

EARLY CHILDHOOD NEUROPEDAGOGY: GOLDEN 3000 DAYS

László VARGA

Benedek Elek Faculty of Pedagogy
University of Sopron
varga.laszlo@uni-sopron.hu

UDK159.922.7:37.013=111

Review paper

Suzy ROSEMOND

Kinder Care Learning Center, Framingham
Massachusetts, United States
suzy.rosemond@kindercare.com

“Brains are built not born”

(Dr. Jack Shonkoff, Harvard University)

Abstract

The human brain is a mysterious organ that poses serious learning challenges to scientists and child educators. This paper provides educational science with new information and data, as well as modifies and complements the content of nursery school and early childhood educator trainings, and finally discusses the innovation of early childhood educational and research facilities. The paper also contributes to this dialogue by summarizing what we already know about the learning process in the brain and suggests how it might inform the teaching and learning process in the classroom. Intelligent investment is crucial in establishing a happy life, which means that there is an unlimited chance and extreme responsibility on our shoulders, since early years last forever.

KEYWORDS: *early childhood, brain development, constructivism, neuropedagogy, windows of opportunity, pedagogical approaches*

The magic sponge or the window of possibilities

The latest researches emphasize childhood as a key factor. In recent years, research on young children's early brain and emotional development has underscored its importance for later development. Integrating this 'Brain-Based, Heart-Felt' research

into classroom practice, will require meaningful dialogue between educators and brain scientists to inform both research and Early Childhood Education (ECE) institutions. Linking brain and EQ research to ECE is extremely valuable to our understanding of children development and learning.

Understanding how neuroscience can inform education strategies and finding out what teachers want and need to know about the ways children learn are two key drivers behind the neuro-education initiative. At birth, the brain is remarkably unfinished. The period from birth, up to eight years is considered to be the peak time for brain development. From birth to about the age of eight the brain is a super-sponge. This is the brain's most absorbent stage, when it actively learns from its environment. "Windows of opportunity" are sensitive periods in children's lives in which specific types of learning take place. Information flows easily into the brain through 'windows' that are open for only a short duration. Then the 'windows' close, and much of the fundamental architecture of the brain is completed and probably will not change much more. It is a central question what to give and what not to give to our children in their first years. Children who have little opportunity to explore and experiment with their environment may fail to develop fully the neural connections and pathways that facilitate later learning. Further, exposure to trauma or chronic stress can make children more prone to emotional disturbances and less able to learn. Scientists are continually learning more about how young children's brains develop. At the same time, teachers are looking for effective strategies to help children use their brains to their fullest capacity.

Neuro-pedagogy in early childhood is an interdisciplinary science born from the dialogue between the research results of pedagogy, the theory of neurophysiology in childhood and early childhood pedagogy (Varga & Szécsi, 2018). In recent years, neuro – pedagogy became a much stronger focus which allows more and more researchers to participate in discovering young children's brain development. The Research Group and Laboratory of Early Childhood Neuro-Pedagogy (NeuPedLab) of the Hungarian University of Sopron has been successfully operating for many years, which, with its national and international scientific discourses and innovations on early childhood, seeks answers to the possibilities of pedagogical exploitation of the latest neurological research results in early childhood. The pedagogical discretion has previously classified this subject in the field of special education. Today the approach is highly positivist and it starts from a healthy child. It does not deal primarily with deficits, or with the state of deficiency, but rather examines how we can support the development of the child's nervous system by applying the available tools of pedagogy. Our research primarily does not focus on mental disorders, weaknesses and injuries, but centers around childlike strengths and virtues. A pedagogical treatment

consists not only of the „improvement” of debilitated functions, but also of the further development of the effective functions, where the whole spectrum of child experience is the primary focus, rather than the shadows of the soul. Therefore, early childhood neuro-pedagogy does not start from the state of deficiency, i.e., it is not deficit-based and its approach is more developmental, positivist, constructivist, and pragmatic.

The previous research indicates (Varga & Farnady-Landerl, 2017) that taking into account the latest neuro-scientific results has a decisive influence on pedagogical professional and innovation activities. Consequently, the added value of the educational and developmental work put at the service of early childhood brain development lies in the kindergarten teacher’s efforts for methodological renewal, as a result of which the direction of exploitation of the sensitive period in kindergarten becomes well traceable. The comprehensive knowledge of neuro-scientific results and their use within the limits of professional competence can be attributed to special attention.

Together, representatives of the various sciences explore the magic of the young child’s mind, its development, and the influence to intervene within it, with well-intentioned possibilities and thoughtful ways. The early childhood mind is a window into the world, a window of never-returning possibilities. Pediatric neurologists, educational researchers, psychologists and practicing educators are working to create new pedagogical theories and innovations from dialogue, common thinking, and research, supporting the development of a new science of neurology and pedagogy from the common ground.

The human mind is a mysterious organ that poses constant challenges for scientists and early childhood educators. The research project covers two key areas of study: the impact of neurology results on the practice of pedagogy and teachers’ knowledge of the nature of early childhood learning. An infant’s mind is not ready at birth at all, so we can say that the brain is the only organ that is born too early. The first eight years are the peak of brain development and during these crucial years, the mind develops at an amazing rate and by the age of three the brain network is already extremely developed. The quality of early childhood education and care has a significant impact on the development of the brain network and structure. From birth to the age of eight, the brain is like a magic sponge – it absorbs everything. This is the most sensitive period of mind development, the „window of possibilities” – this is when the human mind learns the most from its environment. The window is open for a relatively short time, and then, as the window closes, starting around the age of eight, the basic brain structure is slowly being built up.

Neuro-pedagogical perspectives of early childhood learning

In everyday terms, different ideas about learning mainly provide an idea of the object designation of forms of knowledge. In scientific terms, the definition represents an adaptive change in a system in the field of pedagogical concept use that has an impact on the longer term (Nahalka, 2006). From a psychological perspective, learning does not only involve the acquisition of knowledge. The process lasts our whole lives and extends to all areas of our lives. Within the science of psychology, representatives of different trends – biological, behaviorist, cognitive, psychoanalytic, phenomenological perspectives – scholars consider different aspects of learning that are important (Gasko, 2006).

In the context of psychological learning interpretations, in the light of their evolution, cognitive psychology defines learning as information processing, while the nervous system is considered an information processing structure. Based on Atkinson's and Schiffrin's multiple library theory, this model distinguishes memory libraries and feedback functions in the learning process (Gasko, 2006). The model takes into consideration both inputs and outputs. In the case of the brain, a combination of stimuli from the outside world and from the inner state of the brain can be considered input. In the case of outputs, on which the signals appear to define the response of the system, some kind of motor action, a thought, or a recognition is also possible. The system has an internal behavior and a mechanism. Internal behavior converts input signals into output signals based on mapping in neural relationships; the mechanism of the system is therefore capable of changing internal behavior, mapping. This means „permanent morphological and physiological changes in the brain at the cellular level, which causes the original functioning to change.” (Nádasdy & Amp; Eden Fiser, 2003: 393)

The neural mechanism of learning and memory at the cellular level shows similarity. All the complex brain activities are based on the rearrangement of structural connections between nerve cells. While learning is seen as a mechanism for learning information as a result of the re-organization of occurrence, memory is the ability to mobilize acquired information, allowing different types of information to be produced in cortical modalities. Memory as a skill in a different way is the brain representation formed by learning, the neural relationship matrix (Nádasdy & Fiser, 2003). Research has shown that obtaining information (coding – conversion to remember code) and memory retention and recall (decoding – conversion from memory code) can be independently influenced (Bednorz & Schuster, 2006).

From the aspect of the neural mechanism of learning, the central nervous system interacts with the outside world through the senses, in which it primarily serves to

exchange and process different information within its own models of the world. Representation of models takes place in neural structures. In order to ensure rapid and comprehensive information processing, the formation of neuronal systems – ganglia formation – should take place in a small area and, where possible, concentrated (Bednorz & Schuster, 2006). Essentially, neurogenesis, the formation of new cells and its connection to other neurons occur predominantly in the hippocampus, which is part of the limbic system. For the continuous preservation of memories, hectic activity of nerve cells is required (Goleman, 2007). The memory function of the hippocampus, which complements cortical plasticity in the human brain, serves in part to consolidate new knowledge and to recall those already stored (Nádasdy – Fiser, 2003). In terms of structure, it is the central organ of learning, that is, located in the middle of the brain and in direct contact with the amygdala. Thanks to the favorable structural structure, it is possible to bring the contents of the „work memory” – newly acquired information, which is stored only for a short time in the center of the brain, the pre-frontal cortex – into a form suitable for longer storage. In fact, this nervous system activity is the engine of learning (Goleman, 2007).

The effectiveness and the relations to learning as well as the overall, thinking about learning and pedagogical practice are significantly influenced by the system of concepts of education. In a scientific perspective, the pedagogy of knowledge transfer, illustration and action is extremely decisive in the field of pedagogical ideas. Each of the three learning parameters are the explanation, implementation and detailing of the knowledge mediation metaphor (Nahalka, 2006). Regarding the learning interpretations, the theorems of constructivist pedagogy formed as a result of paradigm shifts, play an important role mainly in the examination of teaching-learning processes and in shaping educational practices. The development of constructivism in the last third of the 20th century; according to others, is a philosophical, theoretical trend; some people interpret it as the basic theory of cognition psychology. From the practical implementation point of view, it is mostly related to how and in what way the individual learns and what laws apply to the process of learning (Nahalka, 2013).

Unlike in the past, the learning content and its practical use are not sharply separated in constructive didactic ideas. Education and instruction provide a range of knowledge based on the “opportunities of didactics” replacing the „must” in the pedagogy of the past. In the world of constructivism, the knowledge that already acquired is very important, which is either able to understand the signals of the outside world or not, and in this dynamic process it takes shape within the framework of construction (Nahalka, 2002). According to the theory, people construct their own understanding and knowledge of the world, through experiencing things and by reflecting on those experiences. The constructivist philosophy was founded on the hypothesis that by

reflecting on our experiences, we are able to understand our surroundings and every one of us will generate our own rules which helps us decipher our experiences.

According to Berry (2008), children are consistently interacting and negotiating with others to construct their own unique set of concepts. While children are interacting with others, they will develop their own unique set of concepts, which supports social constructivists as they believe that knowledge must involve social interaction.

The constructivist approach to learning can be applied to all sub-processes of socialization if the learning process is interpreted broadly. Its essential feature is the personal, unique, internal construction process. Accordingly, knowledge, values and attitudes are not passed on and conveyed to the child, but in an active building process they construct their own personality (knowledge, attitudes, values); that is, the structure existing at a given level of development continues to build itself. The resulting structures are adaptive in that they are beneficial and useful in terms of the individual's own evaluation processes (Nahalka, 2013). In other words, the learning system, specifically the human brain, proactively relates to its effects and shapes its own system based on interpretation (Nahalka, 2006).

Based on the fact that any prior knowledge is obviously the result of construction, as we are going backwards in time, we arrive back to the fetal age, when the development of the human brain begins. In the 1990s, cognitive psychological and pediatric psychology experiments revealed existing knowledge elements in the newborn's head. Obviously, nowadays we do not talk about knowledge in a linguistic form, but rather about some expectations about certain processes. American authors (Kuhl; Meltzoff; Alison Gopnik) wrote the book *Wise Men in the Cradle*, published in Hungarian, around this time, in which they revealed that babies know significantly more than previously thought. In connection with the analysis of the learning process from a constructivist starting point, the development of complex structures can be attributed to the pre-established systems. When asked where this knowledge comes from, two assumptions include options for answers. One such theory is the very strong formulation of genetic origin, according to which the knowledge that is the starting point of the construction process is already encoded in the genes. The results of recent research show that this concept is not correct because genes do not describe the structure of the brain in such a detailed way (Nahalka, 2014).

Another interesting idea is the potential response from the development of the brain. Brain cells formed through the process of fetal development are further divided until birth. In fact, the development of relationships between them takes place randomly, and the genes control certain overarching things from this. The system takes input from its surroundings relatively early on, and also produces some kind of output. Inputs (fetal hearing, vision, perception) and outputs (movements considered

involuntary, other reactions) trigger a structuring. Within the random system, there is presumably an evaluation system that considers some things to be good and others to be bad; consequently, it strengthens certain relationships, weakens some of them. The learning process leads to the fact that from a certain point, moving forward we can talk about cognitive processes, in the case of newborns we can talk specifically about contriving (Nahalka, 2014).

In the context of the original and narrower wording of the conceptual shift, it means enriching thinking with a new system and a new approach in a given area. Constructivist pedagogy is a thought structure that is consisting of theories, mindsets, principles regulating practice and a developed concept system. Within the science of pedagogy, conceptual shifts can be considered processes that are known only to constructivist pedagogy and they have no place in other paradigms. Changes on the part of the individual – constructing themselves – can only be made if he recognizes, interprets and is critical of them.

Consequently, the task of pedagogy is to pay special attention to the development of several variable new structures, to facilitate their construction and to enable children/pupils to make decisions (Nahalka, 2013).

Over the past fifteen or twenty years, there have been serious discussions among professionals about what functions the “reborn pedagogy” needs to fulfil and what values it will have to represent in the Hungarian public education. Do you primarily seek to educate citizens who are useful to society, or rather to educate people who are capable of happiness? Do you consider the ability to adapt more important than independence or human autonomy? Do you prefer material knowledge, or problem-solving skills and creativity? Are you preparing students to succeed in Hungary, Europe, and in the globalizing world? Only active attitudes, relevant and expediently structured knowledge, and value-based co-existence of the organizational framework of education and teaching can provide a valid, authentic response to the great challenges of the 21st century (Klein, 2012).

The utterance of this need for change motivated the thoughts of Carl Rogers, an excellent figure in person-centered psychology, about his existing crisis and the possible way out, when he reported in his writing that most teachings have no effect whatsoever, since it usually acts as an activity that is usually completely uninteresting to students. One of these concepts is that „only a learning process that comes from a discovery-based experience and satisfies an inner need will be effective” (Klein, 2012: 516).

Mihály Csíkszentmihályi, a pioneer of positive psychology, has confirmed with his research that personality develops most when it feels „existing in a current”: the activity becomes light and instinctive. He named the positive aspects of human

impulses – happiness, creativity, taking on life, the experience of being human – as a stream or flow of Csikszentmihályi in his volume *The Psychology of the Perfect Experience*. The flow experience makes the human consciousness much more complex, as it provides a common experience of differentiation and integration. In the meantime, a person feels unique, valuable, and autonomous, while at the same time being a happy and useful member of the community (Klein, 2012).

Mihály Csikszentmihályi considers the phenomenon that actions are the most difficult to perform the most difficult tasks as one of the most interesting paradoxes of the current experience. This also applies to learning efforts. In the context of flow theory, the philosophy of lifelong learning as a joyful life option over a compulsive approach where one would only appear if the end of externally managed education would also be the initial stage of internal motivation-driven learning. Post-reform paradigms emphasize activity-oriented, motivated, vital activity, the development of emotion, intuition, and creativity through simultaneous mediation of a holistic approach. In contrast to surface differences, a single basis is highlighted, which function as an authentic and valid alternative to each other. The alternative expresses an optional mode of action and activity. Alternative pedagogy pays special attention to practice, the child and student needs, as well as to individual characteristics. Learners gain learning experiences through activities in lifelike conditions. Due to the facilitating, incentive, and supportive role of the teacher in the teaching and learning process, multifaceted incentives, motivation, and student activation become of paramount importance (Klein, 2012).

In the field of kindergarten education, the project method, which is integral to the kindergarten curriculum introduced in 2008, has become a natural part of the child-centered approach. From an etymological view, the ‘projectum’ is a word of Latin origin, meaning plan, draft or offer and proposal. Based on child-friendly ideas from the beginning of the last century– starting from children, children’s thinking, and emotional needs – the project is one of the most effective methods of organizing learning. The project method, named after John Dewey and William H. Kilpatrick, is based on the joint and coordinated activities of the teacher and children, building upon children’s interests. As an education and evaluation strategy, the main focus is on the research work and on the given topic. Projects include complex tasks with a practical problem to focus on. The task is not simply to solve the problem, but to process the topic as widely as possible, to explore as many connections as possible. The content is subordinated to the topic and so-called sub-themes and stems from the children’s need to know it. Learning is present as an accompanying tool, but activities aimed at achieving the product are of the center of gravity. A specific problem accepted or selected by children, a given topic, is processed individually, often in

groups; in the meantime, they discover the solutions themselves, they define the limits of the learning process themselves. The greatest value of the project is that, unlike traditional curriculum-oriented strategies, the child is not actually assigned to the curriculum, but the child or student assigns the curriculum to themselves (Stark, 2011).

According to Freeman's concept, persons with more favorable intellectual abilities can make more optimal use of stimuli from their environment, that is, in a stimulating environment, hereditary outstanding abilities and skills become even more dominant. One of the most significant factors for the recognition and development of talent is the suitable and complex environment, which according to Mihály Csíkszentmihályi is able to provide ideal conditions for attracting interest. In addition to the knowledge and motivation already acquired, the willingness to focus attention contributes to their development (Bagdy, 2014).

Being open to experiences means flexibility, the interoperability of walls between concepts, hypotheses and senses, and the ability to tolerate ambiguity. For this reason, the development of creativity is of particular importance, because it can play a key role in the „bridge-building” between different reality constructions. From the aspect of learning processes, the definition of constructive creativity, i.e., open to experiences, and its role in personality development in the formulation of Carl Rogers, is the birth of a new one from the individual's specific interactions in order to self-realize it. One of the basic criteria for creativity is that the source and scene of the evaluation is internal. This also suggests that the creative student evaluates his creation on the basis of his ability to express himself in it, rather than the value judgment of the outside world. Another criterion of creativity is the ability of the individual to arrange the specific components at his disposal into shapes and compositions that did not exist before; to formulate provocative hypotheses; be problem-sensitive (Klein, 2012).

Several researchers have found that intrinsic motivation is closely related to creativity. In Mihály Csíkszentmihályi's flow theory, the creative person is not satisfied by the status quo, but is looking for alternatives to both cognitive and emotional reasons. This openness ensures that the individual does not reject other solutions, but rather constantly moves forward with the joy of discovery. According to this, the guarantee of the creation is ensured by interest, perseverance, and originality. According to Albert Bandura, an American psychologist of Canadian descent, when it comes to creativity, self-efficacy influences behavior both directly and indirectly. People with high self-efficiency judge that they control their own destiny and events. They trust their own abilities; difficult tasks are experienced as a challenge, not a threat; set themselves valuable goals and strive to achieve them. In the correlation of

self-efficiency, creativity and openness, intrinsic motivation plays a kind of mediator role (Bagdy, 2014).

In a constructivist approach, creativity cannot be forced, but must be allowed to surface (Klein, 2012). Constructivism equates learning with creating meaning from experience. Learning is more meaningful to students when they're able to interact with a problem or concept and can help engage and motivate students by making them take on a more active role in the learning process while they are using their own experiences. Carl Rogers highlights two factors in his conception of an environment that supports creativity: one is psychological security and the other is spiritual freedom. Psychological security develops in a state of unconditional acceptance when the child or student has an experience of understanding; psychological freedom is the possibility of self-expression (Bagdy, 2014). Freedom also means responsibility; that the student can be himself responsibly, since this is the only way to achieve that the assessment comes from within (Klein, 2012). Carl Rogers's theory has been partially empirical; the background of talent was mainly experienced by those who showed an interest in the fields of science – the great inventors (Bagdy, 2014).

According to Mihály Csikszentmihályi, creative talent is not only the driving force behind the individual's life path, but also society and the whole evolution. The individual takes into consideration the perspectives and interests of their fellow human beings during their creation, which means that creativity can be matched by the permanent development of what is existing in the given society (Bagdy, 2014). Sándor Karácsony, the eminent Hungarian educator, believes that in the process of teaching and learning, from the aspect of the teacher's changed role, the teacher should be a personality from whom „honesty and freedom flow like a mysterious current, who can give and accept equally. „ (Klein, 2012:517). In practical terms, if we accept children unconditionally, and see the possibilities that reside in them, they should gradually learn that they can be who they are; discover the experience of personal self-realization, that is, they can embark on the path of creativity (Klein, 2012).

Empathy, therefore, at least from the perspective of students, implies watching what they are doing; feel what they feel; to enter their world and accept them from this closeness. Based on the experience of constructivist pedagogy so far, this kind of understanding is difficult due to the different reality constructions. At the same time, the endeavor itself provides an atmosphere of trust, in which, by applying the various forms of cooperation, in an inner-guided pedagogical impact system, they can become more open to their experiences and find step by step the basics of evaluation on their own. On the other hand, in such an atmosphere, both pupils and educators can show their true selves in terms of new and varied forms of their attitude to reality. In essence, this is what really promotes creativity (Klein, 2012). In addition to positive

psychology and teach children to empathy, self-realization and self-control it is essential to focus on executive function. Executive function describes a set of cognitive processes and mental skills that help an individual plan, monitor, and successfully execute their goals. The “executive functions,” as they’re known, include attentional control, working memory, inhibition, and problem-solving, many of which are thought to originate in the brain’s prefrontal cortex. Since much of modern life is process-driven and demands that individuals set and meet goals, disruptions in executive function can make it challenging for someone to succeed in school, at work, or in the household. Current researches in early childhood education indicate that developing a creative and child initiated learning environment also can promote the development of executive function from infancy through adult years.

In other respects, openness and flowing energy are needed to minimize the need for children and pupils to have fun participating in the experience where the responsibility of the learning process is in their hands, and that they can control their activities themselves. According to Mihály Csíkszentmihályi, the feeling called the perfect experience depends on the ability of someone to control what is happening in their consciousness. This quality must be developed by everyone relying on their own efforts and by activating their ability to engage constructively. Operating the ideal combination of design and spontaneity, moving the ability to play, exploring and experiencing the joy of realizing it can create a whole new perspective. Nevertheless, those who are fully open to their own experiences, internal and external impulses run unhindered through their nervous system and become aware of this form. When developing in such a system, the child does not think in predetermined schemes. Inventiveness really plays a key role in creative adaptation to the new world, adaptivity, structural links, networking and personality complexity (Klein, 2012).

The theories of the so-called positive psychology, which gained ground towards the turn of the millennium, mainly related to the names of Mihály Csíkszentmihályi and Martin Seligman, confirm all this. Positive psychology focuses on the strengths, values, and development of the individual, instead of deficits, shortcomings, problems. In sum, „human strengths (such as courage, future orientation, optimism, justice, etc.) can be considered evolutionarily formed positive personality traits that promote the prosperity and perfection of individuals and communities” (Ashes & Piko 2008:71).

All these ideas are now central to the theories of positive pedagogy and neuro-pedagogy. It is important to teach children happiness so that learning can also be a source of joy – which, of course, does not exclude the need and importance of positive stress-facilitation.

Conclusion

Recent studies into the children's brain and emotional development emphasize the significance of the role of early childhood on the individual later in life. They suggest that this represents a crucial and determining period. Following the research trends of brain and emotional development, a scientific dialogue ought to be launched between teachers and neurologists trying to find the applicability of neurology research data to education. We also encourage and promote the dialogue between scholars and scientist who foster the importance of early childhood educational theories, childhood neurology and emotional development. Scientists are working hard to form new educational views, to bring innovation based on this cooperation that supports the formation of this new subbranch of science stemming in neurology and pedagogy.

Both loving and professional education is needed at the same time, i.e., scientifically based education, with a secure attachment system and a stimulating environment, are essential to establishing a happy and satisfied human life path. Human sciences have never focused more on early childhood and early childhood development. The stimulating environment, happy childhood, unconditional acceptance, and pervasive parental and educational love form the foundations of early childhood education. Therefore, in the long term, only a society that sees family, parenting and early childhood education as a fundamental value can be competitive, capable of raising spiritually and physically healthy generations. Love turns out to be a breeding ground for early childhood growth and development. Everyone, working in any field of early childhood education, should contribute to the creation of a universally happy childhood.

REFERENCES

- ADAM, Gy. (2004). *The hidden mind*. Budapest: Vince Publishing House.
- ADOLPHS, R. and DAMASIO, A. R. (2003). The interaction of emotion and thinking: a neurobiological idea. In: *József Forgács (Ed.), Psychology of Emotions*, (31–53). Budapest: Cairós Publishing House.
- BAGDY, E. (2014). *The development of talent*. Budapest: Helikon Publishing House.
- BARDÓCZ-TÓDOR, A (2001). *Standard quality management system in school*. Budapest: National Textbook Publisher.
- BAUER, J. (2011). *Our bodies don't forget. Effects of our relationships and lifestyle on the functioning of our genes and nervous system*. Budapest: Ursus Libris Publishing House.
- BAUER, J. (2010). *Why do I feel what you feel? Instinctive communication and the secret of mirror neurons*. Budapest: Ursus Libris Publishing House.
- BEDNORZ, P. and SCHUSTER, M. (2006). *Introduction to the psychology of learning*. Budapest: Medicine Publishing House.
- BERRY, R. (2008). *Assessment for Learning*. Hong Kong: Hong Kong University Press. Retrieved from <https://search-ebshost-com.ezproxy.snhu.edu/login.aspx?direct=true&db=nlebk&AN=322027&site=eds-live&scope=site>
- BOROSS, O. and PLÉH, Cs. (2008). *Psychology - Academic Encyclopedia*. Budapest: Academic publisher.
- CSÍKSZENTMIHÁLYI, M. (2010). *FLOW - The Current - Psychology of the Perfect Experience*. Budapest: Academic Publisher.
- DEWEY, J. (1912). *School and society*. Budapest: Lampel R. It's for rent.
- DOIDGE, N. (2015). *The changing brain. Amazing stories from the forefront of brain research*. Budapest: Park Publishing House.
- DWECK, C. S. (2015). *Change of approach - A new psychology of success*. HVG Books publisher, Budapest
- EAT, K. (2011). Brain plasticity and flexible development. In: Isvan Balázs (Ed.), *Safe Start Volumes I, From Genes to Society: Scenes of Early Childhood Development* (pp. 166-204). Budapest. [online] [2019.10.24.]
- FARNADY-LANDERL, V. (2015). *Early childhood, learning, peers – neuro-pedagogical contexts of personal and social competences in early childhood*. Sopron: University of West Hungary, Benedek Elek Faculty of Education.
- GASKO, K. (2006). Psychological interpretation of learning. In: *István Nahalka (Ed.), Effective Learning, Some basic questions of practical pedagogy* (20–27). Budapest: Humanities Consortium Publishing House.
- GOLEMAN, D. (2008). *Emotional intelligence*. Budapest: Background Publishing House.

- GOLEMAN, D. (2007). *Social intelligence. The new science of human relationships*. Budapest: Libri Publishing House.
- ASHES, Thu. and PIKÓ, B. (2008). Positive psychological aspects in the school world: Challenges of positive pedagogy. *Hungarian Pedagogy*, 108th year. 1, 71.
- Hanson, R. (2016). Should I cry or laugh? *The human brain is tunable to happiness*. Budapest: Ursus Libris Publishing House.
- HÜTHER, G. (2015a). *A little more brain, please*. Göttingen: Vandenhoeck & Ruprecht GmbH & Co.KG.
- HÜTHER, G. (2015b). Preface. In: Purps-Pardigol, S. (Ed.), *Führen mit Hirn*, Frankfurt/Main: Campus Verlag GmbH, 11–15.
- KISSNÉ ZSÁMBOKI, R. and FARNADY-LANDERL, V. (2018). Neuro-pedagogical innovation opportunities in educational research using the EMOTIV EPOC+ mobile EEG device. *Training and Practice*, 16. year. 3. pp. 21–26.
- KITZINGER, A. (2010). Early language development in Europe and Hungary. *Training and Practice*, 8th year. No. 1. 91–98.
- KLEIN S. (2012). *Learning is good. A psychologist on pedagogy*. Budapest: Edge 2000 Publishing House.
- MARKHAM, L. (2016). *Peaceful parent, happy child. The end of the shouting and the beginning of contact*. Budapest: Ursus Libris Publishing House.
- MARTIN, R. A. (1998). Approaches to the sense of humor: A historical review. In: W. Ruch (Ed.), *The sense of humor: Explorations of a personality characteristic* (15–62). New York: Mouton de Gruyter.
- MILLER, K. (2019). Competence-based learning in kind, diverse learning organization for teacher candidates = Competence-Based Learning in Natural Environment, Diversified Organization of Learning for Teacher Trainees. In: Volume of studies in honor of Károly Mészáros 2019, Sopron: University of Sopron, 93–102.
- NÁDASDY Z. and FISER J. (2003). Biological and artificial neural nets of learning. In: *Csaba Pléh – Gyula Kovács – Balázs Gulyás (Ed.), Cognitive Neuroscience*, (389–435), Budapest: Osiris Publishing House.
- NAHALKA I. (2002). *How does knowledge develop in a child? Constructivism and pedagogy*. Budapest: National Textbook Publisher.
- NAHALKA I. (2013). Constructivism and education. In: *Educational sciences: education- research and innovation*, 1 (4), 21–33. p. [online] [4 November 2019]
- NAHALKA I. (2014). Constructive learning theory, measurement of learning outcomes - interview with Istvan Nahalka. In: B. Tier-Szegedi (Ed.): *Apple in the Tree – The Future of Learning 5*, Tempus Public Foundation, 38–47. Budapest, [online] [1 November 2019]
- NEMETH A. and EHRENHARD S. (1999). *Reform pedagogy and school reform*.

- Budapest: National Textbook Publisher.
- Papert S. (1988). *It's a spot. The secret ways of childlike thinking*. Budapest: Computer Science Application Company.
- PATYI, G., SARKADY, S. and SIMON, T. (2009). 50 years of higher kindergarten training in Sopron. In: Fusz, Gy. (Ed.), *The first 50 years of higher education and kindergarten education, 1959-2009*, (153–164). Szekszárd: PTE, IGYFK.
- PIAGET, J. (1970): *Selected studies*. Budapest: Thought KiaDo.
- PLÉH, Cs. (2015). *The framework for learning and thinking. From folk psychology to mechanical psychology*. Budapest: Typotex Publishing House.
- POLSTER, H. R. and HÜTHER, G. (2017). *Back to the roots. This is how „these children of today” develop*. Budapest: Ursus Libris Publishing House.
- RATCHET M. (2014). The amazing test. In: *Everyday Psychology*, 24 (3), 52–55.
- SPITZER, M. (2014). *Learning*. Heidelberg: Spektrum Akademischer Verlag.
- STARK, G. (2011). *Methodology of kindergarten activities*. Cluj: Abel Publishing House.
- STIPKOVITS, E. (2017). Our companion is the mirror. In a web of early attachments. *Psychology*, 2, 2017. pp. Articles 30 to 33
- SABOLCS É. and GOLNHOFER E. (2005). *Childhood: perspectives, narratives*. Budapest: Eötvös József Publishing House.
- SZÓDY, J. (2016). The magic of touch. In: *New Public Education*, 72. 2005. 4, [online] [October 16, 2019]
- VARGA, L. and FARNADY-LANDERL, V. (2017). A new chapter in constructivist pedagogy: neuro-pedagogy. In: Hana, Zsuzsanna (Ed.) *Hungarian Science Day 2015: Pedagogical-psychological background of school success* (81–98). Eger: Lyceum Publishing House.
- VARGA, L. and SZÉCSI, T. (2018). Neuropedagogy in Early Childhood in Hungary: Foundations and Micro-investigation. *Képzés és Gyakorlat*, 16 (3), 67–74.
- VARGA L. (2015): A new science is emerging: early childhood neuro-pedagogy. In: György Juhász – Ádám Nagy – Theresa Strédl – Anita Tóth-Bakos (Ed.), *The 2015 „Innovation and Creativity in Education and Science” of The University of Selye, Volume of Studies of the International Conference on Science* (11–18). Komarno: János Selye University.
- VARGA, L. and BORBÁS, M. (2017). *Early childhood neuro-pedagogy. Supporting early childhood brain development in kindergarten education*. Manuscript. Sopron: SOE BPK.
- VEKERDY T. (2011). *Emotional security. What are we supposed to know about the kids and ourselves?* Budapest: Keyhole Publishing House.

NEUROPEDAGOGIJA RANOG DJETINJSTVA: 3000 ZLATNIH DANA

Sažetak

Ljudski mozak je misteriozan organ koji predstavlja ozbiljne istraživačke izazove znanstvenicima i odgajateljima. U ovom radu se iznose nove informacije i podatci relevantni za edukacijske znanosti, modificira i nadopunjuje sadržaj obuke odgajatelja u kontekstu dječjih vrtića i ranog djetinjstva, te u konačnici raspravlja o inovacijama obrazovnih i istraživačkih ustanova u čijem je fokusu rano djetinjstvo. Osim toga, rad sažima dosad stečena znanja o kognitivnim procesima učenja i dovodi navedeno u vezu s metodama poučavanja i učenja u učionici. Inteligentno ulaganje ključno je za uspostavu sretnog života, što istovremeno podrazumijeva neograničen prostor za napredak, ali i veliku odgovornost koju imamo, jer rane godine traju vječno.

KLJUČNE RIJEČI: *rano djetinjstvo, razvoj mozga, konstruktivizam, neuropedagogija, mogućnost za napredak, pedagoški pristupi*