

**Neuroscience's Impact on Future of learning**

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**Abstract**

In India and in other parts of the world, amongst academia, industry, students and media there are multiple levels of debates about why in schools and colleges learning retention and learning outcomes are not up to the desired mark. Debate is also on how can quality of school education and higher education be improved by involving multiple stakeholders. India, like rest of the Western world, during the last decade dabbled e-learning involving video and graphics- based content. This hybrid teaching-classroom and e-learning failed to improve the learning retention and outcomes. We all know our brain is core to our learning and retention. During the last 20 years, medical science has done great amount of research on how our brain functions including how humans learn, unlearn and retain memories. In the mid-90s in USA and Europe lots of research was done on "cognitive neuroscience" with focus on learning retention and learning outcomes. In the near future, may be two or three decades, the world would see emergence of 'educational neuroscience' as core driver of learning outcomes among students and among workforce of the nation. Cognitive neuroscience has shattered many learning myths like "we use only ten percent of our brain capacity" or "students with more developed left brain are more logical and have scientific bent of mind". The truth is that our brain is like a plastic-neuroplasticity, and at every point in our life we can actually learn, refine or add a new capability. Research in neuroscience has revealed that one can learn, Mindfulness meditation improves our learning attention and retention. Mindset matters as we have society driven "stereotype threats" which makes us conscious about our limitations, and 'Growth mind-sets' are critical to learning.

Growth mind sets can be developed by repeated practice of skills and subjects, ten thousand hour of practice makes us subject-expert or master of skill. Multiple neuroscientific researches have proven that mindful meditation improves learning, attention and retention. It is very important for school teacher and HE faculty to set learning context for each student/learner. Neuroscience research recommends that both learner and faculty should focus on mindfulness, meditation, growth mind-set, continuous practice and emotional connectedness.

In the next two or three decades 'educational neuroscience' will tell us when students learn, how their brain changes and ultimately impacts learning, retention and learning outcomes. Since educational neuroscience is in nascent stage, it needs to be supported by more research and pilot projects across all states in India. Students fear and anxieties like brain scanning can damage nerves or one's brain scan data can be shared in public domain should be dealt with. A national task force is needed to train teachers and faculty on designing content and learning delivery mechanism based on 'educational neuroscience'.

### **An Introduction**

We have heard often that we use five to ten percent of our brain capacity. A fact that is negated by neuroscience. In most situations, we use large part of our brain capacity a fact again proven neuroscience through scans. We all have learned that we have left and right brain that functions completely, separately and differently. We all know that there are some people who are more talented than others, has nothing to do with hemisphere of the brain. We have a channel through which we learn better like we have heard terms like auditory learner, visual learner but truth is we use as many channels as we can. There is widely held belief among people that we have certain windows of learning which once closed has no chance of opening. All these are myths called “Neuromyths” because such statements are not substantiated by any scientific facts or data- based research.

### **The Path of Learning**

There are certain windows of learning that are strictly confined to couple of abilities. If you have not learned any language or you have not been exposed to life’s exposure through personalized experience you will not be able to learn these abilities but for rest of the people there is “neuroplasticity” i.e. at every point in your life you are able to learn, refine or add new capabilities. Research has proven we learn through repeated drill and continuous practice. Ten thousand hours of repeated practice or learning helps us masters a skill. Research in neuroscience has revealed that

- (1) You can learn through “deliberate practice” or 10,000 hours of continuous practice.
- (2) How “mindful “you are. Being mindful means understanding the context of learning i.e. What are you learning? Why are you learning? What are the benefits of learning? What are the consequences of not learning?.
- (3) Mindful Meditation or traditional Vipasana System enhances attention without a focus on either the past or the future as it is related to anterior cingulate cortex (area associated with “attention”) . Neurological study investigating this phenomenon of Mindful Meditation used EEG-based brain activity analysis to observe how neurological systems correlates to meditation the researchers observing it, found that the EEG data resembled that of stage 2-4 non-rapid eye movement, sleep i.e. calmness or stillness.
- (4) If Mindful meditation matters so does “Mindsets”. In an experiment a group of women before mathematics exams were told they were Asian, they performed between average to above average but when they were constantly reminded before exam they were women, the outcome was below average to average . It is very important to create powerful social messages in media which reinforce positivity mindset or belief system e.g. if you educate yourself and acquire professional skills you will be a successful person, so study hard and learn new skills. Positive social messages over decades create positive mindsets . Our mind picks such positive stimulus and success stories from the environment and saves it in the brain for future processing and decision reinforcements.

We need to find out what are those” stereotype threats” that makes us conscious about ourselves and our limitations especially in diverse country in India where there are

huge number of social and culture biases towards women, minorities, ethnic groups, SC and STs. Such stereotypes reduce their academic performance. A research experiment conducted in USA by Steele and Aronson gave Black and White College students GRE test using stereotype-threat condition and no threat condition, In Stereotype threat condition, telling students the test diagnosed intellectual ability, implying that Blacks are less intelligent than Whites are. In the no-stereotype-threat condition, the researchers told students that the test was a problem-solving lab task that said nothing about ability. In the first test blacks scored far less than the whites but in second test scores of both Black and white students were same.

In India, we also have stereotype learning threats like girls are not good in maths, driving and engineering stream. People from certain cities are good in IT and ITes skills. Students from minority and marginalized sections have low learning retention ability etc. This kind of stereotypes have no research basis but are only decade old social myths.

On the hand there are “growth mindsets” a belief that you can learn whatever is in front of you. In an experiment, college students were told that they can use their brainpower as a muscle repeatedly and daily to learn a new skill/ subjects, the areas (subjects/skills) they focussed had above average outcomes.

### **GROWTH MINDSETS**

**1-Repeated practice**-Our brain is elastic, if you practice continuously and repeat you will be able to grow and install learning function. In order to improve learning retention among learners and improve learning outcomes hours and hours (10,000 hours to master a subject) of repeated practice makes your brain expand its faculties, store knowledge in conscious or sub conscious mind/brain.

**2-Attention** –attention is highly relevant for learning. The most common mistake we make is that we allow people to multi task. If we you multi-task your attention will switch from task A to B to C to D and you will not be able to hold right amount of attention to hold knowledge so multi-tasking should be avoided as much as possible. In order to enhance most effective technique is daily is mindful meditation. Mindful meditation is not a social fad or gizmo but well researched neuroscience fact, which has proven that daily meditation, enhances your concentration power and memory.

**3-Desire to learn**-It is very important to explain to people the ‘Context of learning’. Why the need to learn and what benefits they will get in short and medium term in their lives and how they will be able to cope complex situations? It is important faculty creates a “Learning Environment” where learner is given short-term goals, he is given regular feedback for improvements on learning retention and performance outcomes. Positive communication with patience is key as each learner is unique. Faculty should use technology for regular assessments and reviews.

The above can be best described by an experiment conducted by the USA Army on its soldiers. The soldiers were divided into four groups One, Group Two, Group Three and Group Four. During the military march they were told that there would be no communication whatsoever between the groups. Each group would march twenty kilometers over exactly the same terrain on the same day, the only variation was in the

verbal instructions the group received. The first group of soldiers were told they would march – twenty kilometers. Second group soldiers were told, “This is the long military march you and nobody was told how far they would march, nor were they informed of their progress along the way. Group three soldiers were told they would march twelve kilometers. After marching eleven kilometers, they were told they had nine more kilometers more to go. The fourth group of soldiers were told they would march twenty-five kilometers. After marching fourteen, they were told they had six more to go.

Upon completion of the military march, the four groups were assessed to determine which one performed best and which endured the most stress. The researchers found that group one performed the best because they knew how far they were going and getting regular reports, it was the keys to achieving the highest rating. As expected, group two performed the worst. They only knew that “This is the long march they have been waiting for” not knowing how far they were to march, and receiving no information along the way yielded poor results.

Therefore, proper communication and feedback on learning goals is must to improve one’s learning retention and learning outcomes.

**4- Getting it Right-**In a global research on learning outcomes it was found that only 7% of CEOs are happy or satisfied with learning outcomes and investments. The explanation is simple.

Most of the curriculum delivered by faculty is based on “Neuromyths” not latest knowledge and research findings of “Neurosciences”. Therefore, it is very important for teachers/faculty to take into consideration what is true and really matters in order to improve learning retention among learners and improve learning outcomes. The neuroscience suggests that good learner and faculty both should focus on mindfulness, meditation, growth mindset, emotional connection and continuous practice because as we learn our brain continuously evolves.

### **The future of learning**

The future will bring together two different but rapidly progressing fields of “Developmental Cognitive Neuroscience” and complex domain of curriculum and student learning and retention techniques. The future will see along with Artificial intelligence and virtual reality emergence of “Educational Neuroscience” which will answer most important questions-Why some learners struggle with learning retention and how can we improve education delivery to help learners with better learning outcomes. It is matter of one generation or two decades when educational neuroscience will tell us when and how students’ brain change as they learn. This will have a far-reaching impact on how students learn in schools and colleges various subjects. It is imperative that education ecosystem should move beyond traditional education performance systems and standards by incorporating “cognitive neuroscience” insights that lead to effective learning and teaching methods and methodologies. In future Educational neuroscience will also explore how nations workforce while working in jobs or as entrepreneurs learn to skills and behaviours like

emotional connectedness, flexibility, motivation, social and emotional experiences in dealing with community at large for higher productivity and well-being. Educational neuroscience in future will shed light on how individual can self-regulation and self-control their impulsive behaviours.

### **Challenges of Implementation of Neuroscience- based Learning:**

Despite seemingly bright future of “Educational Neuroscience”, there are many implementation challenges:

1-Academia, government and medical science have different thought process. Academia believes it is medicalization of education, govt believes in “wait and watch” policy as it is a new field full of implementation uncertainty, heavy risks, high cost and no proof of effective learning outcomes.

2-Citizens and students feel that “Educational Neuroscience” is an encroachment of their privacy, as brain scans will expose their mental strengths and weakness to other. Legal authorities too feel that in the name of learning, data will be misused. Currently, no tangible benefits are seen by citizens and students and they perceive risks to be far too higher than rewards.

3-Pedagogue experts believe academia has no deep knowledge to create learning content based on scientific medical inputs emanating from “Educational Neuroscience”.

4-Experts believe Educational Neuroscience will overhaul the teaching delivery mechanism and country like India cannot afford to train, retrain, assess, re assess, certify teachers and faculty across multiple languages. As it is India’s monetary spend on teachers training and technology-based innovation in education is abysmal.

5-As neuroscience believes our brain changes continuously due to learning and acts like a “Plastic” in the event the student does not use skill or subjects he/she has learned as a student, his/her brain will revert to original position. Therefore, continuous lifelong learning will be a challenge for the majority of the learners or students .

### **Suggestions and Recommendations**

1-Educational Neuroscience should be factored in future education policy of India.

2-Stronger links should be established between the research communities and the education system (schools, skill education, higher education and institutes for lifelong learning) in order to improve delivery of education for better learning outcomes.

3- Few pilot projects (5 or 6) one in each region of India (North, South, East West, NE) should be initiated to gauge the impact

4-Learning content creation, teacher training, re -training, certification, post training impact assessment should be piloted separately across all states of India for students and adults with learning challenges such as dyslexia and dyscalculia.

5- Government should fund research and pilot projects in collaboration with international experts and researchers from USA, European Union, Japan and Israel. As a nation India cannot be left behind in a technological race to improve students, working professional, entrepreneurs, elderly and other citizens learning retention, learning outcomes, emotional connectedness, flexibility, motivation, social and emotional experiences in dealing with community at large for higher productivity and well- being.

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