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View Point

Education Section

Revisiting Integration: A Proposed Framework in the Light of Competency-Based Medical Education in Indian Context

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ABSTRACT

Various methods of Integration (Temporal co-ordination, Sharing, Nesting and Co-relation) recommended in the revised curriculum of Undergraduate Competency Based Medical Education (CBME) from 2019 academic session onwards is discussed hereby. A brief description of these methods and recommended frameworks for planning such integration sessions are suggested. Medical colleges can plan and place integration of contents across various phases of curriculum on the basis of suggested frameworks, depending on factors like the targeted areas of integration, views and experience of teachers, organisational structure and course outcomes.

Keywords: Nesting, Sharing, Temporal coordination

INTRODUCTION

As per Graduate Medical Education Regulation (GMER-amendment 2019), the undergraduate medical curriculum is revised to Competency-based from academic year 2019 onwards [1]. One of the salient features of this revised curriculum is emphasis on integration of contents, keeping the subject specific specialities intact. The aim of this review paper is to revisit the concept of 'Integration' and its proposed methods in a competency based curriculum of undergraduate medical education. The manuscript also proposes frameworks for Sharing, Nesting and Co-relation that can be considered by Medical schools while planning such integration sessions and can act as a ready reference tool for teachers and students alike. The reference search for this manuscript was carried out electronically from articles and books viz., PubMed, Medline, Scopus, Index Copernicus and Google Scholar focussing on methods of integration in medical education and related framework for its operability.

The need of essential shift from traditional curriculum to SPICES model (Student-centred learning, Problem-based learning, Integrated teaching, Community-based education, Elective programs and a Systemic approach) has been emphasised in literature so as to integrate Health-Illness-Management concept [2]. In a competency based curriculum, integration remains the mainstay to give it a valid stance. It is a learning experience that allows the learner to perceive relationships from isolated blocks of knowledge and establish relationships for its proper application in health care [3]. The idea is to help the learner with an integrated knowledge base, ability to apply skills, faster retrieval of information and more room for curricular exploration.

The new Competency based undergraduate Medical Education applies the principles of Integration to the extent that it retains the strengths of systems based education and assessment while providing experiences that will allow learners to integrate concepts. Wherever possible, GMER-2019 recommends sharing or correlating topics by using an integration or linker session within the curriculum. The objective is to ensure achievement of phase specific objectives wherein integration is embedded to provide adequate recall and conceptual understanding of the clinical/basic science applications. It is recommended that undergraduate Medical Education should be organised in such a way that it brings together various aspects of the curriculum into meaningful association to focus upon broad areas of study [1].

The hallmark, as enshrined in the revised curriculum is the suggested methods of integration viz., Temporal co-ordination, Sharing, Nesting and Co-relation [4]. These modes are in synchrony with the ones envisaged in the taxonomy of 11 step ladder by Harden RM. The proposed methods balance the thoroughness of independent subjects and association of concepts [5] between subjects across various professional years.

Nesting and Co-relation, as integration methods, support the learning theory by Piaget et al., that prior cognitive structures are an important part of cognitive development to meaningfully acquire new information or concepts. Ausubel also postulated that meaningful learning occurs when new information is subsumed by existing relevant concepts, and these concepts undergo further change and growth [6,7]. Hence, the cognitive structures so developed, via these integration methods can serve as a foundation stone for further knowledge and higher order thinking skills.

Integration in CBME: Specifics and Proposed Framework

The GMER (amendment 2019) suggests four methods viz., Temporal co-ordination, Sharing, Nesting and Co-relation for all phases of curriculum, wherein Temporal coordination should occupy almost 80% of the syllabus and remaining 20% should be for other three types [1].

1. **Temporal co-ordination:** The approach is often referred to as 'Concurrent', 'Parallel' or 'Aligned' teaching. The time table is formulated in such a way that topics within the subjects or disciplines which are related are scheduled at the same time. Students are taught concepts of different subjects separately, however, similar areas within different subjects are taught at the same time [2]. A major concern with this approach is that it is left to the learners to establish relationships between contents of different subject areas. Temporal co-ordination is a good starter for a more defined integrated curriculum, and may be considered independently rather than a type of integration. It helps teachers to co-ordinate amongst different subject areas. An example of temporal co-ordination can be teaching of cardiac physiology aligned with teaching Anatomy of heart. [Table/Fig-1] depicts the concept of temporal alignment wherein related topics/themes of different subjects in 1st phase of medical curriculum are taught in the same time frame.

Week	Anatomy	Physiology	Biochemistry
I[st] week	General features of the cardiovascular system	Cardiovascular Physiology	Non-aligned topics
II[nd] week	Introduction to the nervous system General features of Muscle	Nerve and Muscle Physiology	Non-aligned topics
III[rd] week	Non-aligned topics	Endocrinology	Mechanism of hormonal actions
IV[th] week	General Anatomy	Cell Physiology	Cell Water-electrolyte balance

[Table/Fig-1]: Concept of Temporal coordination (Similar coloured blocks depict temporally coordinated topics within different subjects of a common phase).

2. **Sharing:** In this method, shared planning and teaching occurs in two or more disciplines involving over-lapping concepts or ideas emerge as organising elements [8]. The focus is on shared elements between two subjects/disciplines. Generally, this applies to complementary courses wherein dealing with the contents jointly makes more sense than teaching in isolated compartments. This approach also prevents overlap while dealing with objectives of the course and minimises redundancy. The revised curriculum prescribes this method of integration for MBBS curriculum to emphasise the integrated nature of Medical science for considerable portion and to avoid overlaps that is substantive in a traditional curriculum. The concept is to share common objectives of different subjects within same phase and deal with them jointly. Sharing of common objectives also result in realisation of interrelationships, identify commonalities and present the larger picture to learners, rather than subject as tight compartments within a discipline. [Table/Fig-2] depicts sharing of common objectives in Anatomy and Physiology.

Subject	Competency	Objective	Sharing
Anatomy General features of Muscle	Classify muscle tissue according to structure & action	able to enumerate different muscle tissue	
		Able to classify muscle tissue according to the structure	
		Able to classify muscle tissue according to the action	**SHARING** (of objectives by Anatomy & Physiology)
Physiology Nerve and Muscle Physiology	Describe the different types of muscle fibers and their structure	**able to enumerate different muscle fibers**	
		Able to classify muscle tissue according to the structure	

[Table/Fig-2]: Concept of Sharing (Bold objectives are the ones shared between subjects of Anatomy and Physiology).

Template for Sharing [Table/Fig-3]: The template specifies the topic of Integration, Professional year, Primary subject and other subjects with which objectives are shared, targeted competency with details, shared objectives, their teaching learning and assessment methods, Learning resource material and references.

3. **Nesting:** Nesting is the fourth step in the integration ladder by Harden RM [2]. Here the teacher targets, within a subject-based course, skills relating to other subjects. Fogarty R described this as subject specific approach wherein objectives from other relevant subjects are dealt within the core subject to give a wholistic view [8]. The teachings essentially remain subject based, however; the broad goals of curriculum are considered for blending contents so as to recognise generic competencies in related learning domains. For instance; a course in Endocrine Physiology may Nest clinical symptoms, broad management protocols and social aspects in endocrinology that are generally dealt with subjects

Integration module template : SHARING

Module no. : Topic:

a. Professional year :
b. Subject (primary) :
c. Subject with which objectives are shared :
d. Targeted Competency details :

Competency no.	Competency	Domain	Level of competency	Core/Non-core

e. Subject involved with targeted competency and their objectives

Subject	Subject 1	Subject 2	Subject 3	Subject 4
Competency				
Objectives *				

***Objectives shared**

f. Subject that will deal with shared objectives , their teaching learning & assessment method.

	Subject 1	Subject 2	Subject 3
Objectives shared			
TL method			
Assessment type (Formative, Internal, Summative)			
Assessment tool			

h. Learning Resource material:

i. References:

[Table/Fig-3]: Sharing Module Template (Copyright no. L-86554/2019, DMIMS Integration module template, Dr Tripti K Srivastava, Dr Lalitbhushan Waghmare).

of Medicine and Preventive and Social Medicine. [Table/Fig-4] depicts the concept of nesting, one objective from the subject of Medicine while teaching Physiology.

PHASE I - Nesting	PHYSIOLOGY (an objective of Medicine being taught in Physiology)	COMP	OBJECTIVE	OBJECTIVE
			OBJECTIVE	OBJECTIVE
	BIOCHEMISTRY	COMP	OBJECTIVE	OBJECTIVE
			OBJECTIVE	OBJECTIVE
PHASE III	SURGERY	COMP	OBJECTIVE	OBJECTIVE
			OBJECTIVE	OBJECTIVE
	MEDICINE	COMP	OBJECTIVE	OBJECTIVE
				OBJECTIVE

[Table/Fig-4]: Concept of Nesting (Table depicts an objective of Medicine from MBBS phase III being 'Nested' in Physiology of phase I MBBS), Comp: Competency.

Template for Nesting [Table/Fig-5]: The template specifies the topic of Integration, Professional year, Targeted competency with its details, Primary subject and other subjects that are nested, objectives from other subjects that are nested, Learning resource material and references.

4. **Co-relation:** In Co-relation, the emphasis remains on subject specific contents with a common linking session that links all related subjects through a clinical case or a problem. Competencies across different subjects (horizontally and/or vertically) are connected with a linker. Linker is a session that allows the learner to link the concepts of aligned topics, traditionally taught in different subjects. It allows the learner to approach a clinical problem with varied angles that cuts across subject matter lines. Clinical cases can be used to integrate and link learning across disciplines. The linker can also be kind of a project or seminar that integrates these subjects, thus establishing a relationship between different subject areas. It can be referred to as a 'Concomitant program'. [Table/Fig-6] depicts a 'Linker' case to connect the objectives of Microbiology, Pharmacology and Pathology.

Integration module template: NESTING

Module no.: Topic :

a. Professional year :
b. Subject (primary) :
c. Subjects nested (basic sciences / clinical sciences as applicable) :
d. Targeted Competency details :

Competency no.	Competency	Domain	Level of competency	Core/Non-core

e. Subjects , Competency & Objectives to be nested

Subjects	Primary sub (basic/clinical)	Secondary sub (basic/clinical)	Secondary sub (basic/clinical)	Secondary sub (basic/clinical)
Competency				
Objectives	All objectives	Nesting objectives only	Nesting objectives only	Nesting objectives only

f. Primary subject and details objectives nested

Subject	Objectives nested	TL method	Assessment type	Assessment tool

h. Learning Resource material:

i. References:

[Table/Fig-5]: 'Nesting' Module Template (Copyright no. L-86554/2019, DMIMS Integration module template, Dr Tripti K Srivastava, Dr Lalitbhushan Waghmare).

Microbiology	Describe the morphology, mode of infection and discuss the pathogenesis, clinical course, diagnosis and prevention and common microbial agents causing Anemia	Describe the Morphology of Anemia Describe the mode of infection of Anemia Describe the common microbial agents causing Anemia
Pharmacology	Describe the mechanism/s of action, types, doses, side effects, indications and contraindications of drugs used in Anemia.	Describe the mechanism/s of action of drugs used in Anemia Describe the types, doses of drugs used in Anemia Describe the side effects of drugs used in Anemia
Pathology	Describe Hematopoiesis and extramedullary Hematopoiesis	Describe Hematopoiesis . Describe extramedullary hematopoiesis

LINKER

[Table/Fig-6]: Concept of Co-relation (the Linker is any clinical case, problem, scenario, seminar etc. that connects objectives of related subjects within same/ across phases).

Template for Co-relation [Table/Fig-7]: The template of co-relation specifies the topic of Integration, Professional year, Targeted competency with its details, subjects co-related through a case/ linker, proposed linker, objectives that are to be co-related through linker, their teaching learning and assessment methods, Learning resource material and references.

Limitation(s)

This review limits its vision to comprehend integration strategies, as envisaged in MCI document on Alignment and Integration and suggests certain frameworks for smooth implementation of the same. The various challenges in planning and execution of integration, that essentially involves different subjects, multiple objectives, multiple domains of learning and varied instructional strategies are not addressed in this review.

Implication(s)

The four strategies of integration viz., Temporal co-ordination, Sharing, Nesting and Co-relation are all aimed towards connecting pieces of information together and minimise overlaps within the curriculum for the learner. The three templates, as presented in this manuscript can guide the teachers to plan integration in a structured manner and help the learners to find the association between various learning objectives and domains that goes on to fulfil a broad competency within a curriculum. These frameworks can serve as a guide for teachers (Teaching for Understanding (TfU), supported by Perkins' approach) [9] and learners as a ready reference document depicting integration of contents across the undergraduate medical curriculum.

Integration module template : CO-RELATION

Module no.: Topic :

a. Professional year :
b. Subjects correlated :
c. Targeted Competency details :

Subjects co-related	Competency no.	Competency	Domain	Level of competency	Core/Non-core

e. Subject-wise objectives those are chosen for Co-relation :

Subjects	Competency	Objectives
		1. 2. 3.
		1. 2. 3.

f. Linker/Clinical case (should have component of all concerned subjects):

g: Clinical material to be used :

f. Subjects & co-related objectives:

Subjects	Objectives co-related	TL method	Assessment type	Assessment tool
	1. 2. 3.			
	1. 2. 3.			

h. Learning Resource material:

i. References:

[Table/Fig-7]: 'Co-relation' Module Template (Copyright no. L-86554/2019, DMIMS Integration module template, Dr Tripti K Srivastava, Dr Lalitbhushan Waghmare).

CONCLUSION(S)

Integration is the key to holistic learning. It is reiterated that for a competency to materialise in its truest sense, integration of objectives across subjects and domains is the basic pre-requisite. The revised curriculum-CBME gives ample scope and space within curriculum to integrate contents, derive associations and establish relationships between isolated subject compartments. It offers a range of options for integration of contents aligned with the concept of Teaching for Understanding (TfU), supported by Perkins' approach. The choice depends on factors like the targeted areas of integration, views and experience of teachers, organisational structure and course outcomes.

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