

CAVE 3D – WORLD OF VIRTUAL (AND REAL) DREAMS OF DISABLED CHILDREN ABOUT REHABILITATION IN A PLAY – PEDAGOGICAL APPROACH

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Abstract: *The article presents the application of Virtual Reality Technology in the treatment and rehabilitation of children with disabilities. Important areas that are discussed are issues concerning the impact of the 3D Cave on cognitive and motor structures. The defined model of the impact allows the author to unequivocally state that both the scope and the extent of the 3D Cave influence on improving the competence of children are in fact versatile. Reaching more precise opinions, resulting from the so far conducted observations, the author recognizes a number of positive results of the 3D technology impact on diverse spheres of improvement. Modern trends of technical solutions meeting the satisfaction of human needs become an important area of research that require a broader complement of progressive issues, especially when they concern children with special educational needs.*

Keywords: *Cave 3D, disability, therapy, rehabilitation*

INTRODUCTION

Man's disability is undoubtedly the most tangible proof, that among us there are people in need of special support and assistance. One of the specific areas of that influence is a multifaced special therapy which is often very expensive and not available. We are talking mainly about the rehabilitation, which is a key in reference to the diverse and often unconventional methods of work with a child with special educational needs. So it is possible to assume that the contemporary trends, shaping a new image of special education should be reflected in innovative virtual technologies. Marginalize this fact, is a rejection

of the modern paradigm to filtration of many planes of possible effects of the therapeutic in restoring efficiency of people with disabilities. We can therefore say that the search for a compromise between scientific education, therapy and improving disabled children, is an indication of the interdisciplinary way to effective rehabilitation, which today has been already becoming a reality.

From the modern theory of education to innovative technology.

Looking from the perspective of the possibilities of modern educational institutions, we can see that more and more often they overlook in their edu-

cational offers, beyond the standard framework of teaching and educational activities. About directions of this educational policy decide not only the formal perspectives, but also cooperation with scientific centres, thanks to which it is possible to directly verify the effectiveness of the impact of innovative technical solutions. It should be noted that the scope of the undertaken cooperation is Expresssem by will of both sides and, in particular, children with disabilities and their parents, it is why they are becoming beneficiaries of the innovative proposals of Polish engineers and constructors. This argument has revolutionized the perception of the potential needs of people with incomplete efficiency, validated on the basis of practical solutions, not a theoretical reference to potentials of modern therapy and rehabilitation. In conjunction with the more perfect concepts of technical devices to people with disabilities, this is what children expect from such technologies, which will allow them to improve their limited skills in the fun. One example is the "cave 3D", constructed by the Silesian University of technology, on biomedical engineering department.

Cave 3D-the new way to improve disabled children

Development of Virtual Technology in recent years resulted in the creation of many systems, among them the Cave system. *"Cave System, also called as a virtual Cave, move the test person into a centre of the virtual world."*¹ Using person has a feeling of

¹ M. Gzik, P. Wodarski, K. Jozsko, E. Stachowiak: Przykłady implementacji systemów trackingowych oraz systemu CAVE w proce-

being in reality created by computers. Thanks to the multi wall projection stereoscopic picture and 3-d glasses with polarizers active tested person can see around him items which are not real. Active motion tracking system allows him to move around in the room of the cave, at the same time, the proportion controlling the display of projection gives the person an impression of movement in virtual space. In addition, tracking systems allow the interactive effects of created virtual world.²

Moreover the virtual reality, is a world of new technologies creating favorable conditions for full individualization of therapy, prevents attractiveness, especially for children. This argument, in conjunction with progressive activities of the child, as prone to spontaneous and independent problem solving by trials and errors (methodoftrial and error) combines the most important issues – motor and cognitive competences gain in terms of overall development and the child's involvement in virtual 3D play. It's worth to point out that possible acceleration, stimulating child development does not by itself, as a result of maturation, but it is the result of the exercise of specific skills.³ These are the arguments convincing and important from the point of view of developmental progression of each child.

However, you can ask a question, what is the actual process of acceleration and its unification with the development of the child? According to A.

sach rehabilitacyjnych dzieci, „Aktualne Problemy Biomechaniki”, nr 7 2013, s. 59.

² Ibidem, s. 59.

³ Por definicja akceleracji, <http://portalwiedzy.onet.pl/41322...akceleracja.haslo.html>, (28.07.2016r.).

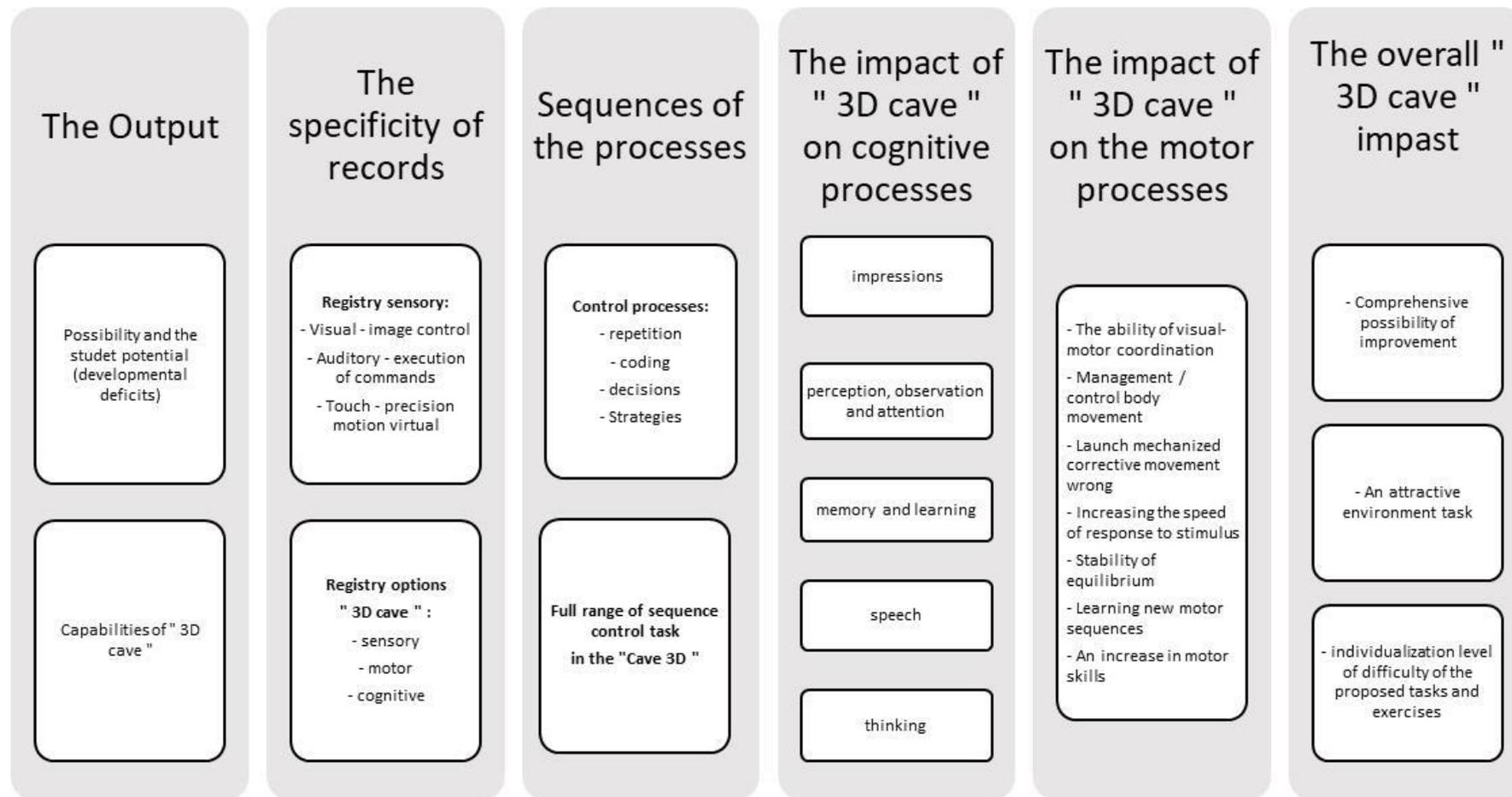
Kopik⁴ *"most of theories involve the causes of this phenomenon, with changes in the external environment, with mutual influence on each other genetic predisposition, environmental and ecological. Most noted causes are: the progress of civilization, the processes of urbanization, improvement of the economic situation and household appliances (better medical care, rational nutrition, improving hygiene conditions)." However, this process should be seen in a different context, namely the retardation of a child's development, especially the disabled child. Whereas the overall improvement of children with special educational needs we noticed that any rehabilitation measures a comprehensive nature become not so much as beneficial, but necessary and expected today by therapists and physiotherapists. Besides the child's development "requires favourable conditions and situations, which as a system of incentives and influence of stimulant\depressant, accelerating/retarded, stimulating\locking in all of his personality, creating in this way, the actual state of his emoluments. Development is therefore the aim of homeostasis, which is only possible with the activities of the unit aimed at continuous crossing themselves, their achievements and the implementation of designated target."*⁵ By analyzing the

very precise observations of author we noticed that it underlines a certain continuity of the impacts of different nature. To obtain the indicated by L. Wiatrowską effect, you need to enter to "stationary" therapy, at least a few methods to set the outcome the least satisfying. In turn, the impact of the Cave 3D we can trace the following diagram.

⁴ A. Kopik: Zjawisko akceleracji rozwoju. „Bliżej Przedszkola” nr 11, 2009

⁵ L. Wiatrowska: Retardacja rozwoju dziecka a postawy rodziców, [w:] S. Walasek, B. Winczura (red.): Wychowanie w rodzinie. Rodzina o specjalnych potrzebach, T. IV, Karkonoska Państwowa Szkoła Wyższa, Jelenia Góra 2011, s. 110.<http://docplayer.pl/5225208-Wychowanie-w-rodzinie.html> (28.07.2016r.)

Figure 1. Schematic model of the impact of the "Cave 3D"



Own study on the example: J. Zielińska, 2014: Zastosowanie nowoczesnych technologii w edukacji dzieci z niepełnosprawnością. W: J. Wyczesany (red.), *Dydaktyka specjalna. Wybrane zagadnienia*, Wydawnictwo „Harmonia”, Gdańsk, s. 82

The scope and span of impact 3D Cave structure of cognitive and motor skills is actually comprehensive. However, by referring to the creators of this device, highlight the required fact about notable profits which can offer you a modern system of virtual technology. Namely, it's not only attractive environment for children, but above all the ability to improve a number of areas of their operations:

- concentration of attention,
- manual dexterity
- Visual-motor coordination,
- coordination of the visually impaired
- hearing,
- perception
- reaction speed⁶

Such a wide range of improvement the child's competence, created by Cave 3D becomes obvious competition for traditional forms of therapy. The only drawback is the cost of the device and its limited availability.

3D cave in practice.

Looking from the teacher's perspective, we can say that "Cave 3 (D)," is nothing but a virtual touch in a colorful world of fun. It is believed that learning, improving and fun in one are three components participating in the child's development. So it seems that modern science and technology has set before us-teachers a very important and difficult question, namely, whether we are able to come to terms with the

⁶ P. Wodarski, M. Gzik, J. Jurkojć, R. Michnik, A. Bieniek: Wyznaczanie zdolności manipulacyjnych kończyn górnych u dzieci z wykorzystaniem Technologii Wirtualnej Rzeczywistości, „Aktualne Problemy Biomechaniki”, nr 8, 2014, s. 163.

fact that technical devices constructed by engineers and scientists solve some dilemmas of people with disabilities? But whether we will be able to adopt these solutions, to apply them in daily practice? Answers to these questions there are basically a lot and they come from all walks of dealing with disabled people (teachers, parents, therapists, researchers, physiotherapists, doctors, etc.). The scientific explanation for the phenomenon of "Cave 3D", is basically a varied, both positive and negative. This duplication of the positions is understandable - supporters will point to a number of beneficial effects "Cave 3D", which is confirmed by the current research⁷, and opponents will detect short comings of the success of the therapy as inefficient, unstable and threatening many developed in Poland and abroad working methods. Such a suggestion we hear at conferences, but on the other hand, there are concerns often justified because man will always be insecure to new arrivals, and especially in such a specific area

⁷ Cikajlo I., Matjačić Z., Advantages of virtual reality technology in rehabilitation of people with neuromuscular disorders, Institute for rehabilitation, In Recent advances in biomedical engineering (NAIK, Ganesh R, Ed.), InTech, Vienna, 2009, pp. 301–320; Cyberterapiacontroansia, <http://www.amando.it/salute/psicologia/cyberterapia-contro-ansia.html>, 28.02.2015r.; Wilson J. R., D`Cruz M., Virtual and interactive environments for work of the future, Int. J. Human-Computer Studies 64, 2006, pp. 158-169, Wojtachnio K., Technologie wirtualnej rzeczywistości w rehabilitacji, „Biuletyn Politechniki Śląskiej”, 2014 Nr 5 (255); R. Michnik, J. Jurkojć, P. Wodarski., A. Bieniek, M. Gzik.:The influence of the scenery and the amplitude of visual disturbances in the virtual reality on the maintaining the balance, Archives of Budo, 2014; vol. 10, I inni

as rehabilitation and therapy for people with disabilities.

The technology of virtual reality - reviews

3D Cave builders notice a number of benefits from its use in the rehabilitation of disabled children. While many research and analysis it was observed that virtual reality therapy strengthens the motivation to perform tedious exercises to improve the physical and intellectual dexterity⁸. In other terms, we see the following effects applied by a virtual world. B. Gulla stresses that "for therapeutic purposes, there are two key elements of virtual worlds - first, curiosity, motivate and engage the participant, so that the effectiveness of the interactions may grow, secondly, the ability to generate and control conditions, desired in the process of therapy and customize them to the progress of the treatment. Virtual reality allows multiple exposure effects material in the process of therapy, gradually increasing the difficulty level, which must deal with the customer and offer a specific type of experience, impossible or dangerous to call in the real world. VR will give you different possibilities for the participation of the therapist (physical presence, the presence or absence of virtual presence and control computer simulation only)"⁹. It

⁸ P. Wodarski, M. Gzik, I. Chuchnowska, J. Jurkojć, A. Bieniek: *Terapia w świecie marzeń. Walka z niepełnosprawnością z wykorzystaniem Technologii Wirtualnej Rzeczywistości*. Majówka Młodych Biomechaników 2014. XI Konferencja naukowa im. prof. Dagmary Tejszerskiej, Ustroń 9-11 maja 2014. Materiały konferencyjne [Dokument elektroniczny]. Dysk optyczny (CD-ROM), s. 132.

⁹ B. Gulla: *Wirtualne perspektywy praktyki psychologicznej*, [w:] M. Wysocka-Pleczyk, B. Gulla,

can therefore be concluded that special education had a solution in the rehabilitation of children with special educational needs. However, it appears the question about the stability of the skills acquired and the consequences of prolonged use "3D Cave" by children with disabilities. That the research reveals his concern is nothing new. Besides, you must answer a series of posed questions concerning the comprehensive research, which expects the environment teachers and therapists. Secondly, whether developed before working methods do not lose their position of therapeutic processes leading children with special educational needs.

The answers to the above questions can be mostly extended by research, which we're looking forward eagerly, but also observations of the behaviour of children in "Cave 3D". Besides bringing this issue stems from my personal experience, I had the pleasure of participating in deliberately organised activities and directly analyze the behavior of children with disabilities. I am convinced that "cave 3D", would be the perfect accompaniment to therapy "fixed", because we noticed that some of the exercises performed in a classroom were associated with games in the cave, which resulted in by far the faster reaction of the children when solving tasks of similar topics. You can also say that it is a fascinating therapy, because it takes place in a unique and attractive environment. Re-

Człowiek zalogowany. Człowiek społeczny w przestrzeni Internetu. Biblioteka Jagiellońska, Kraków 2015, s. 116, dokument elektroniczny: <http://jbc.bj.uj.edu.pl/Content/327436/Oz000761.pdf#page=116>, (20.07.2016r.)

vealed by the activity of children mobilizes both to physical rehabilitation, as well as intellectual property. Activities in the "Cave of the 3D" have their own storyline, in which there is no shortage of items of simple games, and positive competition allows you to forget the disabled children at a long rehabilitation.¹⁰

Application of virtual simulation in the game also resulted in observable commitment, joy and desire to overcome your weaknesses in any of the proposed exercises. Besides "reactions when you take classes, but also in the case of some individuals (joined disorder) were amazement and admiration. Motor activities carried out so far in a limited or minimal level as "Cave 3D" took place in a much broader scope. Particularly fun requiring precision of movement, increased than usual attention span, that in people with intellectual disabilities, is short-lived and easily reversible."¹¹ Confirmation of these findings, it is also the opinion of b. Gulli, which notes the three substantive attributes of virtual reality. Defines them as relevant and useful in therapeutic applications. *"First of all, virtual reality is very engaging with a high level of realism created scenarios, interactivity and multisensual experience. Secondly, it's flexible, and how to program the session can be tailored to the individual needs of the participant and to therapy, it may be subsequently chan-*

*ged, and even modified during a single session. Thirdly, it is possible to be accompanied by a therapist to the customer in the virtual world and applying incentives in appropriate times and intensity."*¹² This extensive quote indicates that the fun of "Avatar" is a virtual world, which does not evaluate for errors, allows you to change, repetitions, sometimes even multiple, is a fictional perfecting real skills. A consequence of this interaction, is the child's willingness to participate in the activities, expressed a high degree of its involvement. In turn the traditional therapy, "stationary" does not in any way related to the virtual world of information and technical ability can not compete with scientific and technical progress, the concern across for people with disabilities. It is for these constructs to innovative technical solutions in order to meet their needs, but also looking for a middle ground in the rehabilitation, which is primarily a constant motivation to act. This kind of trend news becomes a tangible example of that special education should open its doors to new technologies. We see in them the potential and complement efforts in the real and fast restore performance.

Below are some pictures of activities and sample applications for exercise and play in the "Cave of the 3D".

¹⁰ Por. K. Wojtachnio: Technologie wirtualnej rzeczywistości w rehabilitacji. „Biuletyn Politechniki Śląskiej, Nr 5, 2014 s. 29.

¹¹ B. Grzyb, I. Chuchnowska, A. Bieniek, P. Wodarski, J. Jurkojć: Technologia Wirtualnej Rzeczywistości światem zabawy dzieci niepełnosprawnych. „Niepełnosprawność i Rehabilitacji”, nr 3, 2015, s. 56.

¹² B. Gulla: op. cit., s. 124-125.



Figure. 2 Children in 3D Cave: picture 1. Self-directed activity and concentration, Figure 3. Child in special glasses with markers.

Source: own resources



Figure. 4. : Photo 1. Application-nailing balloons Photo 2. A puzzle.

Source: own resources

Instead of a summary

An important mechanism of progress highlights A. Krause become the same expectations of people with disabilities and their families¹³. In turn, update changes, as also progress, its intensity over the centuries is different, however, with these changes we can talk about the dynamics of innovative communities,

¹³ A. Krause, *Współczesne paradygmaty pedagogiki specjalnej*, Oficyna Wydawnicza Impuls, Kraków 2011, s. 13.

its adaptive capacity, whether the success of human progress. On the background of lifestyle transformations, including these technical changes are real in special education. This is particularly true of the concept of theory and action revidational in Europe for people with disabilities¹⁴. Therefore, the restoration of efficiency, is one of the main conditions of special education, it draws

¹⁴ *Ibidem*, s. 14 – 16.

particular attention to the needs of students with special educational needs, and most of the disturbed psychometrics. A child with impaired dexterity performs slowly steps, because "there is a close relationship between the development of mobility, the cognitive processes and child's emotional and sentimental development"¹⁵ Searching for effective and desirable solutions for placed in the article the problem pointed out, that the Virtual World technology, as an area of growing projects in many areas of life, and especially for the disabled allows us to increase treatment options. Their scope of influence you can today described as necessary and essential and it's with a lot of obvious reasons. The first, is a solid human tracking for improved and simple space, which in a rational way makes easier and more enjoyable daily life. Looking from the other perspective, that we find a significant impact of new media on the processes of therapy and rehabilitation, and, in consequence, education, psychosocial functioning and professional people with developmental limitations. Reaching to more accurate reviews, which resulted from observation so far, we see a number of positive results of 3D's impact. Hence, modern trends in technical solutions tries to suit meeting the needs of man in an important area of research that require a broader complement of progressive issues, particularly when they relate to children with special educational needs. Does not change the fact that the new technologies, is moving away from the traditional improvement, which should be recogni-

sed as a significant complement to traditional rehabilitation. It must be stressed, that the effectiveness of the special effects in the field of rehabilitation, considered in the context of human development deficits and possible to achieve efficiency, it's not so much the dilemma, but tactic in therapy, it's perspective and possibilities of modern science in restoring wider efficiency.

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¹⁵ Z. Sękowska, Wprowadzenie do pedagogiki specjalnej, WSPS, Warszawa 1998, s. 319.

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