ESZTERHÁZY KÁROLY CATHOLIC UNIVERSITY

Doctoral School of Educational Sciences

CORRELATIONS BETWEEN PERINATAL RISK FACTORS AND DEVELOPMENT AND LEARNING

THESES of PhD DISSERTATION

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Content

I. CORRELATIONS BETWEEN PERINATAL RISK FACTORS AND DEVELOPMENT AND LEARNING

"A mature adult is one of the most remarkable things that society can create: a living cathedral, the work of many people over many years." D.W. Plath

The value of adult, balanced, knowledgeable, creative people has appreciated. There is an increased focus on the early education of young children and their preparation for life. In recent decades, we have been concerned more and more about the early period as an important period of development, on which much depends in terms of later development and learning (*Kereki, 2020, Gularnick, 2005, Ljubešić, 2013*). The perinatal period, as used in a broader sense, i.e., the early life period and its correlation with learning disabilities later in life have become the focus of scientific knowledge and investigations. Early childhood education, care and development are priority tasks when learning, abilities and functions are being developed. During this period, rapid changes are witnessed, and the foundations for the various development areas are laid down. In addition to diverse changes, a high level of vulnerability is encountered at this time (*Fabian & Dunlop, 2007, Danis & al, 2011*). A large-scale development of and results achieved by the sciences dealing with people and children have contributed to our understanding of how to prevent developmental and learning disorders; how to carry out teaching and educational work more effectively; and what kind of early development services and care to provide to young children and their families where some developmental difference, delayed function or some form of vulnerability is observed at their earliest age.

1.1. Purposes of research

The main goal of the longitudinal research included in the dissertation is to investigate the effectiveness of early intervention and developmental special education care, to further develop early intervention and prevention activities, and to identify patterns of risk factors and developmental differences.

Another goal is to explore the connections between perinatal risk factors and developmental differences, as well as learning disorders, and to predict developmental differences based on the knowledge of the risk factors.

Our questions:

• What connections do we find between perinatal risk factors and developmental differences, as well as learning disabilities?

• What is the effectiveness of early intervention care and later developmental special education care, which activities need to be developed?

II. SCIENTIFIC EMBEDDEDNESS

Early development in Hungary has been put into focus starting from the mid-20th century, was institutionalized in the 90s, and is defined, effective from year 2013, as part of the remit of special service providers under Decree 15/2013 (II.26.) of the Ministry of Human Capacities. The concept of early intervention services and the target audience of such services have significantly changed over the past years. In the spirit of the *OECD (2005)*, these services have increasingly been defined as a task of public education. Under European and international legislation and practice, early intervention- and preventive services for children in early childhood (0-7 years) and their families is defined as 1) a set of available services 2) of primary importance 3) provided to children and their families 4) in the special early age of children, which 5) includes a variety of diagnostics and therapies 6) to ensure children's personal physical, mental, emotional and moral development and, therefore, it 7) strengthens family competencies, and 8) leads to the promotion of social inclusion of families and children (*EADSNE, 2005, 2010*, *Gularnick, 2005, Ljubešić, 2013, Kereki & al, 2013, 2020, Czeizel & al, 2015)*.

Early childhood intervention includes "preventive and intervention services covering all children and their families, with a targeted focus on several groups requiring special support, such as (1) those born with a developmental risk, the injured, those with different or delayed development, the disabled, or the chronically ill; (2) those at risk in terms of psychological development; (3) the socially disadvantaged; and (4) exceptionally talented children and their families, who often form overlapping target groups in early interventions. Thus, the idea of comprehensiveness also includes the differentiated approach which captures the content of preventive and intervention activities from the aspect of the different needs of these groups of children and their families." (*Kereki, 2011: p.3, Kereki, 2020*)

In the focus of early services, there are the children concerned, their families, their sets of relationships and environment, as well as educators surrounding them and specialists providing services to them, and institutions together with their resources, so all those surrounding such

children who are actively involved in providing care in this early period. As part of a development process that takes place according to the in the micro- and macro-systems surrounding children, a key role is played by their families, the environment, as well as the social/societal (health, education, economic, social) factors and supporting factors, which can appropriately help the development and social integration of children (*Kereki & Szvatkó, 2015, Kereki 2020*).

During the period from conception through fetal age and pregnancy, children and their mothers need care and protection, and we may observe risk factors impacting the prenatal period that endanger development and, at a later age, learning (*Evans & Whipple, 2013*). The formation of the mother-child relationship and bonding is important from the aspect of children's further development (*Hámori, 2016*, *2016 Andrek, 2019*). The protection of women and children contributes to the stability of families and a balanced life in families and society (*Danis & al, 2011 "The goal is for us to ensure that all young children, regardless of their physical-psychological and environmental conditions may, as early as from their birth, their conception and even earlier, have access to the institutional, material and personal conditions required to help them develop their authentic personality to the maximum extent"* (*Danis at al., 2011a: p.2*).

Different countries are in the process of organizing different levels of care, the relevant tasks are overseen by different sectors, and it is the responsible sector whose language and concepts may appear in research, reports, and strategies (*Shikwesha, 2014*). Since the ministries of health, education and social affairs tend to play the most important roles in steering early intervention activities, therefore, concepts related to early intervention include technical terms from all three areas. Coordinating and clarifying these terms represent a considerable task for the interdisciplinary community of professionals.

The definition of *target group* has slowly been expanded. Initially, early care was aimed at children with special educational needs aged 3-6 and then to aged 0-3, and later it was expanded also to the fetal age. The target group was further expanded by the addition of children psychologically at risk and highly talented children (*Gyarmathy, 2012*), and later socially disadvantaged children and their families. According to its expanded definition, early childhood intervention and prevention includes *all primary preventive services provided during the pre- and peri-conception period, and from conception to school age. It includes all activities that contribute to children's personal development in the early period, from diagnostics through therapeutic services to anything that increases their families' competence and promotes social integration* (*Kereki, 2013, Kereki 2020*). In the spirit of the *OECD (2005)*, efforts have been made to define early childhood intervention as a task where all diagnostic, therapeutic and developmental activities

are available free of charge to everyone, and as a task that helps the development of children's cognitive, emotional and social abilities, as well as the integration of children and their families (*Gularnick, 2005, Ljubešić, 2013*)

2.1. Perinatal risk factors and development

A *risk factor* is any biological or environmental factor that has a negative impact on development, and directly or indirectly influences processes of adaptation and development through its short and long-term effects. As the number of risk factors increases, the chance of developmental differences and learning disabilities also increases (*Danis & al, 2011, Harris, 2018)*. Risk factors can be divided into two large groups: biological and environmental risks. We distinguish between inherited, biological, health-related, physical, social, psychological, family-related, institutional and other factors (*Kereki, 2020*). In academic literature, there are several groupings of risk factors, but in most cases, dimensions related to individuals, families, relationships, and communities are also taken into.

Risk factors rarely stand alone, often several factors act together, and they may affect children not only directly, but also indirectly through relationships, and their impact may represent an influencing factor related to development (*Dunst, & al, 2006; Moore, 2012*). The most accepted model is the cumulative model (*Sameroff et al, 2000, Lehtota & al, 2020, Krstic, 2017, Harris, 2018, Danis & al, 2011*), in which risk factors form patterns, and they together, in combination exert short- and long-term effects.

A study conducted in the US in 2010 by *Evans & Whipple (2013)* shows that 41% of children under the age of 6 had three or more risk factors, while the proportion of children with no risk factors in the same sample was only 39%. If prenatal risk factors are already present, postnatal risk factors, for instance child abuse, will increase the chance of behavioural or psychological disorders by 24 percent. The same rate is only 2%, if there is no cumulation of prenatal risk factors. As a short- and a long-term effect of risk factors, these children are more likely to have a weak immune system and to develop diseases. In another study, at least 67% of those examined had at least one negative experience in their childhood, while one-third of them had up to even four such experiences (*Veroszta & al, 2022*). These children are the sickest as adults: 2.5 times more of them have liver diseases and 6.5 times more of them heart diseases, depression occurs 4.5 times more frequently among them, and 12 times more of them commit suicide (*Harris & al, 2018*). Their physical-spiritual health is demonstrably weaker. Bad perinatal experiences (stress, trauma, or being

at risk, during pregnancy) will, after birth, affect the development of the brain, including the pleasure and reward centre, and inhibit the development of the prefrontal cortex, which plays a role in control- and executive functions and is also crucial for learning *(Robles & al, 2019)*. The centre of the nervous system that responds to fear (amygdala) is overloaded; and a measurable deviation was found on the HPA axis (hypothalamus-pituitary gland-adrenal cortex axis), which is the brain's stress response system. This centre controls "hit or run" reactions, the production of adrenaline and cortisol, the heart rate, the dilation of the pupils and the airways, everything that is needed to cope with stress. This type of reaction is most typical of men (*Bányai & Varga, 2013, Varga & al, 2019*), who go and fight shoulder to shoulder in danger, battling with the enemy (*Bányai, 2009*). Now we also know that this centre has a response typical of women, the "stay, and keep them warm and protect them" centre, which produces cortical oxytocin (cOT), the hormone that controls labour contractions and also has a role in bonding (*Varga, 2019*). In an experiment with animals, scientists reported that mice that had never given birth were able to calm down a whole box of fearful mice, when injected with cortical oxytocin (*Varga & al, 2019*), i.e., even those who have not given birth are also able to tune out negative experiences. This shows that the process can be taught and oxytocin production can be started. Love can be learned. Negative effects can be overridden.

Garmezy (1985) was among the first scientists to examine the influence of supportive (protective) and risk factors and the phenomenon of resilience (coping). According to him, protective factors, such as children's own abilities, temperament, way of reacting, harmony and cognitive processes, can provide protection, and children's development is also supported by their families, parents, caregivers, positive human relationships and external resources, such as institutional professional support and social support (*Garmezy, 1985*). In the United States, five main protective factors have been highlighted (*Department of Health & Human Services, 2013*), including (1) parental resilience (flexible coping and resilience), (2) social relationships, (3) knowledge about parenting and child development, (4) timely support when any need is recognized, and (5) children's social and emotional competence (*Center for the Study of Social Policy, 2005*). In the present research, we have highlighted some special features of and relationships between functions and development; social development; and factors of institutional support.

2.2. Developmental differences

Development is a series of phased, quantitative and qualitative changes through which living creatures and people undergo some structural, functional and qualitative changes that had not

existed before, and these changes create new structures, organization, higher psychological functions and forms of behaviour and operation (*Bojanin, 20018, Kollár, 2004*). Development is a continuous relationship, a dynamic change and adaptation to the environment, and it lasts from conception to as late as death (*Varga & al 2019, Andrek, 2019*). Your first experiences and their patterns accompany you throughout your life, stimulate your development, and promote your adaptation and learning processes (*Orosz & Nagy, 2016*). In the past, they thought that prenatal development was mainly controlled by genetic processes and the biochemical structure and functioning of the mother's body, and that the environment, relationships and experiences played a decisive role in postnatal development. Today, a very complex interrelationship seems more likely, an epigenetic change (change beyond genetics) in the early period, when no genetic (DNA) change occurs, and only a phenotype change, a physical appearance pattern is experienced (*Falus, A. 2009, Zhang & Ho, 2011*).

If the process is disturbed due to internal or external influences or risk factors, atypical development occurs. An *atypical developmental difference* may be manifested in a delay or acceleration of the stages of development, or in individual versions of the correlation of some stages with each other. Atypical developmental differences may be associated with specific learning disorders. Atypical development evolves along the biological, psychological, relational and social risk factors discussed above, and it can manifest itself in a disorder of the maturation of one or more functions, and differences in specific cognitive, behavioural, emotional-volitional and attentional functions. As a separate group of underlying causes of developmental disorders, we can mention nervous system and brain function differences, the involvement of basic functions, disorders of psychological and emotional development, locomotor and speech function differences, cognitive development differences, disorders of socialization and control functions, as well as disorders of cognition and perception.

As found in most cases, physical and mental diseases and developmental differences have been caused by strong fear, stress, emotional or physical neglect or trauma in the pre-, peri-, postnatal and early childhood periods. *Dr. Harris* (*2018*), the director of the Youth Wellness Centre in San Francisco referred to pioneering research, in which 17,500 adults were examined and a questionnaire was developed to count *Adverse Childhood Experiences* (hereinafter: ACE). When a comparison was made between the ACE score and the health statuse of respondents, a high correlation was found. The higher the *Adverse Childhood Experiences* score, the more health problems people have.

2.2. Learning disorders

Development and learning are part of the same adaptation process: while development is spontaneous adaptation and change, learning may be spontaneous but also organized, a conscious process of creating new permanent information, skills, and knowledge in a series of changes through which individuals adapt to their external-internal environment. The sensori-motor maturity and alignment of development and its progression form the basis for the development of learning abilities. Any damage to this process will, even with unimpaired senses and intelligence level, lead to special learning disorders and inability to learn (*Bojanin, 2016, Krstic, 2003*). There is a close relationship between early experiences such as development and behaviour patterns, and the process of learning and adaptation. Patterns of experiences act as templates, impacting development and learning processes positively or negatively (*Robles & al., 2019, Krstic, 2017*).

The concepts of developmental disorders and learning disabilities are not exactly defined and separated in Hungarian and international literature. This situation has resulted not only from professional, legal and financing issues but also issues and competences related to branches of science. The two concepts are confused in many studies: categories of *specific learning disabilities* are described when providing definitions for *specific developmental disorders*. If development is interpreted, by using Affolter's tree model (*Affolter & al, 2000*), as being part of the same process but, moving forward, as differentiated branches and functions then the roots may represent prenatal experiences and development, the trunk may depict basic functions, and the branches may represent the highest parts of sub-functions according to development. A deficiency of sub-functions, in turn, will indicate difficulties in developing cultural techniques and the occurrence of learning disabilities. Interpreted in this way, developmental differences do not belong to the category of learning disabilities, and the group of learning disabilities is one of the subgroups of developmental differences rather. Therefore, these very diverse disabilities are defined as "developmental" diagnoses in literature, and I made an attempt at collecting them in my dissertation: in the chapter titled *Developmental Processes as Underlying Causes of Developmental Differences and Learning Disabilities*. I made a list of nearly thirty developmental differences and symptoms.

New knowledge and skills are created through learning. *"Learning is a lasting and adaptive change resulting from an interaction with the environment in a system or its controlled subsystem. The examined system is the person himself, the controlling subsystem is the nervous system, the environment is the person's real natural, material, and social environment, and the interaction is*

the material and social action of the person. The term 'lasting' means that the result of learning can be recalled later, and 'adaptivity' indicates that a change occurs as a result of learning, which makes a person adaptive and more adaptable to their environment (Nahalka, in Falus, 2005.: p.79).

However, some groups of children cannot learn well. Despite an average and adequate learning environment, they cannot learn cultural techniques, reading, writing, and math, or they can learn them with difficulty or in a specific way.

Additionally, categorisations of and definitions for learning disabilities are different in Hungarian and in international literature and, likewise, in EU countries, a fact that is reflected in a significant diversity in statistical data for children under 14 years of age.

According to data for the US, learning disabilities are relevant to 2.5-5% of children, on average. Views on how to diagnose the presence and severity of sub-skills in children before their starting school vary from country to country. According to a study carried out in the US in 2010, the proportion of schoolchildren with special learning disabilities is around 5%.

I also found different data in Hungary. Data reported by the various specialist areas and ministries show large differences (7-45%). On the one hand, according to data from the Central Statistical Office, the proportion of children with learning disabilities stood at 7.2% in the 2015/16 school year and 7.3% in the 2018/19 school year. Elsewhere, atypical development affects 25% of children, and another 15-20% of them have poor academic results, i.e., 40-45% of children have some degree of learning disability, which affects approx. 400,000 to 500,000 pupils and families (*Gyarmathy, 2012*). The reason for the significant difference in data and the controversy surrounding it is to be found in categorization problems and diagnostic processes (*Vida, 2018*).

In summary, nowadays the number of perinatal risk factors is increasing, including organic, functional, psychological, relational and social disorders, which may affect up to 60-70 percent of children. Developmental differences evolving due to risk factors and additional risks will add up and cumulate, affecting the learning process, academic achievement, integration, and success in life (*Sameroff & al, 2000, Lehtota & al, 2020, Danis & al, 2011, Evans & Whipple 2013*).

The prevention of learning disabilities and the reorganisation of early childhood intervention- and preventive care has become increasingly urgent. The present research is intended to contribute to this with its quantitative tools, revealing correlations between developmental differences, learning disorders, and developmental patterns.

III. AN OUTLINE OF THE RESEARCH METHODS APPLIED

For the empirical statistical calculations, I used the Statistical Package for the Social Science (SPSS) program and the Excel program. For the processing of quantitative data, the descriptive and relationship-exploring correlation method, logistic regression, factor analysis statistical procedures were used.

3.1. Hypotheses

Hypothesis 1: We hypothesise that we can find a significant positive correlation between perinatal risk factors and developmental differences.

Hypothesis 2: We hypothesise that we can find a significant positive correlation between perinatal risk factors and learning disorders.

Hypothesis 3: We hypothesise that early complex and developmental special education services will show a significant negative correlation with the frequency of developmental differences and learning disabilities.

Hypothesis 4: We hypothesise that we will find a significant positive correlation between developmental differences and learning disabilities, which shows the rate of developmental changes.

Hypothesis 5: We hypothesise that perinatal risk factors significantly increase the likelihood of developmental differences and learning disabilities.

Hypothesis 6: We hypothesise that the correlation between functional disorders and risk factors, as well as developmental differences and learning disabilities will show a typical pattern.

3.2. The sample used in the research

In this longitudinal research, the study sample is divided into two parts: an experimental and a control sample. The members of the EXPERIMENTAL SAMPLE were children aged 0-6 applying for early care, who had already undergone an examination in their early childhood, and then received improvements after the examination, and we assessed them again with an impact assessment after entering school. The experimental sample has two subgroups: subgroup 1 includes children who received early intervention between the ages of 0 and 3 (n=48); and subgroup 2 includes those who received early intervention between the ages of 3 and 6. (n=26).

The children participating in the CONTROL SAMPLE were older than 6.1 years, their first examination was already at school age, they needed developmental special education care and they also underwent two examinations, one before the development and then after the development (n=48)

The research consisted of an EXPERIMENTAL and a CONTROL sample:

$$n = 122 \qquad n_{experimental} = 74; \text{ and } \quad n_{control} = 48;$$

3.3. Presentation of the methods used in the research

We selected and developed the research methods in accordance with the main goal of the longitudinal research, the investigation of the effectiveness of early intervention and developmental special education care and the characteristics of the age group. We combined three main methods during data collection: semi-structured interview, observation, and document analysis.

The anamnestic data were collected from the parents in a semi-structured interview, the development scales were filled out based on observation and analysis of existing expert opinions and health documents. The document analysis applies to the existing obstetric final documents, nurse status sheet, paediatric, neurological, ophthalmology, otolaryngology, neonatology, endocrinology, nurse examinations and the analysis of expert opinions and documents. The results and data of the developmental scales and functional maturity observation sheets were included in the self-edited data sheets. (*Falus & Ollé, 2000, Falus, 2004*)

Presentation of the self-edited data sheets:

1. **Perinatal Data-Sheet**: this questionnaire of my own design was used for recording anamnestic data through interviews. Data sheets were completed with the involvement of the parents of the children having applied for early care and also the parents of the control group, using the retrospective method. Based on interviews, a quantitative database was developed, as derived from answers related to pre-, peri-, postnatal interventions, specialist tests, and difficulties encountered during the perinatal period. In addition, we received data helping us form a picture of social situation. As far as risk factors are concerned, we indicated all of them. The risk factor score (0-26) ranges between Min.=0; and Max.=26. A high score indicates a high frequency of risk factors. Cronbach's alpha=0.723.

2. **Questionnaire of Developmental Differences**: The Questionnaire of Developmental Differences (DD) was used to collect developmental data related to the period before starting school, based on observation and interviews with parents. The developmental differences score (0-

18) ranges between Min.=0 and Max.=18. A high score indicates a high frequency of developmental differences. Cronbach's alpha=0.771. In addition to developmental differences, developmental delay (D delay) was also registered, and the delays indicated are over 0-2.5 years. Registered values include 0 = no delay and Max.= delay exceeding 2.5 years.

3. **Questionnaire on Learning Disabilities**: it provided answers to questions about learning disabilities as well as sub-skills- and functional differences in children after their starting school. The learning disabilities score (0-24) ranges between Min.=0; and Max.=24. A high score indicates a high frequency of various sub-skills-related disorders and learning disabilities and difficulties. Cronbach's alpha=0.867.

4. **Socio-demographic characteristics** (age, place of birth, gender, number of children in the family, position in the birth order of siblings, parents' highest education, number of rooms in their homes, number of people living together, presence of disadvantage, presence of cumulative disadvantage) have been derived from semi-structured interviews with parents.

5. Data on **resources** – **specialists, work processes, organisation- and activities-related documents, as well as frameworks** – have been obtained by analysing documents of persons and institutions.

IV. PRESENTATION OF RESULTS IN THE FORM OF THESES

In our longitudinal research, all three data sheets proved to be suitable as a research tool for carrying out the appropriate tests. The value of the Cronbach's alpha reliability coefficient was adequate, confirming the reliability of the scales.

THESIS 1: ***Our hypothesis was confirmed, a weaker than moderate significant positive correlation was found between perinatal risk factors and developmental differences, (r=0.468; p<0.001).*** From the earliest time, starting from conception, perinatal risk factors show a positive correlation, and they grow together, with the frequency of developmental differences. By the time of early adaptation, the postpartum period, a risk factor presence of 72% is detected among children. In the same experimental sample, the score for developmental differences is 58%. And if the risk factor score increases to a value above 10, then the score for developmental differences increases by approximately 50%.

THESIS 2: ***Our hypothesis was confirmed, slightly weaker than moderate (r=0.411; p<0.001) significant positive correlation was found between perinatal risk factors and learning***

disabilities. Perinatal risk factors show a correlation with developmental differences and learning disabilities, with a decreasing trend: the effect of perinatal risk factors weakens as time elapses.

THESIS 3: ***We hypothesised that early complex and developmental special education services would significantly decrease the frequency of occurrence of developmental differences and learning disabilities.***

Our hypothesis was confirmed for complex early services, it shows a negative correlation with learning disabilities; if early services increase, fewer learning disabilities and a need for less additional development can be expected. Developmental special education services also show a correlation, but not a negative one. **Our hypothesis was confirmed:** early complex care as a supporting factor shows a moderately significant negative correlation with developmental differences (**r= -0.363; p<0.001**) and learning disabilities (**r= -0.401; p<0.001**). At school age, the significant correlation of special education development as an institutional support factor was confirmed. It shows a stronger than medium correlation with developmental differences (**r=0.681; p<0.001**), and a moderately positive correlation with learning disabilities (**r=0.491; p<0.001**). Services for the treatment of developmental differences and learning disabilities is also necessary during school age, as individual therapies may take longer to produce results.

THESIS 4: ***We hypothesised that we would find a significant positive correlation between developmental differences and learning disabilities, which shows the rate of developmental changes.*** After completing the calculation of correlation, we obtained the following result: *there is a stronger-than-medium positive correlation between developmental differences and the score for learning disabilities* ***(r=0.611; p<0.001).*** ***Our hypothesis was confirmed, if the score for developmental differences increases, so does the score for learning disorders.***

If the score for perinatal risk factors is lower than 10 (PRF<10), i.e., it ranges between 0 and 9 points:

- the average frequency of perinatal risk factors is (6.09)
- the average frequency of developmental differences is (11.47),
- the average of the frequency of learning disabilities is (12.09).

If the score for perinatal risk factors is higher than 10 (PRF>10), i.e., it ranges between 10 and 26 points:

- the average frequency of perinatal risk factors is (14.78)
- the average frequency of developmental differences is (12.78),
- the average of the frequency of learning disabilities is (15.16).

Differences between the average values for the frequency of risk factors:

(8.68) for perinatal risk factors;

(1.30) for developmental differences; and

(3.07) for learning disabilities.

It is noticeable that, while the score for developmental differences doubles and the frequency of learning disabilities increases slightly in the case of a risk factor score below 10, the frequency of learning disabilities increases by 20% in the case of a risk factor score above 10, in addition to a decrease in the number of developmental differences. The difference between the values for perinatal risk factors is 51.77%, for developmental differences is only 10%, but for learning disorders is higher again, 20%.

THESIS 5: ***We hypothesised that perinatal risk factors would significantly increase the likelihood of developmental differences and learning disabilities.*** We examined the longitudinal experimental and control samples twice, first examining developmental differences as basic functions and obtaining the table of assessment test data, and then, after development, performing the examination again. At school age, when we carried out the control examination, data on the occurrence of learning disabilities and sub-skills disorders, which form the summary table of learning disabilities, were entered in the appropriate tables of the **Questionnaire of Learning Disabilities**. We expressed data as a percentage and compared them, expressing the rates of development and significant values as well. In overall terms, we can establish that significant and spectacular rates of development and improvement were achieved in the examined children, with the highest rates observed in the group of the youngest ones: total rate of 67.65% in the group of children aged 0 to 6, and of 24.79% in the group of schoolchildren. The study affected the following functional areas, resulting in the following significant improvements: thinking (40.9% for over 6 years); behaviour (14.3% in total); emotional development (18% for 3.1-6 years; 20.5% for over 6 years; 14.4% in total); social control functions (18.6%); emotional trauma (42.6% for 0-3 years; 55% for 3-6 years; 41.2% in total); and special educational needs (23.6% for 0-3 years; 30.4% for 3.1-6 years; 17.2% in total).

Observing the data obtained, we can establish that the greatest improvement is shown in changes in emotional development, traumatic emotional processing, regulatory disorders, social behaviour and control functions. That fact should draw attention to the high chances for intensive improvement in the early period, and the need for early intensive and preventive services. These results show that the most powerful and significant improvement can be grouped around *emotional – social – relational* functions.

An additional test, *a logistic regression calculation*, enabled us to identify which risk factors are the most likely to cause a disorder of each main function, and how many times more likely it is for developmental differences to develop. We performed this calculation for the functions of children aged 0-6 years and those older than 6.1 years (*Annex 7.5*): as compared to an undisturbed, intervention-free birth, induced delivery (5.333), other hormonal interventions (0.224), and delivery with spinal anesthesia (3.553) will make movement disorders //1.262 times more likely. (In the case of induced delivery, movement-related developmental differences are 5.353 times more likely than in the case of children born through a spontaneous vaginal delivery. If the number of risk factors increases by one, the chance of the occurrence of a movement-related developmental difference increases by 1.262 times.)

We found a multiplier of (2.142) for speech function differences, (1.333) for muscle tone differences, (1.714) for cognitive development, (2.5) for cognition-perception, (1.633) for behavioural disorders, and (1.533) for emotional development, i.e., this is the likelihood of the occurrence of developmental differences in the various functions in case of a significant correlation of certain risk factors (*Table 15*). **Our hypothesis was confirmed**, it is possible to predict the proportion of and chances for functional and learning disabilities based on developmental differences and risk factors; chances for other functions to develop are shown in the table titled *Sample of functional disorders* in Annex 7.6.

THESIS 6 ***We hypothesised that the correlation between functional disorders and risk factors, as well as developmental differences and learning disabilities would show a typical pattern.*** Underlying the occurrence of developmental functional differences and learning disabilities, risk factors are likely to be present and to show a pattern. Developmental differences and disorders of the various basic functions have an impact on all additional functions, in the development of which basic functions are present, for example, muscle tone abnormalities – sensitive the most to magnesium intake and stress during pregnancy, and interventions during delivery – have an impact on learning disabilities later in life, high-, and fine motor movement differences, and speech functions. Prenatal risk factors that most strongly affect the development of movement include taking magnesium during pregnancy, the use of painkillers during delivery, caesarean section, and delivery with spinal anesthesia.

Patterns highlight not only the occurrence rates of risk factors and developmental and learning disorders, their correlation and accumulation, but also the need for therapeutic care before and after six years of age. For us, this may be important when involving children in early care and when preparing their Individual Development Plans. Naturally, every young child is different, but if

we apply options offered by *Evidence Based Education*, which informs us about perinatal risk factors mapped through perinatal anamnesis, we will be able to judge the likelihood for and patterns of the occurrence of developmental or learning disorders and to take that into account when setting up development plans. Designing this new approach could form the basis of significant additional research and planning.

V. SUMMARY

In our entire sample, there is an increase in the score for risk factors (40.71%), developmental differences (59.02%), and learning disabilities (43.46%). Of the children participating in the research, 95.9 percent had at least 4 perinatal exposures, and for 65.57 percent of them we found more than 10 risk factors. Developmental differences occurred in nearly 60 percent of them, while learning disabilities were found in all children, in at least two sub-skills. In the EXPERIMENTAL group, there are more children with special educational needs (25%), and the average score is higher for risk factors (11.375), developmental differences (13.216), and learning disabilities (15.873) alike. In contrast, in the CONTROL group, the average score is (10.625) for risk factors, (10.630) for developmental deviations, and (11.686) for learning disabilities. Complex early care reduces the occurrence of developmental differences and later learning disabilities, which show a significant correlation also with developmental special educational services. Our results confirmed the first three hypotheses, there is a correlation between risk factors, developmental differences, and learning disabilities. As a result of early development, the frequency of developmental and later learning disabilities decreases.

As the risk factors score increases, so does the developmental differences score and the learning disabilities score. In children with the highest frequency of risk factors, the frequency of learning disabilities may increase by up to 60-70%. Our results coincide with what is formulated in literature (*Dunst & al, 2006;*), namely, that we can assume a cumulative effect, as described by several scientists (*Sameroff & al, 2000, Lehtota & al, Evans & Whipple 2013*). If a child has to deal with fewer risk factors, they can later enjoy better health, develop better, learn better and become a more balanced, healthier, happier adult (*Harris, 2018*, *Bányai, & Varga 2013, Varga, 2019*). Those persons with more risk factors from the prenatal period will, on average, have 3.6 times more developmental differences, more learning disabilities and will be sicker as adults, finding it more difficult to cope with social requirements. Many of them have to face additional difficulties, such as health problems, additional risks due to their being disadvantaged, which also increases their

vulnerability. In addition, they may be damaged even more as a result of persistent stress, negative effects and learned helplessness (*Harris*, *2018)*.

The six groups of *the factor analysis of Risk Factors* offer an appropriate model for perinatal risk factors influencing development the most, organized into groups. These six groups are as follows: 1.) endangering situations around delivery, 2.) preterm birth, 3.) drugs received during pregnancy and delivery (oxytocin, other hormonal interventions, painkillers), 4.) disorders around delivery, the postpartum period, and breastfeeding, which play a role in the formation of bonding 5.) magnesium and induced delivery, as interventions affecting the muscle tone of the fetus 6.) interventions affecting fertility, interventions around conception, other hormonal interventions and interventions during pregnancy.

The main factor groups of *the factor analysis of Developmental differences* show the functional areas for which development care is to be provided to children aged 0-6 years and school-aged children, and the therapies needed in the short and long term. Relational and environmental effects have been described by several authors, explaining the complexity of the mother-fetus and mother-child relationship and the importance of short- and long-term therapeutic treatment (*Varga et al, 2019, Andrek, 2019)*.

As the main factor groups of *Learning Disabilities* suggest, development care should focus mainly on addressing problems with bonding, and on developing the relational, emotional and social nets. There is another major therapeutic area, where care should be grouped around *development of movement, stimulation of nervous system, elimination of problems with muscle tone*, and then around *speech development and elimination of problems with cognition-perception*. These statements highlight the correctness of the development approaches established in practice, under which, as part of early care, therapies must cover the therapy of regulatory and relationship disorders, the stimulation of movement functions and nervous system maturation, and the development of cognition-perception and speech *(Kereki, 2021, Andrek,2019, Berényi & Katona 2014, Czeizel & Kemény 2015).*

Early complex care reduces the occurrence of developmental differences and learning disabilities later, with which the impact of developmental special education services shows a significant correlation, but not a negative one. A spectacular improvement rate has been achieved in the children examined, especially in the early age group. The development of the brain and functions can be shaped most easily at the earliest time, in the first five years (*Berényi & Katona, 2014, Krstic, 2017, Danis & al, 2011)*. The effectiveness of later developmental activities declines to half of the original level, starting from school-age.

The *function patterns* mentioned by several scientists *(Krstic, 2017, Harris, 2018, Govedarica & al*, *2000, Gyarmathy, 2012*) highlight the sub-areas of the functional areas to be developed and the correlation of sub-skills, the influence of functional areas on each other, and the key correlations of development. Developmental differences are on average 2.5 times more likely to cause learning disabilities. By knowing about the early experiences and patterns, we can not only understand why a child gets sick, why their immune system is weak, what the mechanism of their illness is, but, as educators and teachers, we can also understand why they do not learn, what learning process is likely to help them catch up, and what situations affect their performance and development negatively or positively. *Robles et al (2019*) highlight the same association by examining patterns between early experiences and learning.

Correlations clearly show that *experiencing emotional stress and trauma, emotional development, and the formation of bonding have a major impact on development and learning*. We can find verified, significant correlations between risk factors and developmental differences, learning disabilities and supporting factors. Risk factors and developmental differences show a correlation with the development of learning sub-skills disorders. We can predict the probability at which perinatal risk factors are likely to result in developmental differences or learning disabilities. We can predict that, upon an increase in the risk factors score, the occurrence of learning disabilities will be very likely and we can also foresee the length and direction of the therapeutic care required.

Perinatal risk factors exert short- and long-term effects, but the early, very sensitive, complex period also offers a high chance of recovery. That fact calls for the earliest possible start of early care services, the harmonization of emotional and relational disorders, the provision of support to mothers, fathers and undisturbed delivery in preventive care, as well as the implementation of complex family care services.

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VI. SOME OF MY PUBLICATIONS RELEVANT TO THE DISSERTATION

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