

SHORT COMMUNICATION

HOW TO INCULCATE DEEP LEARNING IN MEDICAL UNDERGRADUATES?

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INTRODUCTION

Teaching is not a simple profession of just standing in front of students and delivering a didactic lecture from notes. Rather it is the most wonderful, exciting and rewarding job in the world, but it takes time, skill and dedication to do it right¹. Just like all real life scenarios, some teaching assignments are more cognitively demanding than others and some learning is more complex than other learning. In order to tackle these problems, we as a teacher need to devise strategies which help our students to learn these topics effectively and can apply practically in future life. Deep learning approach is an excellent tool to manage these difficult tasks. Deep learning requires integrated strategies on behalf of both teacher and students. At the same time, subject content also needs rectification/modification for students to enhance deep learning.

Keeping these factors in mind to promote deep learning, this manuscript divides our strategies focusing on these three stakeholders i.e. teacher, students and subject content (curriculum). This manuscript is focussed to promote deep learning on the topic of Parkinson's disease (PD) to 3rd year MBBS students. This short communication will address the strategies for deep learning on Parkinson's disease by utilizing the building units of cognition for declarative knowledge i.e. concepts, proposition and schema.

Our learning objective for learners is to:

Define Parkinson's disease.

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Describe the clinical features of Parkinson's disease.

Discuss the pathophysiology of Parkinson's disease.

Design a management plan for Parkinson's disease.

Perform relevant neurologic examination independently in a patient with Parkinson's disease.

Counsel a patient with Parkinson's disease.

Strategies as a teacher to promote deep learning

Teacher is one of the most powerful stakeholders in the educational environment. Teacher is a role model for the students and his actions (in terms of tone, voice and gestures) attitudes, enthusiasm, and interest in the subject will affect students. Teachers should formulate learning activities to provide students with multiple means of engagement, representation and expression. A variety of resources including audio, video, text and images can be utilized to provide students information in a different but flexible format. Inviting effective guest speakers and using popular films and videos also stimulate critical thinking in students².

We will promote deep learning in students through:

Activation of Prior knowledge

Prior knowledge is essential for giving meaning to new information. Deep learning is initiated from prior knowledge level³. In this manuscript, prior knowledge will be activated by involving students about neuro-anatomy, histology and pathophysiology of nervous system already known to students. This process can be initiated simply by asking questions like:

Name different neurotransmitters (Acetylcholine, GABA, dopamine, serotonin)?

Name few excitatory neurotransmitters (GABA, acetylcholine)?

Name an inhibitory neurotransmitter (Dopamine)?

How is balance maintained on a see-saw or a rope? (Fine co-ordination and balance at two extremes)

Can you name few diseases involving disturbance in neurotransmitters (Parkinson's disease, schizophrenia)?

Interactive lectures will be used for this purpose. We will then subdivide our large group into 10 equal small groups of students. Each group will be given different tasks about the neuro-anatomy, histology and pathophysiology of nervous system. The students of each small group will teach and discuss their task with one another. The best way of learning is to teach it to others⁴. One student from each group will present their task to the whole class and answer their questions. This exercise will be performed by all groups. Our job as teachers will be to facilitate these small groups' discussion, making these sessions interactive and conclude this activity by clarifying any concept if left unexplored.

Delivering new content (Declarative knowledge) to the students:

We will present the main and new content of the topic (PD) in interactive lecture based on Gagne's nine events of instructions. To gain attention, we will pose a question by displaying a recent picture/video of legendary boxer Mohammad Ali; what disease this celebrity is suffering? This picture/video will be displaying all the important clinical features of PD. Learning objectives will be displayed to students at the start of lecture and lecture contents will be chunked into smaller contents like:

Main concept about PD

Different neurotransmitters involved and their relative excess and deficiency

Management plan to alleviate symptoms of PD

Rehabilitation and novel treatment modalities

Studies have documented that student concentration does not last more than 20 minutes⁵, so we will alter learning techniques regularly by posing questions or testing the students, generating discussion among students and using an audiovisual aid. During lecture, we will also simulate the clinical features of PD for better comprehension of students. We will then again break-up the large class into 10 equal groups, assign tasks regarding these new contents to each group. These allotted tasks will be about the cardinal and non-cardinal features of PD, neuromediators involved in PD and their relative deficiency and excess, functional disability of PD, treatment modalities of PD, differential diagnosis of PD. The students will discuss among themselves, one

member of each group will present to whole class and solve their questions. We will mediate the session as facilitators and clarifying their misconcepts if any. This entire exercise will augment the encoding process of students.

Delivering Procedural and Conditional knowledge

Declarative knowledge should be imparted into procedural and most importantly into conditional knowledge in order to acquire deep learning of a topic⁶. We will break up this large class again into 10 equal small groups, each group will be taken to histopathology laboratory, showing frozen models of human brain with PD, various sections of nigro-striatal tracts, images of PD with dopamine deficiency and cholinergic excess. Each small group will visit hospital medical / neurology wards and bedside teaching technique will be utilized to demonstrate clinical features of PD on real patients. Differential diagnosis of PD, how to differentiate between idiopathic and drug induced Parkinsonism and management plan for PD will also be discussed during this session. Counselling of patient with PD will also be conducted. Moreover, role play as a teaching modality will be utilized for the students. Each student will then be given an opportunity to practice these steps in clinical skills laboratory under supervision. This exercise will be performed several times so that it incorporates effectively into long-term memory. For example, we will present the following case scenario to our students during lecture where they have to differentiate between Parkinson's disease and drug induced Parkinsonism.

You review a 65 years old man who is currently taking antipsychotic medication. His daughters have noticed that his movements have been very slow over the past few weeks. Which one of the following would suggest a diagnosis of Parkinson's disease rather than drug-induced parkinsonism?

Rigidity

Masked face

Bilateral symptoms

Flexed posture

Restlessness of arms and legs

Answer: A

Explanation

Rigidity and rest tremors are uncommon in drug induced parkinsonism.

Strategies as a student to promote deep learning

Learning is neither a spectator sport nor a passive phenomenon. Students do not learn effectively just by attending and sitting in class, listening passively to teachers, memorizing decade old assignments, and then spitting out answers from them. They must talk actively about what they are learning, write it in their own words, relate it to their experiences and apply it to their daily lives. They must make their learning as a part of life. When students are actively involved in learning, they learn more than when they are passive recipients of instruction (Cross, 1987)³. Both simple and complex information encoding strategies will be accomplished for the deep learning of PD.

Strategies for encoding simple information

Mediation

Imagery

Mnemonics

Mediation

Students can mediate the correlation of dopamine deficiency and cholinergic excess with the seesaw (Figure #1). This will help them to remember pathogenesis of PD. An elaborative picture of PD for better comprehension can be depicted in the following illustration (Figure#2). Neurotransmitters and their correlation can be elicited to students by the following illustration (Figure#3).

Imagery

Clinical features of PD can be easily remembered by students keeping in mind the image of Figure#4. Similarly micrographia and treatment plan can be better comprehended by students by displaying the following images. (Figures # 5 and 6) Figure#7 will enhance the imaginal coding of drug treatment for PD in the minds of students.

Mnemonics

Different mnemonic techniques can be used by students for encoding. This can help students in better elaboration of encoding and strong retrieval of data.

Examples are

For clinical features of PD: SMART (shaking palsy, mask like face, akinesia, rigidity, tremors) Drugs causing Parkinsonism are: Cassius to Mohammed; Hero to Role model (Chlorpromazine, Metoclopramide, Haloperidol, Reserpine) (First letter mnemonic) or relating PD with an elderly male waiting for a prayer in a mosque and exhibiting all the features of PD (Keyword method).

Strategies for encoding complex information

Schema activation

Questioning Purposefully

Levels of processing

Schema activation

Schema activation helps students to build new knowledge on the foundation of their previous knowledge. Any discussion or procedure that fills the conceptual gap between what the learner already knows and what he has to learn is considered to be a form of schema activation. Pre-teaching class discussions, hand-outs, internet searching, reading book or journal, brainstorming, and clarifying salient concepts are few examples of schema activation for PD^{3,4}. Text preview especially of the title, its sub-headings and illustrations also assist students in their schema activation. Following slides will be displayed to students at the start of learning activities and will activate their schema.

During learning sessions, we will compose questions or case scenarios that will focus on students' comprehension and application of concept and avoiding recall of simple facts. Following is an example of such scenario during interactive lecture and small group discussion (SGD).

Questioning Purposefully

Questioning is an effective mean of comprehension and deep learning. Students must ask questions from teachers and peers, it will enhance their learning^{7,8}. Students have the liberty of asking questions during interactive lectures, small group discussion and bedside teaching. Students usually are reluctant to ask questions in a large class. Under such scenario, we will ask students to write a question on paper and turn it in and will then address these questions in a relatively anonymous and non-threatening way before the start of next lecture. We will also ask questions from students during interactive lecture and SGD to enhance their comprehension. These questions will augment students' thinking and will help them to analyse the topic in specific ways such as explaining and justifying, comparing and contrast etc. This exercise will lead to proposition development for better concept development.

Examples are

Why most of the psychiatric patients under treatment develop Parkinson's disease? (All anti-psychotics are dopamine antagonists)

Why professional boxers and wrestlers develop Parkinson's disease? (repeated trauma to head leads to nigro-striatal degeneration and dopamine depletions)

Why Parkinson's patients develop emotional lability? (dopamine is also an important neurotransmitter for normal mood and behaviour and its depletion leads to mood disorders)

Levels of processing

Deep learning is based on the concept of meaning of topic. Interactive lectures, small group discussion, bedside teaching, internet searching and self-study all provide tools to process the information into deep learning. Elaboration and explanation of examples also promote deep learning⁴.

The students can also utilize the following strategies to become deep learners:

Awareness about their meta-cognition:

Following check list will be provided to students and they will fill it after every session:

Do I know anything about this topic?

What is the purpose for learning about Parkinson's disease?

Do I know the strategies that will help me to learn?

Am I understanding as I proceed?

How should I correct errors?

Have I accomplished the goal I set for myself?

Will I be able to apply this knowledge to real life scenarios?

Focussing their attention by relating current knowledge to their prior knowledge:

We will help students to use connectionist model for better comprehension and deep learning. We will give our students a specific set of clinical features leading to a specific diagnosis. We will provide them the following data to make a diagnosis of Supra-nuclear palsy, Multisystem atrophy and Lewy body dementia.

Intrinsic motivation of students and perception of relevance

These are the basic principles of andragogy (adult learning approach) and an important component of deep learning.

Repeated practice

Repeated practice promotes automaticity. We will give students a number of case reports highlighting differential diagnosis of PD. This exercise will help students to use less cognitive resources for a given task.

Relating concepts to daily life experiences:

We will assist our students so that they are able

to transfer their skills and abilities from class room to real life situations by building connection between new concepts and life events. These connections then help students to gain access to their knowledge when they need it in real life situations. For this purpose, we will design a scenario for students that will help them to link the information given to them in real life situations. We will discuss the following clinical scenarios on the bedside. This case based approach in the ward will help learners to utilize the knowledge given to them in lectures and SGD for patient diagnosis and management in real life.

Case based scenario

An 87 years old woman is referred with a tremor. It is noticeable at rest but does not bother her; her daughter suggested that she attend the clinic for investigation. She is using bendroflumethiazide for hypertension. She is a widow and lives alone but still does her own cooking and cleaning. On examination she has a slow gait with good stride length. Her writing reflexes are preserved and there is no rigidity. She is slow to get out of a chair. Power, reflexes and sensations are normal.

What will you do?

Review in 6 months' time

Start L-dopa

Start a dopamine agonist

Give a beta-blocker

Arrange MRI of the brain

Answer

Although she may have a mild degree of bradykinesia and a resting tremor, they are clearly not bothering her. As the aim of treatment in Parkinson disease is to alleviate symptoms, there are no compelling reasons to start therapy straight away.

Elaborative rehearsal

Elaborative rehearsal by students is also an effective strategy for deep learning. We will distribute among the students the following article depicting changes in the life of Mohammad Ali and Michael J. Fox when they suffered Parkinson's disease.

A comparative analysis of how Michael J. Fox and Muhammad Ali changed the world's views on Parkinson's disease

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ABSTRACT

Parkinson's disease is a disabling neurodegenerative disease that affects more than 6.3 million individuals expected to double by 2030. The main motor symptoms of Parkinson's disease include resting tremor, bradykinesia, rigidity, postural instability, loss of balance and difficulty walking. Though there is no cure for Parkinson's disease, current therapies focus on improving the symptoms of this debilitating condition. Much needs to be done to promote public awareness of this condition. This review will briefly discuss the

PD, PATHOPHYSIOLOGY – CONTD.

- Imbalance primarily between the excitatory neurotransmitter Acetylcholine and inhibitory neurotransmitter Dopamine in the Basal Ganglia



Fig 1: Pathogenesis of Parkinson's disease

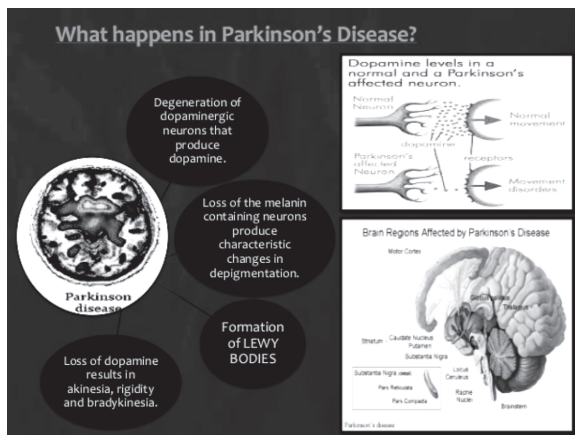


Fig 2: What happens in Parkinson's disease?

Parkinson's Disease-Patho-physiology

- Basal Ganglia
 - Controls movement
- Dopamine
 - Inhibitory neurotransmitter in the basal ganglia
- Acetylcholine
 - Excitatory neurotransmitter in the basal ganglia
- Without dopamine, inhibitory influences are lost and excitatory mechanisms are unopposed →
- Neurons of basal ganglia are over stimulated →
- Excess muscle tone, tremors & rigidity
- Extrapyramidal system next lecture!

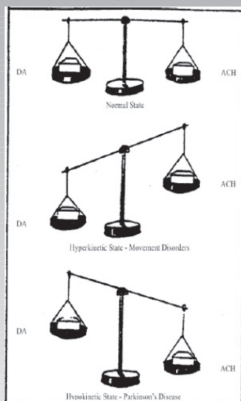


Fig 3: Neurotransmitters involved in PD



Fig 4: Clinical features of PD

FEBRUARY 2010

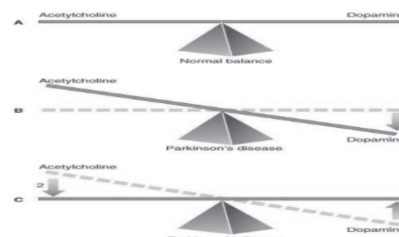
23 Tuesday

054*311 week 8

7.00 am Result order.
8.00 Results sent. Ashraf
9.00 Glycine - sent
10.00 active over the
11.00 Methyl group
12 noon
1.00 These are good - data
2.00 messy - small amount of data
figure a way to make it.

Fig 5: Micrographic writing in PD

TREATMENT OF PD



A. Normal balance of acetylcholine and dopamine in the CNS.
B. In Parkinson's disease, a decrease in dopamine results in an imbalance.
C. Drug therapy in Parkinson's disease is aimed at correcting the imbalance between acetylcholine and dopamine. This can be accomplished by either 1. increasing the supply of dopamine or 2. blocking or lowering acetylcholine levels.

FIG. 14-3. The neurotransmitter imbalance of Parkinson's disease.

Fig 6: Treatment plan in PD

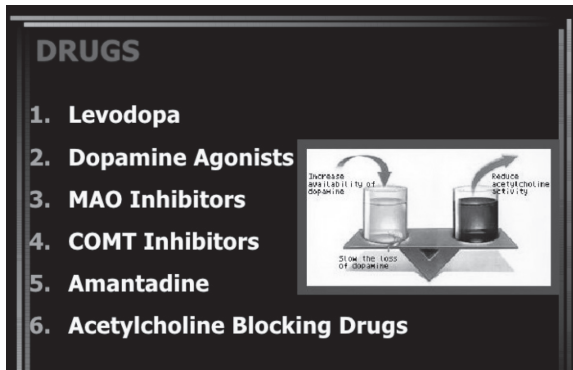
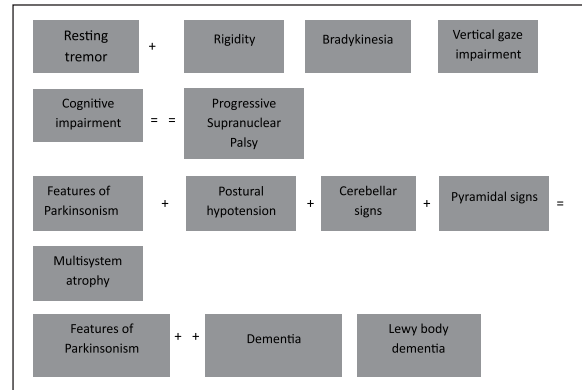
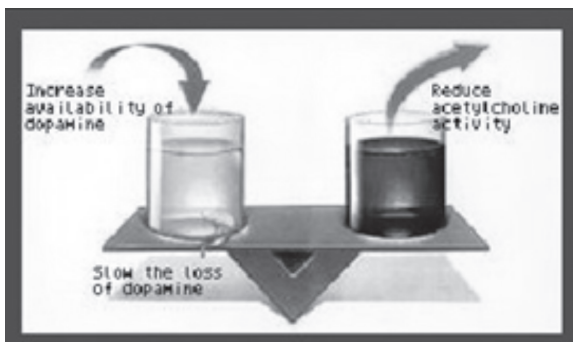
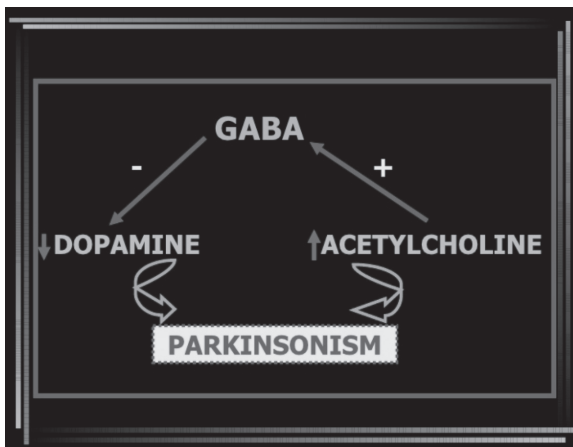
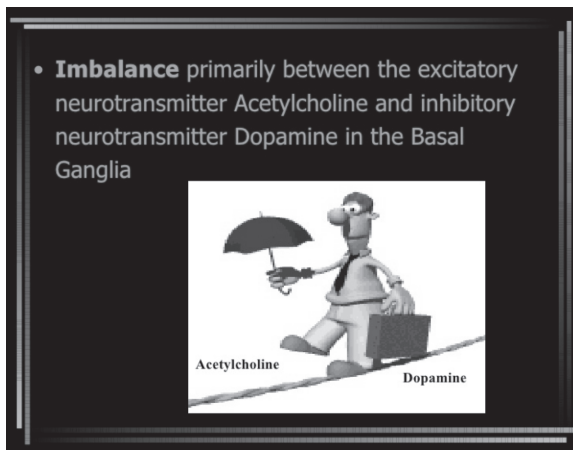


Fig 7: Drug treatment for PD



impact that Michael J. Fox and Muhammad Ali had on the world's view of Parkinson's disease.

INTRODUCTION

Efficient Reading

Regular and efficient reading by students is one of the prerequisites for deep learning.

Social interaction among students

We will encourage learners to arrange peer group learning. This will promote social interaction and enhance their confidence and emotional intelligence.

Strategies to rectify/modify curriculum to promote deep learning

We will be having clear-cut learning objectives of the topic before designing a curriculum and we will strictly follow and document it at the start of learning session. Study guides will be prepared and available at library and college bookshop at the start of an academic session. Our assessment techniques will address the learning objectives. Formative and summative assessment techniques will be utilized and feedback will be provided to the students. Assessment tools will be SAQ's, MCQ's, EMQ's and OSCE.

An academic calendar for the session will be prepared documenting all the relevant details about curriculum and displayed at notice board of student affairs section and College website under title of Curriculum. We will arrange this learning session (PD) in academic calendar after cerebral stroke and prior to learning activities on Alzheimer disease and other causes of dementia. These learning activities will go on simultaneously with care and management of geriatric patients, management of depression by Psychiatry department and management of uro-fecal problems by surgical department. We as facilitators will be in active collaboration with other teachers involved in all these learning activities. This can be accomplished through appropriate documentation and communication about

the aims and objectives of each course, the content and topics covered in lectures and other teaching sessions relevant to our topic. Lecture notes may be circulated to other course teachers as well as to students. By sharing this information, we can take account of what colleagues cover in other parts of the course when planning our teaching, avoiding unnecessary duplication or redundancy, where appropriate, to other parts of the course.^{9, 10} We will utilize an integrated approach of teaching with the support of colleagues from neuro-anatomy, histopathology, occupational therapist, psychiatrist and Parkinson's disease society activist.¹¹ Another option for this perspective can be to arrange a Clinico-pathologic conference (CPC) for students by the active participation of all the relevant specialties.

CONCLUSIONS

Deep learning is constructed on the foundation of prior knowledge. Meaning of the content is created by student and teacher learning activities. Students approach learning with the intention to understand and seek meaning, and consequently, search for relationships among materials and interpret knowledge in light of previous knowledge and experiences. Teacher facilitates students in all these learning activities.

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