Medical Students' Viewpoint Regarding the Integrated Module of Basal Ganglia

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Abstract- Integration is an important educational strategy in medical education. Considering this idea, the goal of the present study was to design and implementation of longitudinal and vertical integrated education of anatomy, physiology, pharmacology, neurology and neuropsychiatry subjects of brain's basal ganglia by a multidisciplinary team. Kern's approach to curriculum development was used. Participants were 20 medical students at basic science level who contribute in a 10 stations of pre-test exam at Medical School's Skill Lab. After the implementation of the module by a multidisciplinary team, post-test were done. A structured questionnaire was designed to assess student opinions about adequacy, usefulness of the module using a Likert scale with 5 categories ranging from “completely agreement” to “completely disagreement". The result of pre and post-test were also compared. Twenty questionnaires were completed, giving a 77.63% satisfaction rate. Seventy-five percent of students found it useful and appropriate at basic science level. About fifty percent of students suggested the implementation of this module for other medical students. The score of post-test was significantly (14.52±0.47 vs 6.32±0.62, $P<0.05$) higher than pre-test results. The viewpoints of medical students were positive and they value the module highly. Since it is not easy to change the style we teach, these results suggest necessitate of supporting the faculty member's participation in these modules.

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Introduction

The university managers have emphasized on using new educational strategies to provide the opportunity of profound learning for the students (1-3). Integration has been introduced as an important educational strategy and the need for integration in health sciences sets the future direction for health education (1,5). Vertical integration can be defined as the integration of basic science with the clinical context. Integration of different discipline of basic science can be defined as horizontal integration (6).

Eleven steps between discipline-based and integrated teaching have been explained (5). However, the shift from a subject-based to an integrated curriculum may involve major changes (1) and there exist some evidence of the obstacles and difficulties of implementing instructional changes (7-8). The reports of diverse experience in design and implementation of integrated modules will provide an operational template for future efforts in this regard.

The goal of the present study was to design and implementation of integrated education of anatomy, physiology, pharmacology, neurology and neuropsychiatry subjects of brain's basal ganglia by a multidisciplinary team.

Materials and Methods

We applied the Kern model for curricular design. According to the 6-step approach by Kern, the educational requirements of targeted group of learners were determined by a multidisciplinary team of expertise.

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Appendix 1. Eleven general instructional objectives and 49 specific observable behaviors were determined by multidisciplinary team. 1: Must know, 2: Better to know, 3: Nice to know

Educational goals	Superiority/ Precedence	Specific observable behaviors	Score
1. Recognizes the principal component of Basal ganglia	1	1. Explain the movement pathways.	
		2. Name the component of Basal ganglia.	15
		3. Show the location of each component of Basal ganglia on Atlas.	20
		4. Show the location of each component of Basal ganglia on moulage.	11
		5. Explain the superiorities of Cudate and Lentiform nucleus with Internal capsule.	9
			12
		6. Explain the type, shape and distribution of different neuron in Basal ganglia.	19
		7. Draw the afferent, efferent and relationship of different nuclei of Basal ganglia.	19
			12
		8. Describe the somatotropic distribution of neurons in each nucleus.	
2. Know the phylogenic development and genecology of Basal ganglia	3	9. Describe the genecology of Basal ganglia.	7
		10. Describe the phylogenic development of Basal ganglia.	7
3. Know the communication of different nuclei of Basal ganglia with each other and other part of the brain.	1	11. Describe the communication of different nuclei.	19
		12. Explain the relation of basal nuclei with Thalamic nuclei.	14
		13. Explain the relation of basal nuclei with brain stem.	13
		14. Describe the relation of basal nuclei with cerebellum.	11
4. Understand basal ganglia function in movement, cognition and emotional phenomena.	1	15. Explain the reasons that attributed Basal ganglia to the movement phenomena.	19
			13
		16. Compare the blood circulation of Basal ganglia with the other area of the brain.	11
			17
		17. Describe the role of CU in Basal ganglia metabolism.	17
		18. Name the functional component of the striatum.	16
		19. Describe the function of parallel circuits.	18
		20. Explain the tonic electrical activity of each nuclei and their variation during movement.	19
			17
		21. Name the exist hypothesis about Basal ganglia function.	18
		22. Explain the function of Direct, Indirect and Hperdirect pathways.	12
		23. Explain the function of different receptors in Basal ganglia.	11
		24. Describe the effect of different neurotransmitters on Direct and Indirect pathways.	12
		25. Define the Mood and Thought and their brain component.	
		26. Define the function of Basal ganglia in Thought regulation.	
		27. Define the function of Basal ganglia in Mood regulation.	
5. Know the pathology of Basal ganglia.	2	28. Describe the structural disturbances of Basal ganglia.	16
		29. Describe the functional disturbances of Basal ganglia.	16
		30. Describe the syndrome related to Basal ganglia dysfunction.	17
6. Know the sign and symptom of Basal ganglia disorders.	2	31. Recognize the clinical manifestations related to Rigidity.	16
		32. Recognize the clinical manifestations related to Bradykinasia & Akinesia.	16
		33. Recognize the disturbances in Balance reflexes and gait.	16
		34. Recognize the abnormal movements (Chorea, Dystonia, Atetosis and Tremor).	16
			18
		35. Name the neuropsychiatry symptoms related to Basal ganglia disorders.	

7. Know the neuronal relationship with Basal ganglia.	1	36. Explain the neuronal feature of Corticospinal pathway. 37. Explain the Pyramidal and Extrapyramidal pathways.	12 18
8. Know the different neurotransmitters inBasal ganglia.	1	38. Name the different neurotransmitters of Extrapyramidal pathway and draw their chemical structure. (Ach, Dopamine, Glutamate, GABA) 39. Name the biosynthesis, release and termination of Ach, Dopamine, Glutamate and GABA.	16 - 13
9. Know the receptors of different neurotransmitters in Basal ganglia, and signaling pathway of them	1	40. Explain the different type of Ach, Dopamine, Glutamate and GABA receptors. 41. Explain the distribution pattern of Ach, Dopamine, Glutamate and GABA receptors in Basal ganglia. 42. Explain the signaling system of Ach, Dopamine, Glutamate and GABA receptors. 43. Name the most important agonist and antagonist of each receptor.	12 12 - 15 11
10. Pharmacological intervention in Basal ganglia disorders	2	44. Name the different drug classes which use in Basal ganglia disorders. 45. Explain the mechanism of action of the drug classes which use in Basal ganglia disorders. 46. Mention the most important drug in each class which uses in Basal ganglia disorders. 47. Mention some drug which cause disturbance in Basal ganglia function.	15 15 14 13
11. Effect of aging on Basal ganglia	3	48. Describe the structural changes of Basal ganglia during aging. 49. Describe the functional changes of Basal ganglia during aging.	12 11

Targeted group of learners were medical student at basic science level. Students learning objectives were defined based on educational needs. Eleven general instructional objectives and 49 specific observable behaviors were determined by multidisciplinary team (Appendix 1). Then, objectives were scored on a scale of 1 to 5 based on their importance. The individual scores was integrated and sorted.

The curricular content was specified according to the objectives and goals. The elective module was implemented as a workshop during 3 consecutive days using educational strategies such as team teaching and, case-based interactive lectures by a multidisciplinary team.

The medical student at basic science level was enrolled to participate in this elective module through a general announcement at the university. Among 51 enrollments through a web page address, twenty people were randomly selected. Table 1 shows some demographic data of them. After a primary explanation about the module, medical students participated in a 10 stations of pre-test exam at Medical school's Skill lab. At the end of the module, post-test were also done.

A structured questionnaire was designed to assess student viewpoints about adequacy, fairness and helpfulness of the module. The questionnaire comprised qualitative and quantitative parts. Quantitative part consisted of 17 questions using a Likert scale (Appendix 2) which had five response options ranging from 1 (strongly disagree with the statement) to 5 (strongly agree with the statement). The responses to the Likert scales were calculated into percentages. The agreeable/disagreeable responses were grouped, for example with totals for answers 4 (agree) and 5 (strongly agree). In qualitative part of the questionnaire, the students were asked to identify the most important strength and weakness points of the module.

Validity

Validity of the questionnaire was assessed in both of content and construct validity. Content validity was assessed by discussion with academics, experts in the medical education field, however construct validity was evaluated by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy tests. KMO value of the questionnaire was 0.5.

The abstract scenario of the presentation

First of all, a film about a patient with Parkinson disease was exhibited. The students were asked to mention each sign they saw at the film. Then neurologist of the multidisciplinary team told a story about the history of Parkinson disease diagnosis. Through telling the history, he mentioned that the scientist found that the problem may be at the Substatia Nigra.

Appendix 2. Questionnaire items for the evaluation of the basal ganglia integrated module

Questionnaire Items	Strongly disagree	Disagree	No comment	Agree	Strongly agree
Medical student at basic science level are the best group for participation in this module.	☐	☐	☐	☐	☐
The place of holding was suitable.	☐	☐	☐	☐	☐
Facilities available in the place consist of high quality.	☐	☐	☐	☐	☐
Instructors were able to manage the module and presenting the subjects very well.	☐	☐	☐	☐	☐
At the beginning of the module, all educational goals and objectives was clearly demonstrated for the targeted group of learners.	☐	☐	☐	☐	☐
Targeted group of learners was involved throughout the module well.	☐	☐	☐	☐	☐
The number of the participant was appropriate.	☐	☐	☐	☐	☐
The schedule of the module was appropriate with instructional objectives.	☐	☐	☐	☐	☐
The time table of the module was implemented well.	☐	☐	☐	☐	☐
Educational methods were appropriately designed to achieve instructional objectives.	☐	☐	☐	☐	☐
The appropriate accessory instructional device was used to achieving instructional objectives.	☐	☐	☐	☐	☐
The program directors provided all necessary facilities for successful implementation of the module.	☐	☐	☐	☐	☐
Presentation of movies and discussion about them was helpful in achieving the deeper perception.	☐	☐	☐	☐	☐
This module was able to provide a sufficient knowledge and perception of basal ganglia.	☐	☐	☐	☐	☐
I necessitate the participation in the module for further medical students.	☐	☐	☐	☐	☐
I will applicant the achieved knowledge of this module in future.	☐	☐	☐	☐	☐
In spite of the limitations, data presented in this module are useful.	☐	☐	☐	☐	☐
What were the most important strength points of the module in your opinion?	……..……..				
What are your comments for improving the quality of the module?	……..……..……				
What were the most important weakness points of the module in your opinion?	……..				

Then the scenario was continued through targeted questions. Where is the Substantia Nigra? The anatomist of the team answered this question. During explanation of the Substantia Nigra, he stated that it is belong to a set of nuclei named "Basal ganglia". Then these set of nuclei were explained. Why Substantia Nigra is Black? Here, the pharmacologist of the team introduced the neurotransmitters and finally dopamine metabolism.

What is the function of Substantia Nigra and Basal ganglia? Here the physiologist of the team, explained the different theory to clarify their functions? Then, the members of the multidisciplinary team get to a challenge to relate the sign and symptom of the patient with the presented theories. Finally the neuropsychiatries and some therapeutic points were mentioned.

Results

Result of questionnaire for the evaluation of the module

All questionnaires were completed by the students at the end of the module. There was a high response rate (100%). The satisfaction rate was 77.63±1.40 which was estimated according to the following formula:

$$Percent\ of\ construct = \frac{Sum\ of\ construct\ Score - Min\ construct\ Score}{Max\ construct\ Score - Min\ construct\ Score} \times 100$$

In all, 75% of respondents felt that medical student at basic science level are the best group for participating in this module. However, 20% expressed their disagreement in this regard. All of the students believed that the instructors were able to manage the module and present the subjects very well. In qualitative part of the questionnaire, they emphasized on the co-operation of basic and clinical faculty members as a strength point of the module. The high proportion of students believed that the number of the participant, the schedule and the time table of the module was appropriate. Most students (90%) believed that location and environmental facilities were appropriate. The view points of the students about each questionnaire items are presented in Table 2.

Score of each participant in pre and post test evaluated and analyzed by Wilcoxon two related sample test. The result of post-test (14/52±1.85 vs. 6.06±2.2, $P<0.05$) was significantly greater than pre-test (Figure 1).

Table 1. Demographic data of 20 medical students who participate in elective basal ganglia integrated module.

Subject	Data
Age (Years)	20 ± 1
Sex (% male)	75%
Year of Education	Second year
Knowledge or awareness of integrated educational methods (% Yes)	25%
Pervious participation in integrated training module (% No)	100%

Table 2. Viewpoint of the students is listed for each statement of the questionnaire. The student's responses to the Likert scale were calculated into percentages. The agreeable and disagreeable responses were grouped.

Questionnaire Items	% Disagree	% Agree
Medical student at basic science level are the best group for participation in this module.	20	75
The place of holding was suitable.	10	90
Facilities available in the place consist of high quality.	-	95
Instructors were able to manage the course and presenting the subjects very well.	-	100
At the beginning of the module, all educational goals and objectives was clearly demonstrated for the targeted group of learners.	10	75
Targeted group of learners was involved throughout the module well.	-	90
The number of the participant was appropriate.	5	90
The schedule of the module was appropriate for achieving instructional objectives.	15	60
The time table of the module was implemented well.	15	60
The appropriate accessory instructional device was used to achieving instructional objectives.	-	95
The program directors did all necessary facility events for successful implementation of the module.	-	90
The program directors provided all necessary facilities for successful implementation of the module.	-	95
Presentation of movies and discussion about them was helpful in achieving the deeper perception.	-	100
This module was able to provide a sufficient knowledge and perception of basal ganglia.	-	90
I necessitate the participation in the module for future medical students.	10	50
I will applicant the achieved knowledge of this module in future.	5	90
In spite of the limitations, data presented in this module was useful.	5	90

The Likert scales had five response options ranging from 1 (strongly disagree with the statement) to 5 (strongly agree with the statement).

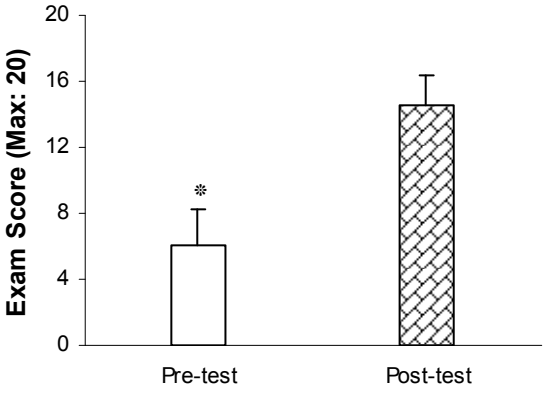

Figure 1. Results of pre- and post-test. The data are presented as mean±SD. * $P<0.05$.

Discussion

Early stage of this project was allocated to design an elective integrated training module of the brain's basal ganglia using a multidisciplinary team. It is obvious that during configuration or organizing of such a team, members are encountering numerous facilitating and inhibiting factors. Identification and clarifying of these factors in a practical experience is an important approach to close various disciplines to each other.

In this study, facilitating factors during team activities were as follows:

1. Members had shared opinions regarding the need for change and use of new educational methods
2. Collaboration of faculty members in different areas of basic and clinical sciences were pleasured as a new experience
3. Member's interests for designing an integrated modules
4. Providing an opportunity for improving information through interdisciplinary collaboration.

The above-mentioned items should be considered during choose of multidisciplinary team's member from different disciplines. Collaboration of faculty members in the team is the most important winner's factor in the management of integrated modules.

In the current study, the inhibiting factors during team activities were as follows:

1. Problems in coordinating group meetings with participation of all members in a certain time. Lack of member's time was a major problem to manage the meetings.
2. Conflicts to select core from non-core topics.
3. Technological limitation in selecting the most appropriate educational strategies.

Silverthorn *et al.* (6) also reported the difficulty of implementing instructional change.

The team work in the current study showed that, if the facilitating factors have been considered, members themselves surmounting the inhibiting factors.

There is some report of integrated curriculum for medical students (9-10). In 2005, Snyman et al. described an instructional design of the vertical as well as horizontal integrated learning program (6). The integration of basic sciences with the clinical curriculum should make learning more relevant and ultimately more available for use in a clinical context (11).

Findings of this study determined that most students participating in the module (75%) felt that running or organizing of this module in basic science level considered appropriate. In small group discussions, they indicated that presenting topics of different disciplines concurrently, omitting of overlaps and providing various concepts relationship was reasons for their agreement. Twenty percent of the student opponent to implementing the module at the basic science level, their concern was deletion of core topics of the first and second semester courses and replacing them by integrated courses. They mentioned that integrated topics are not necessary and useful at the first or second semester of education at the University. In group discussion, they suggested the reduction of volume of basic science courses and presenting integrated courses in the last semester of the medical curriculum.

Most students believed that teachers had enough competencies in management of the module and presenting subjects in integrated approach. Proficiency sufficient and comprehensive coordination between teachers and their focus on integration issues, cooperation of teachers at basic science by clinician and

presenting of clinical points were prominent options which was highlighted in open part of the questionnaire by the students.

In the learning process, students (92.5%) believed that educational methods used in the module, including film and talk show was appropriate. In this module, team work training and planed lecture was used. However, the most prominent feature was transverse and longitudinal integration, not diversity in educational methods.

Although the most students (60%) believed that the timing observed for the module was well, but 15% had the opinion that the overall schedule of the module was not appropriate in comparison with learning objectives.

About 90% of the students believed that the knowledge, attitude and proper understanding of the basal ganglia rules are provided. Fifty percent of student emphasized the importance of the topic and its application in their future jobs. So they recommended participation in the module for other medical students. Other students (40%) did not have any idea in this regard. This may reflect confusion about selection of the best time for implementation of such integrated modules in the medical curriculum.

In analysis of the overall satisfaction of the module, student's satisfaction rate was %77.63. This matter illustrates the success of attracting students at basic science level and the need to support by authorities along medical education programs in the future.

Finally, the above findings and related discussion was shown that this module was assessed successful by the students and had been able to achieve a large number of the study goals.

We hope that with cooperation by authorities in the matter of implementation problems, more desirable module been achieved in future.

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