

REWIRING THE BRAIN FOR ADAPTIVE TEACHING AND LEARNING

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Abstract

The paper was informed by neuroscientific breakthrough that the human brain's structure and function could be changed, more by mindfully focusing on it while attending to such activities that are helpful. With such properties of the brain, individuals could adopt some measures to improve overall wellbeing including learning. The paper advocates a conscious creation of approaches to learning that are efficient, engaging, and productive. The discussion was guided by the theory of Deliberate practice and Metacognitive theory. The paper suggested approaches such as learning new things (which activate new neurons), replacing faulty learning with meaningful learning, learning new ways of doing things, giving students challenging tasks (which propel them to think), learning effectual processing skills, replacing negative automatic thought with positive affirmations, and to develop thought framework that can be used over and over to keep getting results. These are to be embellished with moderate to vigorous exercise for optimum performance.

Keywords: neuroplasticity, metacognition, mindfulness, thought framework.

Introduction

In the field of psychology and scientific circles, the idea that the brain can be rewired or changed is referred to as neuroplasticity. Neuroplasticity promises that you can rewire your brain to improve everything from health to mental well-being, to quality of life. The concept of neuroplasticity as the ability of the brain to reorganize itself both physically and functionally throughout life is not new, as that goes as far back as 1800s, but the relatively recent capability to visually "see" into the brain allowed by Functional Magnetic Resonance Imaging (fMRI) science has confirmed this ability of the brain beyond doubt. See the blog masterpiece or mass.

Neuroplasticity is the process by which all permanent learning takes place in the brain. It is said that neuroplasticity also enables people to recover from stroke, injury, and birth abnormality, improve autism, ADD, ADHD, learning disability, and other brain deficits such as depression, addictions and reverse obsessive compulsive patterns. Confer, the best brain possible, (Hampton, 2015). More researches are needed to confirm the above claims. Both idiographic and nomothetic data will be relevant in order to appreciate this claim.

What neuroplasticity implies is that given that certain brain machinery decline with age, illness or whatever, there are steps people can take to tap into plasticity and reinvigorate that machinery. It is believed that with these properties of the brain, individuals can adopt some measures as suggested by the neuroscientists to improve both the structure and functions of the brain, which will improve the overall wellbeing including learning and adaptive behaviour.

Adaptive behaviour is brought about by adaptive learning; a conscious creation of oneself. The concept of adaptive learning implies a technique for providing personalised learning, which aims at providing efficient and customized learning parts to engage each student. Adaptive learning system uses a data driven approach to adjust to the pace of learning, enabling the delivery of personalized learning at scale. Adaptive teaching among others can enable innovative teaching practices, and incorporate a variety of content formats to support students according to their needs (Moskal, Carter, & Johnson 2017), cited in Qi an, & Huang (2019).

In this work, adaptive learning is conceptualized as a type of learning in which the learner takes the initiative to address or remedy learning and engagement patterns that are counterproductive in order to address his/her goals. Learning in this context covers formal and informal forms. Adaptive teaching and learning offers the following benefits: learners receive the right content at the right time, maximizing learning efficiency, effectiveness, engagement and retention.

Secondly, trainers grasp cohort dynamics through real time analytics and know exactly what their learners are struggling with, so that they can quickly adapt instruction. Thirdly, content authors understand what content works, so they can continually refine content (Educause). This can guide trainers using computer instruction. While bearing the concept of adaptive learning as given in this work in mind, consideration is given to the theoretical framework for the discussion.

Theoretical framework

Theory of deliberate practice (Wang, 2016; Ericsson.1991)

Deliberate practice refers to a special type of practice that is purposeful and systematic. While regular practice might include mindless repetition, deliberate practice requires focused attention and is conducted with the specific goal of improving performance. Fundamentally the theory of deliberate practice posits that development of expertise requires incorporating a self-reflective feedback loop into the skill delivery or development process, rather than simply performing a task repetitively until mastered (Wang, 2016).

According to Ericsson (1991), deliberate practice involves stepping outside your comfort zone and trying activities beyond your current abilities. While repeating activities you have mastered might be satisfying, it is not enough to help you get better. She added that simply wanting to improve is not enough; people need well defined goals and the help of a teacher who makes plan for achieving them. At first the teacher gives feedback on your effort, eventually you can spot problem on your own performance and correct accordingly.

Metacognitive theory (Flavel, 1976)

Metacognition is defined as “thinking about your own thinking”. This encompasses the process of planning, tracking, and assessing your own understanding or performance.

Flavel, the American developmental Psychologist identified what he called two elements of metacognition as knowledge of cognition and regulation of cognition (Flavel, 1985). Regulation is used to describe how an individual monitors and assesses his knowledge.

These two theories (deliberate practice and metacognition) are crucial in rewiring the brain for effectiveness, as the individual must know what needs to be changed or improved upon before he rewires to fire. Again, in the process of rewiring, monitoring is needed to assess whether an individual is making progress or not, and to ascertain which strategies are working and the ones that are not working. All these involve focusing attention and deliberate practice.

Why would learners need to rewire?

One fundamental teaching of behavioural theories of learning is that behaviour is learnt and can be unlearned. On this premise it is obvious that some students have faulty learning approaches which must be changed if they must improve. There are also individual students who have developed negative attitude towards life generally, they tend to be negative in their thought patterns, and develop negative automatic thought. Refer to cognitive triad of Beck (1976). The end product is that negativity produces negativity, and the ugly circle continues.

There are also congenital problems which affect the rate and quality of learning, as well as problems brought about by developmental changes such as aging, health and other adventitious problems. The idea that different parts of the brain perform different functions, and the more you engage a particular part, the more you strengthen its function while the areas of the brain that are not in use get weakened. All these call for rewiring of the brain for greater effectiveness.

How can the rewiring be done?

Learning new and noble things

One sure way of rewiring the brain is to learn new things. One of the hardest things for individuals to do is to learn new things. Most people are resistant to change; they seem to enjoy the comfort of that which they can do well. At the long run positive change pays, and resistance to change can be a source of hindrance to adaptation and progress. As earlier stated, as an individual learns new things, the neurons associated with such actions are activated; they become more active and fire. Not only do learning new things strengthen new neurons, but as Nathan Spreng, the Director of Brain and Cognition Laboratory at McGill University puts it (science news), learning or rehearsing old idea over and over strengthens the part of the brain associated with that function, but as the individual becomes over familiar with it, with time the individual no longer thinks while performing the action, and the area of the brain linked with daydreaming and mind wandering becomes more active. The implication of this is that new learning is imperative as a way of rewiring

the brain. Teachers should search for effectual delivery practices, and incorporate self-reflective feedback loop into such practices in order to ensure what works.

Faulty learning style such as cramming or rote learning should be replaced with meaningful learning. It is common for pupils to master table of multiplication without attaching meaning to it. If such students are guided in the understanding that multiplication is simply continuous addition of a particular number, they will understand that 4 multiplied by 4 is the same as $4+4+4+4$, and in so doing the meaning is made clear. Given that from the beginning, learners learn to attach meaning to what they learn, they will struggle with that idea as they progress; monitoring will automatically be applied to check for understanding and the strategies that work.

Students should be exposed to different ways of doing one thing and allowed to adopt the strategies that suit them. In this way you provide different strokes for different folks. As they try out these new strategies they make the discovery by themselves. Teachers should occasionally give challenging tasks to students which will push them a little beyond their comfort zones and cause them to think. This is likened to what Vygotsky referred to as zone of proximal development (ZPD) (1978). Thought, and constructive thought is what strengthens the brain, hence the saying “use it or lose it”.

There are processing skills some students use while learning, which are counterproductive, such as taking up a topic from textbook and running through it, believing that the points will register just like that. It does not work that way, even if you are a genius that will not give you your best. First look at the topic, the sub-topics, reflect on it and that gives you an idea of what the whole topic is all about, it gives you an idea of what to look for as you read on. Then as you begin to read, you underline the ideas you are looking for as you encounter them, put the ideas in your own words. When you come across a concept, stop to think of the members of the concept class; if some examples are given in the text, try to provide more examples on the margin of the text book page. Until you are able to do this, you have not mastered the concept. As you read stop to ask yourself question. Self-questioning helps you to clarify your points and ensures you understand what you are reading. Raise fact finding questions, questions serve as important tools not just for teacher but for learners as ongoing assessment of comprehension and retention of what is being read.

Effectual processing skills which students should acquaint themselves with include; focused attention, depth of processing, elaboration, imagery, chunking, and use of mnemonics. Except a learner knows what she is looking for in a given textbook, she might be carried away by less important points, overlooking what matters. Again the ability of a learner to process information in depth is a guarantee that such information will be stored in the long term memory and be retrieved when needed in future. When information is processed in depth, a deep memory trace is formed which is difficult to erase. Having mental pictures of the features associated with what one is studying, such as the teachers' illustrations, practically and pictorially is one of the factors that promote learning and retention. Students can take their time to group similar ideas together for easier recall. This can apply in very broad topics; by taking them in bits that are similar and easy to

manage until the whole topic is covered. The use of mnemonics as a tool for remembering can never be overemphasised.

Replacing negative automatic thoughts with positive affirmations

For the individuals who have developed negative automatic thought, there is the need to replace this with positive affirmations. Deliberate effort should be made to counter-condition every negative thought by deliberately visualizing oneself in a positive mood, expressing positive ideas. Thus I cannot is replaced with “I can”.

Issues should be seen as they are in order to handle them properly, at the same time bad situations should be seen as being capable of changing for good. There should be no overgeneralization or magnifications, thus habitual appraisal habits can become less biased resulting in a better emotional response. This can be achieved by helping students to be aware of their biases as they occur, and then criticise them. There are no logical bases for biases; when an individual carefully examines his judgement, looking for evidence to support them, the person finds that there is none. The individual is in a position to form a new, more accurate appraisal (Dombeck, Well-Moran, (n.d) cited in Madu, 2012). In this way the idea of rewiring implies cognitive restructuring.

Negative view of oneself, the world and the future; what Beck calls cognitive triad should be negated, even when things are bad, effort should be made to tell oneself that everything will be ok and to work towards that idea. This is necessary because the brain takes the information we pass on to it and acts on that. It is not an exaggeration to state that our beliefs and expressions go beyond ourselves to act on our environment and future. This could be seen in the biblical account of Abraham when asked by his son about the animal for the sacrifice, and he answered, “the lord will provide” (Gen.22:8). This expression of belief was fulfilled, as the lord provided a ram for the sacrifice. What about the Shunamite woman who said “it is well” even when her child was dead? (2 kings 4:23-24) Her child did come back to life.

Such engagement patterns are crucial if teachers and students must adapt new strategies for improving teaching and learning respectively. They should say yes to new strategies which hold the promise of better performance and adaptive living and discover the benefits by themselves.

Develop thought framework that can be used over and over to keep getting result

The act of thinking sets in motion a chemical reaction in the brain that can be likened to plugging in a string of lights. As you think about something, you turn on a string of light related to that topic. Your thought must be focused; otherwise you will only be ruminating. Such a thought framework must take cognisance of all the important elements required in problem solving, such as accuracy and complete statement of the problem, honesty in answering the question on the cause of the problem and the determination to dive deep into the issues and get them solved (Saki chi Toyoda, 1867-1930). Here teachers and learners are encouraged to explore Paul-Elder`s (2001) framework for critical thinking. The three steps as given by Toyoda correspond to Paul-Elder`s three which are; observe the problem to build rational knowledge; ask questions to analyse and evaluate

data; find answers to the problem. These are turned into six steps for effective critical thinking. These involve;

- a. Knowledge: define the main topic that needs to be covered
- b. Comprehension: understand the topic by researching on it
- c. Analyse the data and link between the collected dat
- d. Analysis: reach a solution to the problem or the topic investigated
- e. Synthesis: turn the solution to an implementable action plan
- f. Evaluate: test and evaluate the solution

The six steps of the critical thinking represent building a clear coherent reasoning for the argument at hand. This ensures that the topic is clearly addressed in all the critical thinking process stages. Paul-Elder`s framework aims at improving our reasoning through three main elements, namely; reasoning, intellectual standard, and intellectual traits (Paul-Elder`s Framework for critical thinking, <https://www.designatate.com>).

According to Paul-Elder (2001), whenever we have a topic to discuss, we tend to use a number of thinking parts in order to understand the topic in hand. These parts are known as elements of thought or reasoning. *Elements of reasoning include purpose, attempt, assumption, the view point, data, information and evidence, concept and ideas, inferences and interpretations.* These elements of thought could be applied to any assignment or project given to students. Although the thought framework applied over different tasks could be the same, it offers students the opportunity to appreciate different purposes, assumptions, concepts, inferences and interpretations offered by each task. In other words the thought framework simply help students to learn new things better.

In order to achieve the goals of reasoning and accuracy of results, the reasoning parts must be carried along good intellectual quality standard. The intellectual standards are nine factors that can be used to evaluate the quality of the reasoning parts. These standards include *clarity, accuracy, precision, relevance, depth, breath, logic, significance, and fairness.* In the course of enquiry or reasoning, the individual must stop to ask questions based on the above standards. Thus for *clarity*, the individual may ask, “Is the idea subject to elaboration, can it be illustrated?” For *accuracy*, the question may be, “can one find out if that is true, and is it verifiable? The questions go on to address all the nine intellectual standards.

Following the application of the reasoning parts and validating them using intellectual standard, the characteristics that are expected to develop are known as *intellectual traits.* The features of intellectual traits include; *intellectual humility, intellectual courage, intellectual empathy, intellectual integrity, intellectual perseverance, confidence in reason and fair-mindedness.*

Thus, your thought framework becomes your mental picture, the blue print for finding solutions to problems. This allows an individual, after collecting data regarding a problem to be

solved, to sit down and systematically address the problem, instead of a haphazard approach that may end up as inconsequential. As Elmancy (nd) puts it, Paul-Elder's framework enables one to evaluate one's argument, eliminate biases and escape current mind-set. How can a teacher or student apply this?

In any given assignment, Paul-Elder's framework can help students to evaluate and establish their points of view. Following Paul-Elder's framework, students can build rational

knowledge about the topic at hand by researching on the purpose, attempts, assumptions, concepts, ideas, viewpoints, information and evidence associated with the problem. After gathering information, such a student sits down to analyse the data /information in order to identify important relevant points to the problem at hand. From such relevant information, the learner follows the six steps for critical thinking to identify which aspect of the body of knowledge defines the main topic to be covered?

Now using elements of reasoning, the learner ensures that the information he is providing addresses the purpose of the assignment. By reflecting over his assumption or point of view with information before him, the topic is made clearer: he comes to comprehend the topic more. By linking his data to the topic (application), his body of data fits into the topic. This enables him to reach a solution to the problem. Such a solution is turned into implementable action plan which in turn is tested and evaluated. This helps the learner to develop metacognitive knowledge. Metacognitive knowledge refers to an individual's knowledge and belief about cognitive matters gained from experiences and stored in long term memory. This makes it easier for the learner to fall back to such resources for future problem solving.

Aerobic exercise and neurogenesis

According to psychology today, a moderate to vigorous physical exercise is one of the most effective ways to stimulate neurogenesis and the birth of new granule cells in the hippocampus and cerebellum of the brain. Neurogenesis is the process by which nervous system cells known as neurons are produced by neural system cell (University of Queensland Brain Institute). Using an adult rodent model, Nokia et al (2016) implemented a six to eight weeks programme to examine whether high intensity interval training and resistance training were comparable to aerobic exercise in stimulating adult hippocampal neurogenesis. Findings showed that exercise modality, particularly aerobic exercise is an important factor in exercise induced changes in hippocampus neurogenesis. The effect of exercise on brain function dates back to the time of Plato and Aristotle in their theory of mental discipline namely, classicism of Plato and Aristotle and faculty psychology. Today research is throwing more light on the nature of exercise, namely moderate to vigorous and sustained aerobic exercise. We are constantly going back to history to tap from the legacy of our intellectual forebears. Teachers and students can avail themselves of this knowledge to keep their brain alive and active.

Summary and conclusions

Given that the ideas put in this paper are put to use by teachers and students, the outcome will be maximized efficiency, effectiveness, engagement, retention and retrieval. The magnitude of such learning outcome cannot be attained by casual teaching and learning approaches devoid of reflectiveness and revision of cognitive strategies. Teachers and students are therefore encouraged to learn new things, change faulty learning approaches, learn different ways of doing one thing, acquire effectual processing skills, replace negative automatic thoughts with positive affirmations, develop thought framework that can be used over and over to keep getting result and to engage in regular moderate to vigorous exercise.

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