged for Kate to spend a morning as a visitor in the Kindergarten/Reception class of the local primary school. Kate loved the experience – particularly the games the girls played at morning recess - and clamoured to be allowed to visit the class again. After two more visits, the primary school Principal suggested to Kate's parents that she leave pre-school and enrol in primary school, even though the year was already half way through. They agreed happily and Kate entered the Kindergarten/ Reception class at the start of Term 3 of the four-term year. She loved the class and her new friends and at the end of the year Kate moved with them into Year 1, a smooth and happy grade advancement.

Case Study3

Jordan is one of the brightest students your school has had in many years. He is six years old and in Year 1. He is a quiet, reflective little boy who is often seen standing apart in the playground, watching the other boys play but rarely being invited to join the game. Indeed, he doesn't seem interested in joining in. Ms Peters, the Year 2 teacher, once commented, 'He's so detached. He's just watching. He's like an anthropologist studying a strange, different race of people.' When he does feel like playing, Jordan gravitates towards the girls, who generally accept him but even then he doesn't seem to engage emotionally.

Case Study 4

Ceridwen started to read just before her fourth birthday and her talent developed at a remarkable pace. She entered school at 4 years 10 months with the reading abilities of someone two years older. She is fascinated by fairy tales and legends and has a lively creative imagination. Ceridwen's teacher, Ms Anderson, placed her on an individualised reading program and gave her tasks which involved creating new situations in the stories she read. What might have happened if Cinderella had kept track of the time and left the ball before midnight? What might have happened if one of the ugly sisters had taken the same shoe size as Cinderella? After a few months Ceridwen started writing entirely new versions of some classic fairy stories. She dictated them into a tape-recorder and a friendly mum who helped in the class each week typed them up. Renata, Ceridwen's special friend in the class, who is a talented artist, drew illustrations for the books and Mr Cornwall, the school librarian, bound them and put them in the library. Ceridwen's task commitment developed as a result of the curriculum differentiation offered by Ms Anderson. If she had been asked to work through reading readiness exercises with the other children - or just sit and read by herself while the teacher was working with the other students - she might not have retained her interest in reading at school.