

THOUGHTS ON INTELLIGENCE, TALENT AND AUTISM IN THE CONTEXT OF A COMPETENCE SURVEY

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Abstract: A survey on competences and intelligence – conducted among the students of the Faculty of Engineering at the University of Debrecen – has led to certain peculiar, although according to the relevant literature, not surprising results. It seems that intelligence, which is often associated with talent, is not related to individual good performance. Talent and intelligence, as a key basic element of talent, do not necessarily equal success and excellent abilities, or great achievements in one's studies. Apparently, intelligence does not really determine which students will excel and which will not. Talent in itself is not sufficient, it has to be cultivated. Individual inherent capabilities (such as intelligence) can be used to achieve the cultivation of talent. However, to be able to do that, one needs meta-skills such as complex attention, interest and the ability to concentrate. Schools and teachers play a crucial role in developing students' talents. In the engineering course programme, these skills can be developed from the perspective of natural sciences. There are, however, certain humanistic skills that are required for the development of empathy (emotional intelligence), or the social skills that enable students to fit in, to work in teams and to establish meaningful human relationships. It is well-known that autism (which involves a deficiency in the above-mentioned skills) is more common among mathematicians and engineers, and there is definitely a higher incidence of autistic features among students of technical sciences. The present article puts forward thoughts on these topics (intelligence, talent, autism) in the context of the survey's results.

1. THOUGHTS ON INTELLIGENCE

1.1 SOME HISTORICAL BACKGROUND

It was Francis Galton (1822-1911) who first began to deal with intelligence as a quantitative concept of mental faculties. His main field of research was eugenics, the examination of differences in mental and physical abilities. He elaborated ideas regarding individual abilities and characteristics: he redefined and clarified the question of nature vs. nurture in psychology. In his works he formulated the view that individual abilities, including intelligence, are hereditary, but the impacts of certain environmental factors cannot be ignored. In his understanding, "nature" refers to what human beings already possess when born, while "nurture" signifies everything that happens to them after birth. He was the first to examine twins, and with this method he found evidence to support both the hereditary nature of abilities and environmental impacts. His professional life was significantly influenced by the fact that he was a cousin of Charles Darwin's, and it was the theories of evolution that steered him in the direction of eugenics. According to Galton, intelligence is a perceptive and cognitive ability that is inherited from one generation to the next. From this hypothesis, he concluded that with the method of selective breeding, the cognitive abilities of the human race could be improved. For a long time, these ideas were the basic principles of eugenics, and they spread particularly among fascist thinkers and researchers during the Second World War, who wished to bring about an Aryan race. The possibilities and limitations of improving general mental abilities are still central topics of several research studies (Atkinson, Hilgard, 2005). Apart from this, Galton conducted other psychology-related research as well, for instance, in the area of visual imagination (creativity). It is an interesting fact that Galton – while analyzing individual differences – also discovered that the human fingerprint is unique and does not change during a person's lifetime. This latter discovery of his became the single most important

criminological tool in the determination of one's identity, which is a special result of the research on individual abilities.

Although Galton's intellectual heritage was carried on by James Mck. Cattell (1860-1944), mainstream intelligence research was later defined by Alfred Binet (1857-1911). Binet, along with a doctor colleague of his, introduced the Binet-Simon Intelligence Scale, which included over thirty exercises. The method and result of intelligence tests was used by the American scientist Lewis M. Terman (1877-1956). It was thanks to his activities that the use of the term "intelligence quotient" and its abbreviation "IQ" became widespread (Czeizel, 2004). In the Binet Scale, intelligence was assigned only one score, while David Wechsler (1896-1981) divided this score into three different ones (verbal, performance and global IQ) in the test he himself developed. In Hungary this latter intelligence test is the most prevalent, although several adaptive tests (ones that adapt to the abilities of the respondent) are also used.

The above summary highlights the nature of intelligence: it is a complex capability that is mainly directed at problem-solving. It covers the ability to see connections and to remember, as well as the speed of thinking. Due to the complexity of intelligence, it can be broken down into several dimensions: we can talk about linguistic, musical or bodily-kinesthetic intelligence; visual-spatial and mathematical intelligence; interpersonal and metacognitive intelligence. Apart from the intelligence that measures mental faculties, emotional intelligence is also mentioned with increasing frequency nowadays, a term associated with the name of Daniel Goleman (1995), whereas in fact it was first used by D. Mayer and Peter Salovey in 1990. IQ tests do not measure emotional intelligence (EQ), although many believe that it is this type of intelligence that is necessary for the development of individual abilities. Emotional intelligence is about evaluating, dealing with and positively influencing the emotions of oneself and those of others. From the list of general types of intelligence, it is most closely related to interpersonal intelligence.

Despite these achievements and research results, some people still consider the measuring of intelligence impossible. They share the view of Arthur R. Jensen, an expert on intelligence, who once remarked: "Intelligence, like electricity, is easier to measure than to define."

1.2. THE SIGNIFICANCE OF INTELLIGENCE AS AN INHERENT CAPACITY

Inherent capacity means the potential we have when we are born, while ability is what is actually realized in performance from this potential (Czeizel, 2004). In order to perform well, certain social conditions are required, as well as meaningful personality development. The term "talented" is applied to children who have a high IQ, scoring within the top 3 to 5 % range of the IQ scale. In this approach, outstanding performance or success seems to be directly related to mental abilities. In the realm of natural sciences, children of outstanding cognitive abilities will only become scientists if the given field is particularly promoted in their surroundings. General mental abilities could be the basis of good performance, but according to Mihály Csíkszentmihályi (2010), the significance of these capacities is overrated. Intelligence as an inherent capacity is indeed one of the elements of talent, but it does not determine success and outstanding achievements.

Further interesting results arose from the studies that dealt with the connection between intelligence and creativity (Guilford, 1967; Getzels and Jackson, 1962). Creative children do not perform well in intelligence tests (Szabó, 1997), and it is often the case that teachers and tutors would rather devote their attention to children of higher intelligence who are easier to discipline. In 1962 Getzels and Jackson concluded that children who were highly creative and of a high IQ at the same time performed well both at school and

in a social context, while the most problematic situations at school were due to a high level of creativity but low IQ. Low creativity and high IQ made children performance-oriented, whose social life was found to be one-sided compared to that of other groups. Finally, children belonging to the last group – the ones with a low level of both creativity and IQ – often resorted to defense techniques in their social relationships; they were passive and often showed psychosomatic symptoms.

What methods can be used to develop mental abilities? Can emotional intelligence be learnt? Such questions are often asked. It is a proven fact that intelligence can indeed be developed. The link between intelligence and thinking is clearly explained by a dynamic comparison: the relationship is like that of the bicycle and the cyclist, where the bicycle is intelligence, but it is the cyclist – the thinking man – who can decide where to go and with what speed. Intelligence can only be used well if we are well-versed in thinking, otherwise it will be a capability left untapped. Robert Fisher (2010) advises the following on how to develop our mental capability, our intelligence:

- 1) *verbal intelligence* can be developed through practising debating in speech, solving crosswords and other word games, as well as reading and writing.
- 2) some ways to improve *visual-spatial intelligence* include building models, reading maps, visualizing and rotating objects in three dimensions, creating a visual map, practising with puzzles. A dependence on forms of media, especially in childhood, can have an adverse effect on this type of intelligence.
- 3) to develop *logical and mathematical intelligence*, one should solve brain teasers and tasks of combinatorics (such as creating a budget for our expenses).
- 4) *bodily-kinesthetic intelligence* can also be developed, with the help of activities like dancing, pottery, or DIY.
- 5) playing music on an instrument of one's choice, or the singing of songs, as well as the combination of music and dance can all contribute to the development of *musical intelligence*.
- 6) *interpersonal intelligence* will improve rapidly when one participates in group activities, shares their emotions and thoughts with others, and help their friends solve problems.
- 7) *metacognitive* intelligence, which means that one is able to see the development phases of their life clearly and to draw consequences regarding future behaviour. This type of intelligence can be improved through writing a diary about one's experiences and feelings.

Beside the above intelligence modules, emotional intelligence can also be developed, which is an important element of the trait inventory of a successful leader. The trainings and courses that aim at enabling participants to recognise others' feelings and condition better, proved to be successful in raising the level of emotional intelligence (Cherniss, 2000). It is a peculiar fact in the area of intelligence studies that the consumption of Omega-3 fatty acids has a positive impact on mental abilities, while excessive consumption of sugar slows down the efficiency of thinking.

It seems, therefore, that intelligence is an inherent capacity that in itself is not enough to achieve success or cultivate talent. It provides one with an opportunity, but not a clear-cut way to develop their own abilities.

2. THOUGHTS ON TALENT

2.1. ON TALENT AND THE FACTORS THAT CONSTITUTE IT

At the funeral of Zoltán Latinovits (1931-1976), a famous Hungarian actor who died a tragic death, Zoltán Huszárik (1931-1981), a film director and a personal friend of the actor, had the following to say about talent: "...talent is crossing a suspension bridge on fire." This phrase suggests that talent is not an ability that predestines one to achieve success and happiness, but more like a trial.

According to Mihály Csíkszentmihályi (2010), there are three factors we need to understand in order to find the appropriate approach to the concept of talent. These three factors determine what talent is. The first is the factor of personal characteristics, which are partly inherited (e.g., IQ), and partly emerge during the development of the individual. The second factor is cultural expectations, which defines for the individual what is meaningful and valuable in the given culture. The third factor refers to social expectations and support, which comes from the institutions and people who make the final say in what is valuable. Talent is often viewed as something that will always find a way no matter what. This may be true, but it is best if there are certain boundaries for it (Gyarmathy, 2006). Sometimes children of exceptional abilities require a great amount of care from their parents and society. Consequently it seems that talent is not an inherent capability, but rather a promise, a development process. It is a changing characteristic which promises a future potential. Not only is the fulfilment of talent beneficial for the individual, but in the long run the whole of society needs talented people. The cultivation of talent contributes to the survival of society, even that of the entire human race. This means that all exceptional abilities have to be developed and cultivated, since we can never know which of them will be needed in the process of evolution.

Several definitions of talent have been formulated; let us have a look at the theory elaborated by Renzulli (1986), who found that talent is determined by four basic factors:

- 1) *above average general abilities*: these include a high level of abstract thinking, advanced linguistic ability in the mother tongue, good memory, effective techniques for processing information etc. The role of these could differ in individual areas of talent.
- 2) *above average special abilities*: these provide the character of talent and there are several of them. The categories set up by Gardner are universally accepted, and they have already been touched upon in the discussion of multiple intelligences. In this model, there are seven distinct categories of abilities: linguistic, musical, mathematical-logical, visual-spatial, bodily-kinesthetic, social-interpersonal and metacognitive.
- 3) *creativity*: it consists of more than one element: originality, flexibility, sensitivity to problems. This factor is crucial to the functionality of talent, as one of the features of talent is that it leads to new solutions in problematic situations, which would be unimaginable without creative abilities.
- 4) *task commitment*: this includes personality traits that provide the energy for high-level performance: interest, competitiveness, endurance, emotional stability, directing the focus of attention. No matter how well one's abilities develop, without these no outstanding performance can be achieved.

Consequently, gifted people are those who, on the basis of their excellent inherent capabilities – the combination of the above-mentioned factors –, are able to achieve high level performance in any area of life (Balogh, 2007).

The origin of the word “talent” can be traced back to the Middle-East, where it used to refer to money. Today it is used to talk about people who are able to bring out their hidden gifts (Czeizel, 2004).

2.2. THE ROLE OF SCHOOLS IN THE CULTIVATION OF TALENT

The basis for the fulfilment of talent is the attainment of high-quality knowledge. Gifted children are supported in this by the school and their parents. The role of the family is not only crucial from the perspective of socialization, but also because they are the first to recognize their child’s special capabilities – and in an ideal case cultivate them and try to find the appropriate learning environment for them.

The sociological studies of recent decades have concluded that Hungarian society is heavily stratified (Ferge, 1976). The social status of families influences the school performance of children, and therefore the children’s future position in society (Cs. Czachesz; Radó, 2009). It is an unfortunate tendency that – for various reasons – school performances have deteriorated over the last decades. A further problem at schools is that, due to the nature of mass education, individual abilities cannot be considered by teachers, so differentiation cannot be realized. There would be a great need for initiatives that involve schools, teachers and students alike. An example for such an initiative was put forward by Ferenc Genschwein, the headmaster of Fazekas Mihály Secondary Grammar School in Budapest, who introduced a system in which he was able to monitor how many students in each class entered competitions or excelled at something under the supervision of their teachers. He implemented a system of rewards, which made the school successful in the long run.

It is generally true of higher education that the transcript of records only reflects a student’s academic development. While in secondary schools students receive some feedback regarding their diligence and behaviour, this kind of feedback is completely missing in higher education. Students in tertiary education are expected to be perfectly well-behaved and diligent, but obviously this is not the case. Students would benefit from the introduction of programmes that also measure their competences at the end of the semester, attesting to their development as well as assisting them in realizing their shortcomings and finding ways to overcome them. Such a programme was introduced by the Faculty of Engineering at the University of Debrecen, with a number of students participating.

3. THOUGHTS ON AUTISM

3.1. AUTISM AND MATHEMATICS

Autism is a neurological-developmental disorder that is manifested in impaired social relationships, communicative skills, and often in serious problems in emotional life. In one of their books, Baron-Cohen (2000) revealed interesting links and supporting data regarding the relationship between mathematical abilities and autism. According to Baron-Cohen, it seems that the closer we get to exceptional mathematical abilities, the more frequent the occurrence of autism is. He also found evidence to support that the children of mathematicians have a higher chance of becoming autistic, which also suggests a genetic correlation between mathematical affinity and autism. Furthermore, the research concluded that disorders in the autism spectrum are more common in regions where there are a lot of companies and institutions working in IT. He had previously proved the existence of a link between an aptitude for systematizing and the autism spectrum: the

fathers and grandfathers of children affected by the disorder were engineers in higher than average numbers. Siblings of mathematicians also suffer from autism in a very high proportion; what is more, students of natural or technical sciences also show autistic traits in a higher percentage.

The results of these studies are in agreement with the preliminary hypothesis that in areas where a high number of parents work in a position that requires some skills at systematizing (such as IT or engineering), the children will more likely turn out to be autistic. This is because the gene variants that have a role in the development of autism can also surface in a special aptitude for systematizing in the case of direct family relationships. These results help explain why the genes of autism have not been discarded during evolution: in the view of Baron-Cohen and his colleagues, some of these genes could also carry positive traits. The typical symptoms of autism are the following, although not all of these are simultaneously displayed by patients: autistic solitude (mental loneliness), especially limited activity and interest, a special deficiency in communication (in general, in social interactions, in activities that require imagination). Asperger syndrome is a type of autism, in which the patient is able to achieve excellent communication in writing, but finds it difficult to interpret the accompanying phenomena of verbal communication (gestures, body language, manner of speech), or to maintain eye contact. Asperger syndrome, unlike autism, is characterized by a normal pace of linguistic development and an average or higher than average level of intelligence. For these reasons it is more difficult to diagnose. Several people suffering from Asperger syndrome are able to recognize the ways in which they differ from other people, learn to overcome their difficulties and fit into society without being aware of the fact that explanation for their problems is indeed Asperger syndrome.

3.2. THE SIGNIFICANCE AND DEVELOPMENT OF HUMANISTIC SKILLS IN THE ENGINEERING PROGRAMME

These days there is an increasing demand for engineering and nature science education programmes not only in Hungary but in Europe as well. With the gradual decline of people's knowledge of the humanities and the decreasing emphasis on education in these areas (music and singing, literature, acting, communication), new problems arise. These humanistic skills help people in workplace socialization as well as in achieving a harmonious quality of life. The cognitive abilities can only be cultivated by those people who develop and appropriate "sense of body"(Szabó, 1997). According to this, one of the best ways to learn about one's own body is singing. During singing, the child's brain has to modulate vocal cords with great precision in order to produce the appropriate sounds. This is the best kind of fine motor movement, and the basis for highly differentiated thinking achieved later.

Communication and sensitizing exercises strengthen people's ability to articulate themselves and identify feelings. They can support them in dealing with conflicts and finding creative solutions in difficult situations.

The results of the tests currently being completed and evaluated at the Faculty of Engineering at the University of Debrecen suggest that the majority of students have problems with expressing their feelings, controlling other people and handling conflicts, as well as the using assertive communication techniques. In order to improve the present situation, special courses will be needed in future semesters which provide opportunities for developing these skills in group work or one-to-one sessions.

4. CLOSING REMARKS

Great inherent capabilities quickly become apparent. From an early age, children often hear praise that primarily focuses on their capabilities. For this reason, children considered clever easily lose their motivation as they feel they do not need to do anything: "I am smart, full stop." Those children, however, who realize that their inherent capabilities are average, learn to be diligent, and their surroundings are more likely to acknowledge this, rather than their capabilities. These children soon understand that to perform well, they need to practise and pay attention, to be diligent and persistent. Over the years, this latter group of children may gain an advantage over those who consider IQ and talent as given capabilities. Pink (2010) recommends that in order to support talent and motivation, we should praise and encourage children's skills and actions, rather than their inherent capabilities.

The recognition and cultivation of talent is a common interest for the whole of society. It can be observed that students in higher education do not value good performance too much, but prefer standing out in social activities (active presence on social websites or excessive drinking). Teachers have a great role in finding ways to show students the importance of good educational performance.

Among optional courses, there should be a preference for those in the humanities, because these develop skills that are indispensable to the future success of students in the workplace.

The Faculty of Engineering at the University of Debrecen, with the full support of the leadership, wishes to implement a programme for students which assists them in recognising and overcoming the above-mentioned hurdles and problems throughout their studies.

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