10 minutes neurofeedback for better concentration

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Abstract: Neurofeedback and its usage in the bettering of concentration of children with learning disabilities have been studied in the past decades. Though the various studies show the effect of neurofeedback, be it in a positive light or otherwise, usually it is used as a standalone system. In this paper an other perspective is taken. Neurofeedback is integrated in a movement development course which is intended to improve various traits of coordination and personality of children which are linked to their studying abilities. Analyzing the gathered data and comparing it to previous work experiences one can draw conclusions how the course's effect changed and how it modified the participating children' possibility for success. Depending on this success it is possible that the overall cost related to learning disability could be reduced. Using these in formations estimations can be made how society would benefit if an ideal method for treating learning disability could be found.

Keywords: neurofeedback children movement-development concentration economic effect learning disability

1 Treatment of children with learning disability

1.1 Experience in Hungary

1.1.1 Various development methods

In Hungary if a child is diagnosed with a learning disability usually they are referred to a specialist who will treat the child through movement development. In previous studies it was shown that if children during their first one-two years don't go through the appropriate developmental steps, like for example crawling, their learning abilities and behavior will be affected [1]. Targeting the lower brain processes a more solid foundation can be created in the brain process' structure. After achieving this foundation can the connection between the lower and higher

centers be attempted to be repaired. These are achieved through various stimuli, in the beginning phase, mainly movement, which mimic an infant's moves. In the past 20 years different methods were developed based on results of this method, each with its unique characteristic and aim. Experience tells that the success of these methods varies from child to child. As the number of these methods rise it is increasingly hard to parents to choose a matching development type for their children. That is especially true when problems re-arise in school years even after a child has gone through several years of special courses.

1.1.2 Learning disability in school and it's possible effect

In the aforementioned case parents are skeptic and are looking for a quick fix in order to avoid problem in their life.This rush can negatively effect these children because they already have a built in pressure to perform so their parents can be at ease.[2] During work at a Hungarian foundation we as well have experienced that a few of the children, who we have worked with, came back in their school years. These children had trouble concentrating, old habits that negatively affect their performance came back. One possible cause of this that because of the stress they experienced, they lost the learned concentration which was the source of their success. This hypothesis is based on an observation that these children' cognitive behavior if measured with an EEG show that their concentration level is lower than their "normal" schoolmates.[3] This was personally checked using a commercially available EEG Headset.In addition tho this normally these children are already accustomed to normal development exercises and can feel that their work is futile. To avoid an extra addition to their frustration a new approach was needed to be put in use.

1.1.3 Neurofeedback

Parallel to the old exercises new tasks were added to the training regimen which were more appropriate to the children' age and more enjoyable.To serve as a new stimuli I created a simple neurofeedback system in DIY, which consists a Muse Headset, dry electrode EEG, an old radio car, and a smart-phone. Using this system the children are learning to control their mind-state, for example if they concentrate hard enough the radio car will move forward. This simple task serves multiple purposes. First it brings a playful element in the movement development which children often find wanting. Plus children love technology so their motivation is improved as well. It provides additional feedback to the specialist and the participant as well. If they can control the radio car well, and the observed brainwaves back it up, one can make a more educated guess about the child's efficiency that day. Using this method a few promising results were accomplished but the system is still in need of improvement. While participating children can achieve four or five times increase in their concentration level the observable effects form an outsider's point of view are not universal. Some perform very well

after the course, some have varying performance observed by the parents. Overall the quality of the provided service improved very much, children participate with more motivation, every occasion is made more suited to the individual child's need. Using these experiences one can guess how much plus is given to these children and how that will affect their success in their life.

2 Success and economy

2.1 Modelling success and it's effect on the economy

2.1.1 Economic price of learning disabilities

Considering the price of learning disabilities we must differentiate between the level of an individual, its family, and higher levels like national or society. On the individual level it is said according to the Roeher institute that the price over a lifetime of learning disability is around two million dollars. [4] If one works in the field or studies the literature it will be clear that we are not talking about exact number. This is an estimation, which can be understood as individuals with learning disability are more endangered to different factors, like stress, productivity loss or health issues. Over a lifetime the direct and indirect costs add up. Of course as a child the family bears consequences, but even then the situation is not simple. If we consider as an example that the parents must transport their child three or four times a week to extra education various outcomes can be speculated. It is considerable time which is spent with the transit of the child which could result in tiring the family out. Treatment of a learning disability can lasts years so over the time parents can be depressed because they will feel that they are fighting an overhill battle. These parents will be tired at work, are more likely to take a break from work etc. These are only examples from a personal point of view and experience. Of course in most cases parents take up these tasks because they want their children to be successful in their life. Question is what are the important factors of success?

2.1.2 What makes the difference?

Over the past years this question was often repeated, what makes one child with LD successful? Some say that these students come up with unusual strategies [5] or are more goal oriented [6] . In my experience the following determine the possibility of success: 0.4 x Inner environment+0.25 x School+0.35 x Extra activities.

Inner environment consists of genetics, family situation, physiological state of the child and other factors. School is self explanatory while extra activities are defined by their quality and how much plus they add in knowledge and skill to the child"s life. Depending on the attributes of the extra activities in an ideal case a positive feedback circle can be achieved. In this ideal case the child's improvement will affect the family, life at school. These changes will improve the child's confidence, goal-oriented attitude, which again will provide additional value. The goal is to push children above a threshold, from where on they can sustain a way of life where overall quality of their life is improved, it can be said that they are successful. This model in its form is far from done, various other factors and mathematical approach will be considered in order to improve. The main question is what efficacy can be achieved by the used movement course enhanced with neurofeedback. Unfortunately the gathered data is insufficient to precisely state anything, so only theories can be made what would happen if most of the "problematic" children would become later on successful.

2.1.3 Society's benefit

According to Eurostat there were 167 million children and young adults in EU-28. If we say that 10 percent of this population has learning disability that would mean 16.7 million people who must fight with this burden. Some of them must be successful, others not so much. Though we use this number as an estimation who are in need or would have been in need for some sort extra course in their life we get how much society would benefit. Naturally there does not exist a perfect, ideal method that solves all problems. It must be questioned that depending on efficacy how much can children be improved and how much the cost of a lifetime of learning disability can be lessened. Normally everyone wants their children above 90 percent but in reality that is no so easily attainable. Depending on the circumstances different outcomes can be achieved during these developmental courses. If we take a pessimistic approach and say 40 percent of the 2 million dollars can be reduced, that would mean 800000 dollars benefit for a person during their life. It must be stressed that this benefit does not mean one will get this sum as actual money, but probably will spend less because of stress, lack of concentration. This will mean they can spend more on themselves or spare more for their older years. If we take these numbers the following calculation can be made for society's benefit:

(16.7*10^6)*(800*10^3)=1.33*10^13

That would mean 13.3 trillion dollars which could be used by this portion of the young population for self-improvement for instance in the next 40 years. Why is success and self-improvement so important these days? Stress and depression are already a problem which affects today's workforce. In coming years this pressure can possibly be multiplied as climate and demographic changes pose new challenges in the future. This can result that the social burden becomes

unsustainable on the young.[7] Facing these problems should be a priority and part of the solution is to prepare the upcoming generations. Preparing the young can be done differently. Parents can take the children themselves to special training, or pay for private schools. A possible solution could be an another kind of school which is specialized for children with learning disabilities. In this ideal school different developmental methods would used alongside neurofeedback to ensure proper development. Naturally the price of such a school would be considerable but comparing it to the benefit it is small as an investment. Especially if the number of children who are in need of some kind development is on the rise as discussed in my previous work.[8] On the other hand if in this case the Eu's population would spend less on stress and productivity loss that would be an improvement in the quality of life.

Conclusions

Overall in this paper the following are highlighted. Children who went through movement development courses get sometimes in stressful times. To help them I started developing a neurofeedback system which augments the movement development targeting these school aged children. Using these experiences gained during work and previous research the possibility of success of these children is analyzed. If a better suited method could be achieved and the children could be more successful the cost of learning disability could be reduced. Depending on how much the associated 2 million dollars can be converted to "benefit" different changes would happen in the quality of life on an individual level. These sums assumed were spent on self improvement would mean that society could have a reasonable number of improved workforce. In face of demographic and climate changes which will pose challenges for everyone in the next decades bettering future generations is an important matter.

References

[1] Goddard, Sally. "Reflexes, learning and behavior." *A window into the child's mind* (2002). pp. XVII-XIX

[2] Bender WN, Rosenkrans CB, Crane MK. Stress, depression, and suicide among students with learning disabilities: Assessing the risk. Learning Disability Quarterly. 1999 May;22(2):143-56.

[3] Wang J, Barstein J, Ethridge LE, Mosconi MW, Takarae Y, Sweeney JA. Resting state EEG abnormalities in autism spectrum disorders. Journal of neurodevelopmental disorders. 2013 Dec;5(1):24.

[4] Crawford C. Learning disabilities in Canada: Economic costs to individuals, families and society. Prepared for the Learning Disabilities Association of Canada by the Roeher Institute. 2002 Jan.

[5] Heiman T, Precel K. Students with learning disabilities in higher education: Academic strategies profile. Journal of learning disabilities. 2003 May;36(3):248-58.

[6] Hall CW, Spruill KL, Webster RE. Motivational and attitudinal factors in college students with and without learning disabilities. Learning Disability Quarterly. 2002 May;25(2):79-86.

[7] Kassam,A. et al, Europe needs more babies, The Observer,2015 Source: https://www.theguardian.com/world/2015/aug/23/baby-crisis-europe-brink-depopulation-disaster

[8] Boncz, B. "Concentration development of children with learning disabilties-is it worth it?" Obudai Egyetem Keleti Karolyi Gazdasagi kar TDK, 2018. p.13