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Naturalist Intelligence: How to Recognize and Support of Pupils and Students Gifted in Natural Sciences in the Czech Republic

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Abstract

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The article introduces Howard Gardner's Theory of Multiple Intelligences and the so-called intelligence spectrum. It focuses on the so-called eighth – Naturalist Intelligence. It presents a research overview of how Naturalist Intelligence manifests itself. This overview is a useful tool and basis for development of diagnostics of this talent. The article discusses the situation of a child with naturalist intelligence in their class, school and family. It draws attention to the issue of assessment and advocates the idea that assessment should be fair with respect to all intelligences (such as portfolio assessment). It points out the fact that development of naturalist intelligence is nowadays impossible without extracurricular and free time activities. It also introduces two such activities – Czech Children's Congress and the project Landscape of Our Home. The article presents 9 casuistries (selected from literature and from the author's own research records).

Key words

Multiple Intelligence Theory; naturalist intelligence; talented child; Czech Children's Congress; project Landscape of Our Home; environmental education; didactics of natural sciences

Abstrakt

Tento článek je anglický překlad původního článku https://doi.org/10.14712/18023061.43.

Článek stručně představuje teorii rozličných inteligencí Howarda Gardnera a tzv. inteligenční spektrum. Podrobně se věnuje tzv. osmé – přírodovědné inteligenci. Nabízí rešeršní přehled jejích projevů, který poslouží k vytvoření diagnostiky tohoto nadání. Diskutuje postavení dítěte s přírodovědnou inteligencí ve třídě, škole i v rodině. Upozorňuje na problematiku hodnocení a navrhuje dbát na to, aby hodnocení bylo tzv. spravedlivé i k inteligencím (jako je např. portfoliové hodnocení). Upozorňuje na skutečnost, že k rozvíjení přírodovědné inteligence jsou v současnosti nezbytné mimoškolní a zájmové aktivity. A představuje dvě z nich – Sněm dětí ČR a Projekt Krajina domova. Článek obsahuje 9 kazuistik (vybraných z literatury i z vlastních výzkumných záznamů).

Klíčová slova

Teorie rozmanitých inteligencí; přírodovědná inteligence; nadané dítě; Sněm děti ČR; projekt Krajina domova; environmentální výchova; didaktika biologie

Introduction

At present, the Czech educational programme provides general, comprehensive environmental education. Environmental education is designed to have a broad scope (to reach every pupil). Apart from this general, comprehensive environmental education, we also need professional environmental education focusing on education of future experts in the field of environmental studies and natural sciences, on education of experts who will maintain and develop a complex understanding of living systems in the scientific community.

This paper introduces the readers to Howard Gardner's Theory of Multiple Intelligences and points out its pedagogical implications. It also presents examples of good practice of work with pupils gifted in natural sciences in the Czech Republic and illustrates the theory with case studies from the Czech Republic and abroad.

Giftedness and the Theory of Multiple Intelligences

There are no two pupils with the same talent, the same manifestation of the talent and acting. No two people are the same. However, pedagogy often needs to define criteria according to which pupils can be divided into groups where different teaching methods will be used (different approaches to pupils with different learning styles). A number of typologies were developed in the past (e.g. Hippocrates' division into sanguine, choleric, melancholic and phlegmatic types). One of the latest categorizations developed at the end of the twentieth century by the psychologist and neurologist Howard Gardner known as the Theory of Multiple Intelligences has proven to be effective in the educational process and is still used today.

H. Gardner came out not only of outward manifestations of this intelligence,[1] but also of medical reports recording a loss of specific abilities after a brain injury or stroke. Each of the seven (and later eight) intelligences defined by Gardner is tied to a specific place in the brain (whether precisely localized, or not) and thus can be lost as a result of brain damage. Or, in other words, none of the intelligences was defined before its link to specific functional structures of the brain was sufficiently documented (Gardner, 1999).

A new pedagogical approach was developed on the basis of Gardner's theory. It proved to be so effective that it was incorporated into school curricula in California and has been partially introduced into education in a number of countries worldwide (Gardner, 1993).

The Czech system of education has adopted a number of methods and approaches based on Gardner's theory (respecting individual learning styles, individualization, portfolio assessment, looking for new ways of cooperation with family etc.).

What is most important in Gardner's theory with respect to environmental education is his attention to Naturalist Intelligence.

[1] Gardner deliberately chose the term intelligence to emphasise that measuring of total (global) so-called g intelligence was not fair, because the measuring was conducted in writing and the set tasks assessed logical thinking and mathematical skills. Gardner states that the concept of talent or giftedness would be equally fitting but would probably attract less attention.

Intelligence spectrum

The Theory of Multiple Intelligences points out that intelligence consists of a spectrum of various intelligences. The basis for the assumption that intelligence is a complex consisting of more factors it the fact that there are very low correlations between individual test groups (Gardner, 1999). The spectrum consists of:

- Verbal (linguistic) intelligence,
- Logical-mathematical intelligence,
- Bodily-kinaesthetic intelligence,
- Musical intelligence,
- Visual-spatial intelligence,
- Intrapersonal intelligence,
- Interpersonal intelligence (very close to Shaphiro's concept of emotional intelligence) and
- Naturalist intelligence.

Each person has a unique individual spectrum of intelligences. In the environment of Czech schools, preference is given to pupils whose spectrum of intelligences is balanced or who have a high proportion of verbal and logic-mathematical intelligences (these pupils also achieve the highest scores in IQ tests). Highly specialized pupils – with innate strong representation of one of the components of the intelligence spectrum – have problems at schools (unless it is verbal or logical-mathematical intelligence). Teachers I met in my seminars on the Theory of Multiple Intelligences smiled if they were to imagine there was a W. A. Mozart sitting in their class, expected to fulfil all school tasks and duties. However, the situation of a pupil with similarly distinctive intelligence spectrum in our current educational system is far from merry. Gardner and his followers (2003) attach importance to innate predispositions and claim it is difficult, almost impossible to teach children something that contradicts their predispositions and "naïve" theories developed in preschool age. That is why so many unilaterally gifted pupils suffer and a considerable number of talents is wasted.

Naturalist Intelligence

Naturalist intelligence was described by **Howard Gardner** in 1996 as the eighth intelligence (Campbell, 1997). This intelligence may be characterized as ***the ability to observe, understand and classify natural entities***. An expert in natural sciences is likely to be someone who can recognize and classify plants, animals and inanimate objects (including life on molecular level) and perceive their relations to the environment more easily and in a better way than others. Examples of people with very high naturalist intelligence are Charles Darwin, Carl von Linné, Gregor Mendel, James Watson, Francis Crick, Rachel Carson, Diana Fossey, Jane van Lawick-Goodal or Dmitri Ivanovich Mendeleev.

Gardner (1999: pp. 98 and 99) points out that intelligences are not physically verifiable entities but artificial scientific concepts that we need to interpret in reality. Naturalist intelligence in itself does not "palpably" exist; when we speak of it, we must be aware that it is reification. The need to name this entity can be documented by the parallel evolution of the term **biophilia** (Kahn, 1997; Kellert and Wilson, 1993 in Franěk, 2000 and also Clayton,

Myers, 2009: pp. 81-85). Biophilia is defined as a biologically innate predisposition of a person on whose basis people build a positive relationship to living and inanimate nature and which is behind the need to be in close contact with nature. Franěk (similarly to Gardner) points out the alarming fact that if this predisposition is not developed from an early age, it disappears, or in some individuals even biophobia develops.

Characteristics of children with Naturalist Intelligence

Naturalist Intelligence may be discerned already at pre-school and primary school level. For example K. Lorenz recalls his first (childlike) research projects: "I did a lot of things right from the start, either by chance or instinct" (Mündl, 1992: p. 18). Leslie Owen Wilson (Wilson, 1998) following H. Gardner developed the following list of characteristic behaviour of children gifted with the "eighth" intelligence:

- They classify and categorize objects easily;
- They have highly developed senses (sight, hearing, smell, taste and touch) and use them to explore nature;
- They like being outdoors – they love outdoor activities such as gardening, walks, trips and expeditions to nature connected with observing and exploring the nature;
- They are unusually attentive to the changes taking place in their surroundings;
- They are interested in plants and animals and take care of them;
- They start collections;
- They cut out information about nature from magazines and make notes on their own observation and exploration;
- They are very much interested in TV programmes, videos and books about wildlife and nature;
- They find it easy to learn characteristic features, names, structures of and information about plants, animals and products of nature.

This list was further amended by Maggie Meyer (Meyer, 1998) by the following:

- They are interested in and understand cyclic phenomena (moon phases, high and low tide, seasons etc.);
- They are patient observers;
- They feel and discern relationships with nature and in nature;
- They feel attached to a particular place, ecosystem or ecosystems (sea, forest, desert, wetland);
- They prefer natural environments to places cultivated by people;
- They keep coming back to some specific natural environments;

- They prefer going to the ZOO to going to amusement parks;
- They prefer work with natural materials;
- Their free-time activities include hiking, mountaineering, fishing, canoeing, sailing, cross-country skiing, outdoor camping, sport diving.

These characteristics[2] may help significantly when developing diagnostics for children gifted in natural sciences.

Children with Naturalist Intelligence at schools

Naturalist intelligence (as well as other intelligences and talents) may be fostered or supressed by parents, teachers and other close people. That is why not every child who manifests naturalist intelligence follows the career of a natural scientist. Their situation is even more difficult because this intelligence is very rare in population. A person with high naturalist intelligence often feels lonely, underestimated and even ridiculed at school and sometimes also in the family. This assertion is confirmed by interviews with prominent Czech environmentalists, e.g. with J. Jeník and J. Slavíková conducted by Pavel Kovář (Kovář, 1989) as well as by autobiographic recollections of the natural scientist E. T. Seton, who asks why he became a natural scientist when his siblings (brought up in the same family in the same conditions) showed none of this talent.

(Case study 1). The usual socio-cultural background in which European children are brought up does not support unintentional development of naturalist intelligence (Case study 2). This loops in pre-service teacher training that focuses more on language and mathematics than on natural science contents. For example V. Spilková states that pre-service primary school teachers from Charles University, Faculty of Education complain that they lack adequate training in elementary science (biology, geography and history), both with respect to didactics and content in their undergraduate studies (Spilková, 1997: p. 74). If teachers do not have adequate training in the area, they cannot be expected to develop their pupils sufficiently.

A pupil gifted in natural sciences will not develop sufficiently without further and intentionally targeted support in the Czech school environment. The usual school environment not only fails to value his/her talent, it often fails to identify the talent (see Case study 3). Currently, the only way to support naturalist intelligence in pre-schooler and primary school pupil are extracurricular activities (family or clubs).

However, a child with high naturalist intelligence is not only neglected. Paradoxically, their talent can be counterproductive for their future professional lives. Pupils gifted in natural sciences have problems to pass standardized tests (SAT abroad, SCIO, Calibro in the Czech Republic). These are tests that are evaluated by giving proportion of correct/incorrect answers and do not allow discussion of mistakes. Creation of these tests is not consulted with natural scientists. Parents then have no choice but to teach their child to anticipate what the authors of the question might have wanted to hear. However, this will not work for every child gifted in natural sciences (see Case study 4).

[2] The high level of agreement between these characteristics and manifestations of environmental sensitivity (Wilke, 1993) is very interesting. It confirms parallels between both these concepts.

Extracurricular / free time activities of pre-schoolers and primary school pupils

One of the factors that obstruct development of naturalist intelligence is that pre-schoolers and primary school pupils cannot and do not make decisions about their free time activities. Parents (mothers) nowadays, under the pressure of socio-cultural environment, rather have their children attend ceramics, music and art lessons in Elementary Art School or lessons of ballet, gymnastics and football, then have them attend natural science clubs.

If a child's innate predisposition drives them to study nature and the child wants to attend a science-related club, the child will not be allowed to have this club as their only interest, unlike, for example, in case of football or ballet that can become the exclusive interest. The child is expected to engage in activities that are “socially acceptable”, otherwise the mother is likely to face unpleasant pressure in the mother community (whether on benches around the sandpit or in the workplace). If children gifted in natural sciences do not have enough energy to pursue more extracurricular activities, they are not likely to be allowed to develop their interest in natural sciences in early school age (Casuistry 5).

Extracurricular activities at lower and upper secondary schools

Lower and upper secondary school pupils have influence on their free time and extracurricular activities. However, naturalist intelligence in most pupils of this age has already been supressed. In reaction to social pressures, these pupils started developing their other gifts and talents, because proportion of intelligences in a population is also given by social pressures (fashion).

Insufficient development of one kind of intelligence is often the starting point of another interest. (Gardner 1999: p. 21).

An individual gifted in natural sciences (who managed to maintain their hobby) is even more out of line, isolated and lonely (Case study 6). If they do not join an extracurricular community of similarly gifted individuals in due time, their personal problem may become a social problem (negative social behaviour often stems from an unsatisfied need for self-fulfilment).

Support of naturalist intelligence

Having learnt about the concept of naturalist intelligence and discovered that their child or pupil manifests characteristics of naturalist intelligence, parents and teachers ask how to support and develop naturalist intelligence in their child or pupil. Bruce Campbell states that children with naturalist intelligence should be asked to help, e.g. when labelling science specimens, when systematically organizing collections and setting up experiments in nature. He also recommends acquisition of magnifying glasses, binoculars, microscopes, cameras, video cameras, and personal notebooks so that young scientists do not have to transcribe field notes from paper notebooks to their personal computers at home. He makes an appeal to parents and teachers to allow these children to have pets, breed animals and work in the garden. These children need help and support when setting up herbal or insect collections. Teachers should teach them about the life and work of important natural scientists (Campbell, 1997).

However, what seems to be most important is giving these children time to **spend in nature** (Franěk, 2000) **and allowing contact with similarly talented children and adults** (experts). Only then can they share their experiences, observations, results and joy of being in nature. Bruce Campbell (1997) made a list of organizations that provide this supportive environment. **Czech** organizations supporting this intelligence are scouts, natural science clubs organized by Youth Centres, museums, Eco centres, Czech Union for Nature Conservation and some schools. Also activities of Association of Little Debrouillards of the Czech Republic, A Rocha organization, Czech Children's Congress and various projects (e.g. the project Landscape of Our Home) are important. **Children can test and measure their natural science talent and knowledge in national competitions (Biological Olympiad, Green Path-Green Leaf).**

Changes in assessment

With respect to his Theory of Multiple Intelligences, Gardner (1993) advises us to rethink the way pupils and students are assessed. He is very critical of the SAT test (Scholastic Aptitude Test), based on knowledge and paper and pen work. He believes it should be replaced by portfolio-based assessment. Together with his colleagues, he tried to develop a methodology of evaluation based on portfolios. It must be stressed here that portfolio-based assessment seems to be very useful for assessment in environmental education (for more details Jančaříková, 2007).

Case studies

Case study 1

E.T. Seton describes his childhood and the compulsive need to learn about nature as follows: "*All my desires and efforts led me to deal with wild creatures in the world around me. Coming from the woods to the great city of Toronto, I was leaving everything behind, but my spiritual strength and will made me look for and find wild creatures in the city. They entered my life in a way that frightened those whose predispositions and interests were different. Every year I got new opportunities and every year some surprising evidence of that hidden law – I sought and found. I wonder if this law is also the creative force (sic!), because my brothers, who lived with me in the same house did not build the same relationships.*" (Seton, 1977: p. 56).

Case study 2

Our socio-cultural environment does not fully appreciate or even depreciates natural science giftedness. This has negative impact on children's motivation. For example in the famous film of Jiří Brdečka and Oldřich Lipský *Adéla ještě nevečeřela* (1977), the heroine's father, the natural scientist professor Boček (Ladislav Pešek) runs confusedly back and forth chasing butterflies with a net, is dragged by fate and is laughed at by other film characters. In Karl May books, there is also a character/caricature of a funny natural scientist. He is, in contrast to Old Shatterhand and Vinnetou, absolutely helpless, useless and defenceless (his hat is shot through, he sits on the horse backwards, etc.). The natural scientist from Jules Verne's novel A Captain at Fifteen is not able to lead an expedition (unlike the fifteen-year-old main hero of the novel). He is at least granted the honour of recognizing (albeit not too quickly) on which continent the expedition is located, but then he marvels at the discovery of a new species of insect, which, however, is only a spider with torn off legs. The criminal in the famous sir Arthur Conan Doyle's detective story The Hound of the Baskervilles is the

natural scientist Stapleton. (Almost) no attention is paid to biographies of natural scientists. This can be illustrated by father and son Čelakovský. While traditionally pupils get a lot of information about the father, poet František Ladislav Čelakovský, they learn nothing about his son, Ladislav Čelakovský, an important botanist (taxonomist and morphologist).

Case study 3

Maggie Meyer, a sixth grade teacher, (Meyer, 1998) states that it was thanks to Gardner's Theory of Multiple Intelligences that she started to understand her pupils learnt in different ways. Each of them has a stranger and a weaker spectrum of intelligences and this determines how they understand her lessons. The teacher must respect their pupils' needs. Meyer goes on to describe that although she herself did not have much experience with getting to know the nature, she tried to teach her class outside on walks to support those pupils for whose learning style it was helpful to be learning outdoors. Very quickly, she realized that one of her so-called weak pupils (he needed an individual study plan because of his special needs) was able to identify and name birds flying over them. She asked him how he recognized the birds. He gave her a five-minute lecture on the different shapes of bird heads and squadrons, different colours and silhouettes of their bodies, and their singing. She was stunned. This not very successful schoolchild was obviously educating himself outside of school! He spent a lot of time observing the nature. His family members passed him information and knowledge about nature much like folklore is passed from generation to generation. No standardized test could give this boy the points he deserved, because no standardized test was constructed for so specific minority.

Case study 4

Eleven-year-old Daniel was preparing for entrance exams to a lower secondary grammar school. Standardized tests (Calibro) he was working on with his mother included the following question:

Snowdrops can be found in woods:

a) In spring,

b) In autumn,

c) All year,

d) In winter,

Daniel selected the answer "all year". However, according to the authors of the test this was a wrong answer. The correct answer was a).

When discussing the test with his mother, Daniel said: "If I take a scoop, I can find the bulbs at any time of the year…". A child gifted in natural sciences may be disadvantaged in tests constructed by adults with a different intelligence spectrum. Only work with the mistake (discussion with the mother) made it clear that the child did not show a lack of but a surplus of knowledge.

Case study 5

Ten-year-old Honza informs the leader of the Wild Marjoram Science Club that he can no longer attend its meetings because of a third basketball training a week: "I'd rather come here, but my mother wants me to go to basketball trainings." This is how science and scout clubs lose their 5th grade members. Fifth graders often start new activities in other areas.

Also, the load of school work increases in the fifth grade, especially if the children are planning to try entrance exams to lower secondary grammar schools. The first recommendation their parents will give their children is to stop attending science or scout club. The situation is worse if the club is paid. Parents are willing to pay for an English language or a ballet club but not for mere walking in nature.

Case study 6

Student A describes how lonely she felt at school: "*All my classmates went to pubs or dance clubs. None of them would go to the woods, just me. I felt like an alien until I met the people here* (participants at the Czech Children's Congress)."

Case study 7

In my more than twenty years of work with children, I have met a number of children gifted in natural sciences. Yet, until I got familiar with studies of Gardner and his colleagues and followers, I could not overcome the deeply rooted prejudice on inferiority of natural sciences and could not acknowledge the existence and value of naturalist intelligence as a gift equally as precious as e.g. absolute pitch. Many mothers would explain to me that "Annie or Adam cannot attend a science club any longer as they are too busy: on Mondays and Wednesdays they go to gymnastics, on Tuesday they take piano lessons and on Thursdays have music theory. They also need time to relax." I used to nod with understanding and say goodbye to the child who had been so happy, their eyes glistening, while observing swarming under a stone. Today I realize a science club is equally as important, and for some children even more important than piano lessons, gymnastics, ballet, football … and I am ready to guide parents in this direction. Taking into account that a person with some special type of intelligence will usually not become an expert unless they get due support, it is very likely that children who leave science clubs will waste their innate naturalist intelligence. They will either become experts in other areas (most people have more stronger intelligences) or, in the worse case, will become very bad pianists.

Case study 8

Czech Children's Congress for Environment is a sophisticated selective educational activity of the Koniklec Agency in the area of environmental education. It was awarded the Prize of the Ministry of the Environment of the Czech Republic ´96 and the Prize of Sasakawa Peace Foundation ´97. Each "district" is represented by one young person aged 14 to 17. This representative is active all year and documents their work in reports (nine monthly and one final). Depending on the quality of the reports, members may get an attestation at the end of the year.

For each period of four years (the period of activity of representatives in the Czech Children's Congress), four scientific themes are chosen corresponding to the four elements: air, fire, water and earth. These are brought to the attention of the members of the Children's Congress through regularly sent information, during their own work and during meetings (1 nine-day, 1 five-day and 4 weekend meetings). These meetings include excursions, lectures and discussions with prominent experts. At all six meetings, members of the Children's Congress may interrogate representatives of regional and municipal authorities and NGOs about problems they have encountered throughout the year. Once a year, representatives discuss the most current topics with Czech government officials, Senators and Members of Parliament.

The members inform their friends, classmates and representatives of city and district authorities about all the gained knowledge and their activities. The general public have the

opportunity to get acquainted with the activities and topics of Czech Children's Congress through national and regional press or radio and television (Czech Children's Congress, website).

Case study 9

The **project Landscape of Our Home** is a seven month project (June-December 2009) building on the Czech Children's Congress, aiming at children gifted in natural sciences. The project was joined by more than 100 children from 34 schools. More than 15,000 teachers were addressed (Landscape of Our Home, website).

Conclusion

If a young person wants to become a natural scientist in our socio-cultural environment, they have to face many obstacles. I call for this situation to change. It is time to realize that naturalist intelligence also deserves support from our society, especially from teachers and parents. We should develop school education programmes and rebuild classes so that pupils with naturalist intelligence can find answers to their learning needs (including introduction of information on the life of important natural scientists). We should appeal to parents to support the giftedness of their children and not to force them into piano lessons, for example, when they want to spend their free time in nature with binoculars and a notebook. We should inform parents that what they consider "idling around in the woods and by water" is as important as lessons in Elementary Art Schools.

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