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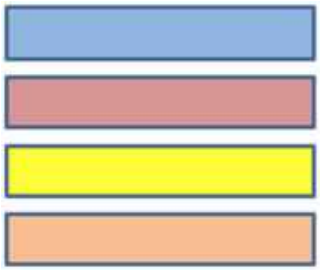
of Medical Council of India

COMPETENCY BASED UNDERGRADUATE CURRICULUM
FOR THE INDIAN MEDICAL GRADUATE

Knows Knows how Shows Shows how Performs

Describe Observe Demonstrate
Enumerate Assist

Counsel Prescribe



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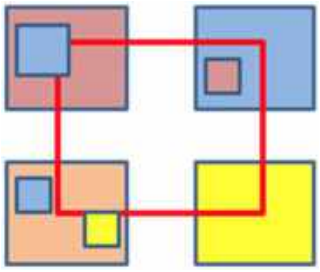

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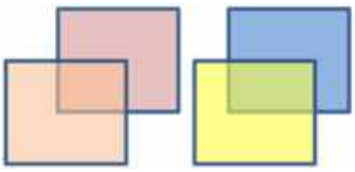

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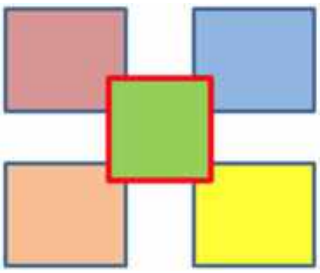

Interpret

Critique Collaborate

Module 4

Alignment and Integration

Clinician Communicator Team Leader Professional Lifelong Learner

Knowledge | Skills | Attitude | Values | Responsiveness | Communication

Curriculum Implementation Support Program

Alignment and Integration

Module for

Undergraduate Medical Education

Program

2019

Medical Council of India

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भारतीय आयुर्विज्ञान परिषद् के अधिक्रमण में शासी बोर्ड
BOARD OF GOVERNORS
IN SUPERSESSION OF MEDICAL COUNCIL OF INDIA

Foreword

Alignment and Integration

Subject based education has tremendous advantages. It provides learners with the opportunity to dwell deep into the learning matter and acquire strong fundamental concepts and the ability to build on it and attain scholarship. However, the unique needs of medical education necessitate both an understanding of "interconnectedness" between subjects and their ultimate application to the patient. In an attempt to address the need for enhancing the "wholesomeness" of education in the competency based curriculum while retaining the inherent strength and flavour of subject-based instruction, the Expert Group has recommended the use of two strategies: (a) alignment of related subject matter in a temporally coordinated fashion, and (b) use of three integration concepts that will enhance prior recall, application and emphasis of interconnectedness namely **sharing, nesting and correlation.**

This is a novel and challenging approach that has been suggested to further the goal of the competency driven curriculum that will require considerable planning, collaboration and team work amongst learners, teachers, planners and administrators in institutions. We believe that this investment is necessary to prepare learners to confront, adapt and be successful in the challenging environment of medical care. In addition to meeting the needs outlined, this approach will foster self - directed learning, team work, collaboration and inquiry. Importantly, the patient centricity that this approach will bring into the curriculum from year one will ensure that learners always have a connect with the ultimate goal of the MBBS program.

This booklet is intended to help institutions and teachers to design curriculum incorporating the approach suggested by the Expert Group. It is richly illustrated with examples on how to create an aligned and integrated timetable. We hope that this will be a useful guide.

We are grateful to the members of the Expert Group and the Academic Cell for painstakingly putting this booklet together. We hope that teachers and institutions will benefit from the suggestions provided herein and can successfully adapt and apply them into their own environment. We aspire to learn more and share with the nation the best practices that abound in all the medical colleges across the country. The ultimate aim of this exercise is to create a generation of doctors who will provide standard health care to the nation while becoming excellent scientists and scholars.

Chairman, Board of Governors

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Foreword

Alignment and Integration

This booklet provides a suggested pattern for alignment and integration of related competencies encapsulated in different subjects for teaching competency based MBBS program which commenced on August 1, 2019 across the country. Alignment of related topics to the extent feasible is a major thrust of the competency based curriculum. The Regulations in Graduate Medical Education 2019 (GMER 2019) also suggests integration to the extent of 20% of the subject-based curriculum through horizontal and vertical integration. This booklet is in alignment with the GMER 2019 part II document and provides institutions and curriculum planners a step by step approach to create a timetable for teaching, incorporating the principles of alignment and integration.

This booklet has been developed by experts invited by the Board of Governors in supersession of the Medical Council of India and incorporates their vast expertise and experience. The Council acknowledges their time and effort dedicated in creating this guide that can be used by institutions to develop their own learning process and content. Appreciation is also due to the efforts of the Academic Cell of the Council and faculty at the various Regional and Nodal Centres of MCI who worked tirelessly to ensure that the new competency driven curriculum and its various unique components are implemented faithfully and flawlessly across the medical colleges in this country from August 2019.

Vats

(Dr. R.K. Vats)
Secretary General

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Curriculum Implementation Support Program

Module – 4

ALIGNMENT AND INTEGRATION

Alignment and Integration

Introduction

The purpose of the MBBS program is to facilitate the medical student to become a primary caregiver to patients. Learning in the various basic and clinical science subjects is predominantly directed towards achieving this purpose. The volume and details required by the student to master each subject that comprises the overall MBBS program is considerable. Subject based instruction provides an opportunity for the student to acquire both vast and deep knowledge of each subject. This structure of instruction, however, may lead to lack of appreciation by the student of the inter-connected nature of knowledge in the various subjects, their relatedness, and importantly their relevance to patient care. Additionally study in silos alone may lead to redundancy in instruction.

Several innovative methods have been developed over the years to address these challenges including various levels of integration of instruction that diminishes and removes boundaries within subjects both horizontally in a phase and vertically across phases. While appreciating the value of these approaches, the proposed Graduate Medical Education Regulations (GMER) 2019 has sought to strike a balance that will retain the strength of traditional subject-based teaching and the reality of subject based assessment while providing the relevance, opportunity to understand the interconnectedness and reduce redundancy in the subjects being taught.

In order to achieve this, the MBBS curriculum will become a) aligned to the extent possible - meaning that as much as possible topics in different subjects in the same phase that have similar threads will be grouped together in the timetable and b) integrated to a limited extent both vertically and horizontally. The purpose of horizontal integration (within a phase) is to remove redundancy and provide interconnectedness. In the earlier phases, the purpose of vertical integration (across phases) is to emphasise the applicative use of the basic science concept taught. In the later phases, its purpose is to utilise and build on prior knowledge and emphasise the foundations of clinical practice.

This document is meant to guide institutions, Curriculum Committee, MEU members, and teachers on how to create a timetable that incorporates the principles that have been laid down above reflecting the spirit of the proposed GMER document 2019.

Objective

The participant must be able to:

Facilitate the development of an aligned and integrated curriculum in his/her institution as envisaged in the GMER 2019 document.

Glossary of terms used

For the purposes of this document -

Alignment implies the teaching of subject material that occurs under a particular organ system/disease concept from the same phase in the same time frame i.e., temporally.

Integration implies that concepts in a topic / organ system that are similar, overlapping or redundant are merged into a single teaching session in which subject based demarcations are removed. For the purpose of this document, topics from other phases that are brought into a particular phase for the purpose of reinforcement or introduction will also be considered as integrated topics. In the GMER 2019, time for integrated teaching is clearly demarcated.

Linker is a session that allows the learner to link the concepts presented in an aligned and integrated topic.

Curricular element or Program addressed

Alignment and Integration

Relevant Extracts from GMER 2019

10.1 Preamble: The salient feature of the revision of the medical curriculum in 2019 is the emphasis on learning which is competency-based, integrated and student-centered acquisition of skills and ethical & humanistic values.

Each of the competencies described below must be read in conjunction with the goals of the medical education as listed in items 2 and 3 of the GMER.

It is recommended that didactic teaching be restricted to less than one third of the total time allotted for that discipline. Greater emphasis is to be laid on hands-on training, symposia, seminars, small group discussions, problem-oriented and problem-based discussions and self-directed learning. Students must be encouraged to take active part in and shared responsibility for their learning.

10.2 Integration must be horizontal (i.e. across disciplines in a given phase of the course) and vertical (across different phases of the course). As far as possible, it is desirable that teaching/learning occurs in each phase through study of organ systems or disease blocks in order to align the learning process. Clinical cases must be used to integrate and link learning across disciplines.

Subject specific competencies with appropriate alignment and integration are available in the new competency based UG Curriculum document uploaded in the Medical Council of India website.

Description of the curricular program

Alignment

Teaching related systems or topics from different subjects in the same phase is strongly recommended. This is the principal method to be followed while creating the phase-wise timetable or calendar and is called alignment (see figure 1).

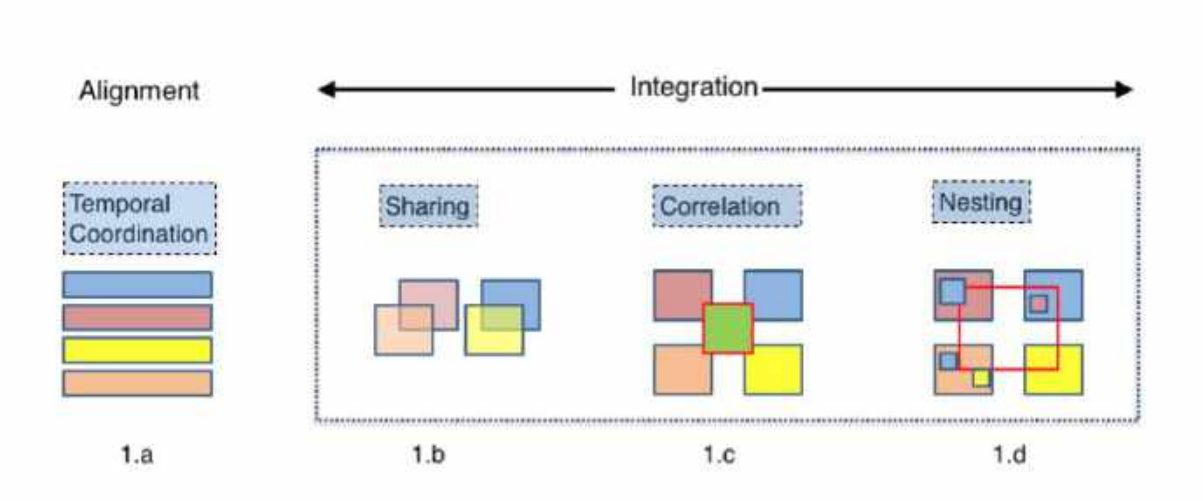


Figure 1: Integration concepts framed in the GMER 2019. Coloured boxes represent subjects. **1a. Alignment** - Temporal coordination: The timetable is adjusted so that topics within the subjects or disciplines which are related, are scheduled at the same time. **1b. Sharing**: Two disciplines may agree to plan and jointly implement a teaching program. **1c. Correlation**: The emphasis remains on disciplines or subjects with subject-based courses taking up most of the curriculum time. Within this framework, an integrated teaching session or course is introduced in addition to the subject-based teaching (green box with red border). **1d. Nesting:** the teacher targets, within a subject-based course, skills relating to other subjects *(Adapted from Harden R Med Edu 2000. 34; 551).*

Alignment is recommended for the majority of the curriculum allowing similar systems or topics in different subjects to be learnt separately but during the same time frame.

Aligning could be done as organ system based (figure 2a) or topic/disease based (figure 2b) or both (figure 2c)

Example: Syllabi in Cardiovascular system or Respiratory system in anatomy, physiology and biochemistry can be scheduled simultaneously in the timetable (figure 2a).

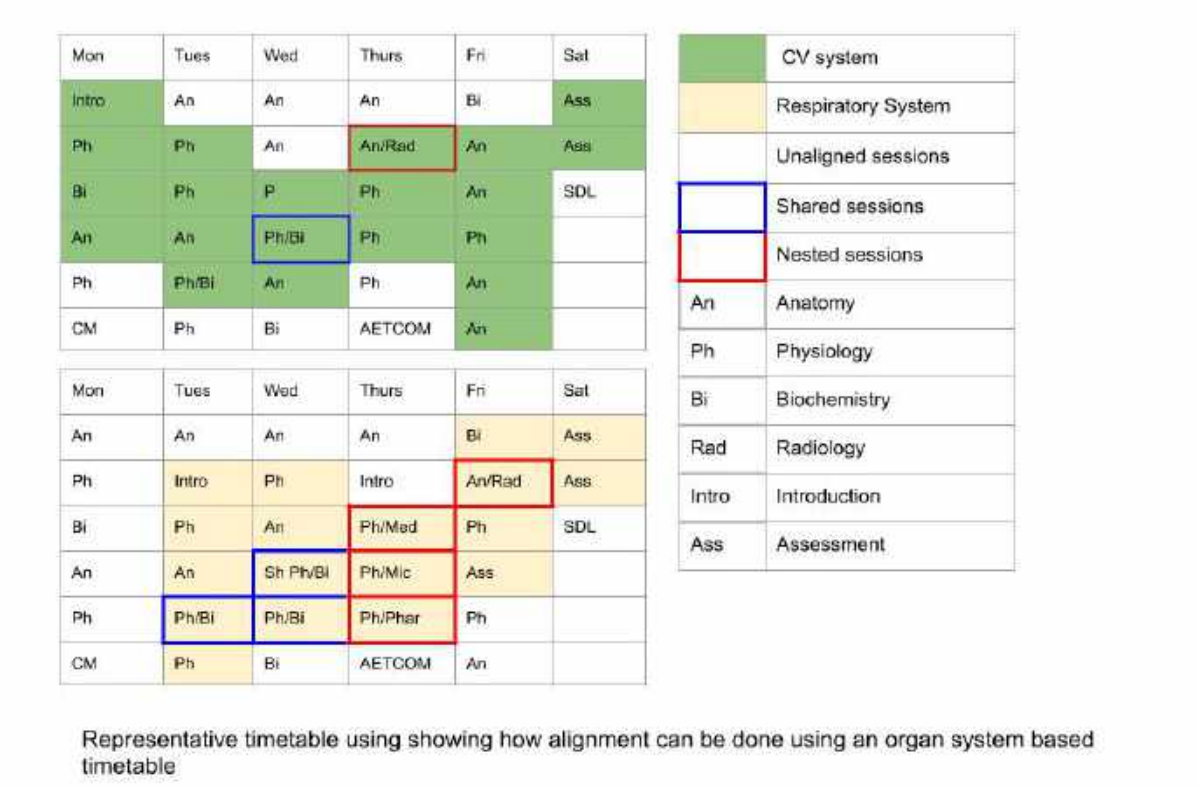
Example: A topic such as acute myocardial infarction or Tuberculosis can be created with the relevant learnings that will lead to the understanding of these topics

If desired, the major alignment can be organ system based with incorporation of some specific topics that will lend itself to integration (see below).

For eg. – In CV organ system the major alignment is with two topics, Acute Myocardial Infarction and Heart failure.

These topics or organ systems that are going to be aligned should be identified by the Curriculum Committee of the teaching institution and must be taught in an aligned fashion in each phase.

The method to derive topic objectives and sessions from competencies is outlined further in this booklet.



Mon	Tues	Wed	Thurs	Fri	Sat
Intro	An	An	An	Bi	Ass
Ph	Ph	An	An/Rad	An	Ass
Bi	Ph	P	Ph	An	SDL
An	An	Ph/Bi	Ph	Ph	
Ph	Ph/Bi	An	Ph	An	
CM	Ph	Bi	AETCOM	An	

Mon	Tues	Wed	Thurs	Fri	Sat
An	An	An	An	Bi	Ass
Ph	Intro	Ph	Intro	An/Rad	Ass
Bi	Ph	An	Ph/Med	Ph	SDL
An	An	Sh Ph/Bi	Ph/Mic	Ass	
Ph	Ph/Bi	Ph/Bi	Ph/Phar	Ph	
CM	Ph	Bi	AETCOM	An	

	CV system
	Respiratory System
	Unaligned sessions
	Shared sessions
	Nested sessions
An	Anatomy
Ph	Physiology
Bi	Biochemistry
Rad	Radiology
Intro	Introduction
Ass	Assessment

Representative timetable using showing how alignment can be done using an organ system based timetable

Figure 2a: Creating an aligned timetable using organ systems (six hours per day basis)

Mon	Tues	Wed	Thurs	Fri	Sat
An	An	An	An	Bi	Ass
Ph	Intro	An	An/Rad	An	Ass
Bi	Ph	PhBi	Ph/Med	An	SDL
An	An	Ph/Bi	Ph	Ph	
Ph	ECE	An	Ass	An	
CM	Ph	Bi	AETCOM	An	

Mon	Tues	Wed	Thurs	Fri	Sat
An	An	Intro	An	Bi	Ass
Ph	Intro	Ph	Intro	An/Rad	Ass
Bi	Ph	An	Ph/Med	Ph	SDL
An	An	BI	Ph/Mic	Ass	
Ph	ECE	Ph	Ph/Phar	Ph	
CM	Bi	Bi	AETCOM	An	

	AITO MI
	AITO Tuberculosis
	Unaligned sessions
	Shared sessions
	Nested sessions
An	Anatomy
Ph	Physiology
Bi	Biochemistry
Rad	Radiology
Intro	Introduction
Ass	Assessment

Representative timetable using showing how alignment can be done using a Aligned and Integrated Topic Based timetable

Figure 2b: Creating an aligned timetable using Topics

Mon	Tues	Wed	Thurs	Fri	Sat
Intro	An	An	An	Bi	Ass
Ph	Ph	Intro	An/Rad	An	Ass
Bi	Ph	PhBi	Ph/Med	An	SDL
An	An	Ph/Bi	Ph	Ph	
Ph	Ph/Bi	An	Ass	An	
CM	Ph	Bi	AETCOM	An	

Mon	Tues	Wed	Thurs	Fri	Sat
An	An	An	An	Bi	Ass
Ph	Intro	Ph	Intro	An/Rad	Ass
Bi	Ph	An	Ph/Med	Ph	SDL
An	An	Sh Ph/Bi	Ph/Mic	Ass	
Ph	Ph/Bi	Ph/Bi	Ph/Phar	Ph	
CM	Ph	Bi	AETCOM	An	

	CV system
	AITO MI
	Respiratory System
	AITO Tuberculosis
	Unaligned sessions
	Shared sessions
	Nested sessions
An	Anatomy
Ph	Physiology
Bi	Biochemistry
Rad	Radiology
Intro	Introduction
Ass	Assessment

Representative timetable using showing how alignment can be done using system based timetable with use of topics in each system to improve integration

Figure 2c: Creating an aligned timetable using organ systems and topics

Integration

Integration is a learning experience that allows the learner to perceive relationships from blocks of knowledge and develop a unified view of its basis and its application. The GMER 2019 applies these principles to the extent that will retain the strengths of subject based education and assessment while providing experiences that will allow learners to integrate concepts.

Keeping this in mind, the Regulations recommend the adoption of temporal coordination (called **alignment** in this document) as the major method to be followed allowing similar topics in different subjects to be learnt separately but during the same time frame (Fig 1a).

Example: Pancreatic Beta cell anatomy and histology, Pancreatic Beta cell physiology and Insulin structure and synthesis in biochemistry are usually taught at different times of the year. An effort is made to group these related topics in different subjects during the same time frame in the calendar (figure 3a and 3b).

In a small proportion - not to exceed 20% of the total curriculum an attempt can be made to **share** (figure 1b) topics or **correlate** (figure 1c) topics by using an integration or linker session. The integration session most preferred will be a case-based discussion in an appropriate format ensuring that elements in the same phase (horizontal) and from other phases are addressed.

Example: Since there is significant overlap in liver function in physiology and bilirubin metabolism in biochemistry - two departments could **share** sessions thereby reducing redundancy in what is being taught. (Note that it is not essential for two teachers to teach but it is important that the session is planned to ensure that the objectives of both subjects are achieved) (figure 3c).

As much as possible, the necessary correlates from other phases must also be introduced while discussing a topic in a given subject - **Nesting** (figure 1d).

Example: In a session on bilirubin metabolism a patient (a paper case is sufficient) with Dubin Johnson syndrome is **nested** as a short discussion to provide an understanding of what can go wrong, how does it manifest and what is the relevance and future application of learning bilirubin metabolism (figure 3e).

Care must be taken to ensure that achievement of phase based objectives are given primacy - the integrative elements from other phases are used only to provide adequate recall and understand the clinical application of concepts. It must be emphasised that integration does not necessarily require multiple teachers in each class. Experts from each phase and subject may be involved in the lesson planning but not it in its delivery unless deemed necessary.

Topics that cannot be aligned and integrated must be provided adequate time in the curriculum throughout the year. These concepts are summarised in table 1 and figure 3 (a-e).

Assessment will continue to be subject based. However, efforts must be made to ensure that phase appropriate correlates are tested to determine if the learner has internalised and integrated the concept and its application.

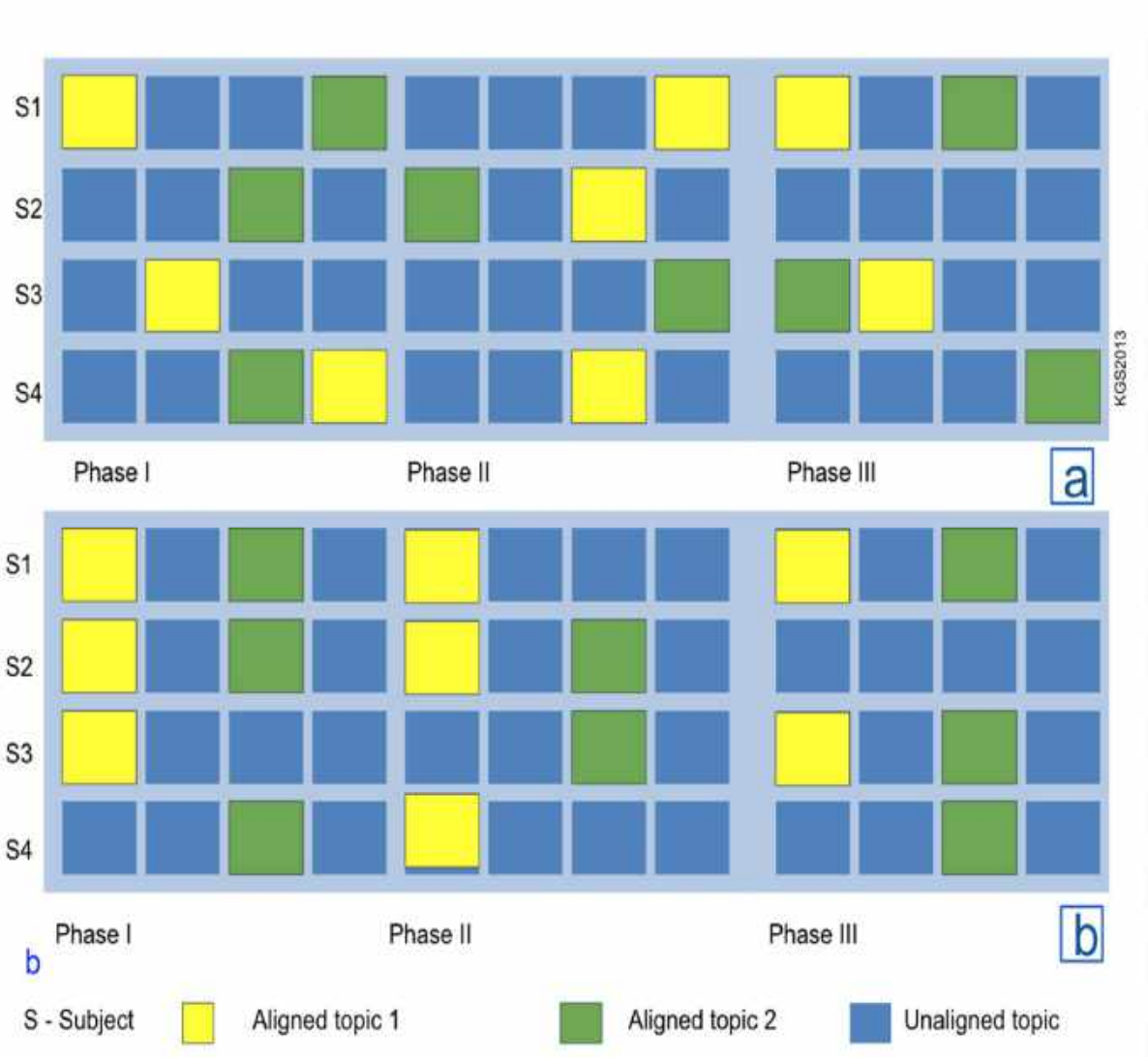
Table 1. Considerations for using alignment and integration in the curriculum

Competency /Objective	Same Phase	Different Phase
Cannot be aligned with a similar topic in a different subject eg. Lower limb anatomy and dissection	Teach separately	-
Can be taught together in different sessions in the same topic eg. Beta Cell histology in anatomy, Beta Cell function in physiology and structure and secretion of insulin, in biochemistry	Align	-
Can be taught in the same session in the same topic eg. Sharing - function of the hepatocyte, in physiology and bilirubin metabolism, in biochemistry eg. **Nesting** - Present the clinical features and laboratory data of patient with Dubin Johnson syndrome in a session on Bilirubin metabolism	Share	Nest
Can be used to link concepts taught in a particular topic eg. a patient with Type 1 Diabetes is used to understand the functions of the pancreatic islet - secretion and metabolism	-	Correlate

Figure 3: Pictorial illustration of alignment and integration concepts used in the GMER

Figure 3a: Traditionally topics which have the same core of ideas in different subjects are taught at different times.

Figure 3b: Alignment is teaching these related components of a topic from different subjects at the same time i.e, in a temporally coordinated fashion.



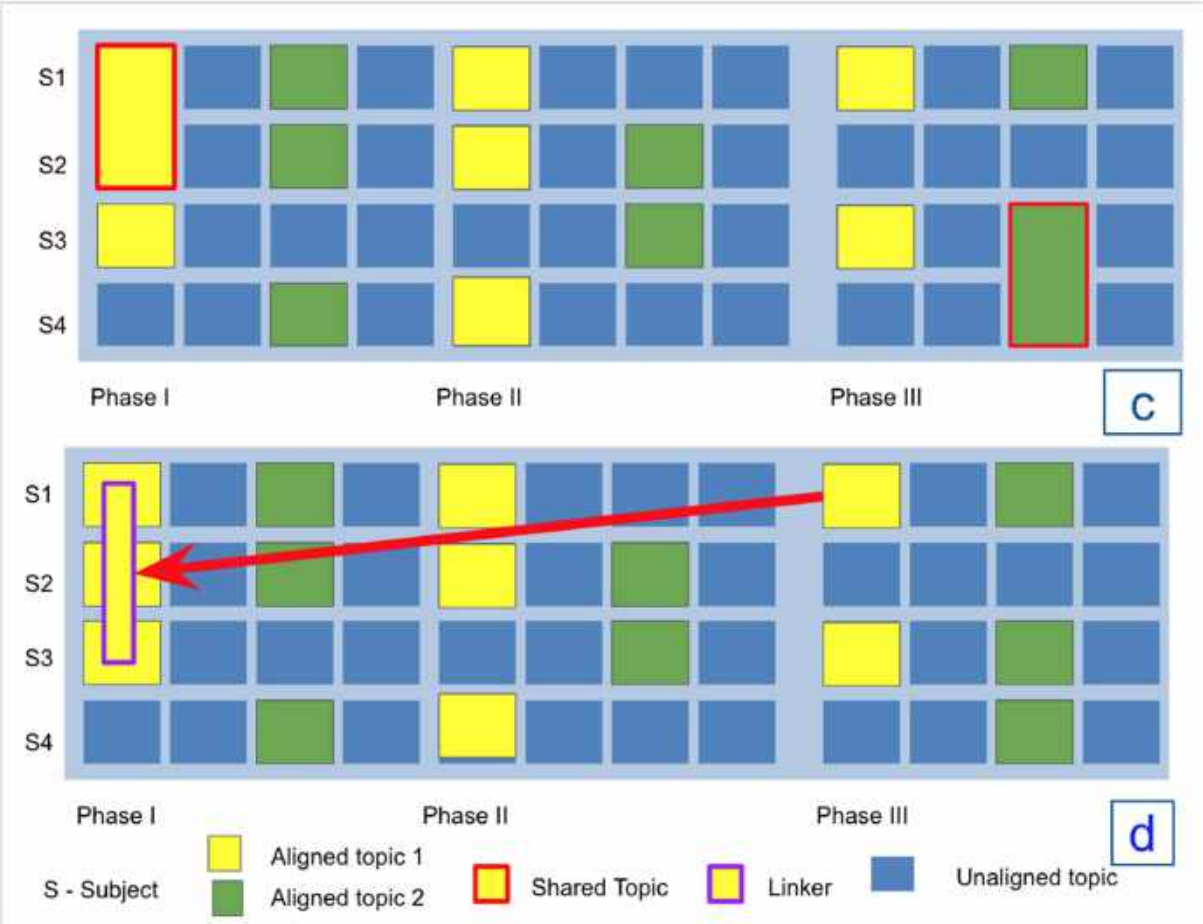


Figure 3c: Redundancy can be reduced by creating a session, merging session objectives from two or more subjects and creating a shared session (Box with red outline).

Figure 3d: Increased correlation can be achieved by using a Linker (Box with purple outline) - usually a case (with sufficient complexity) from the same topic from a higher phase is used to anchor the learning.

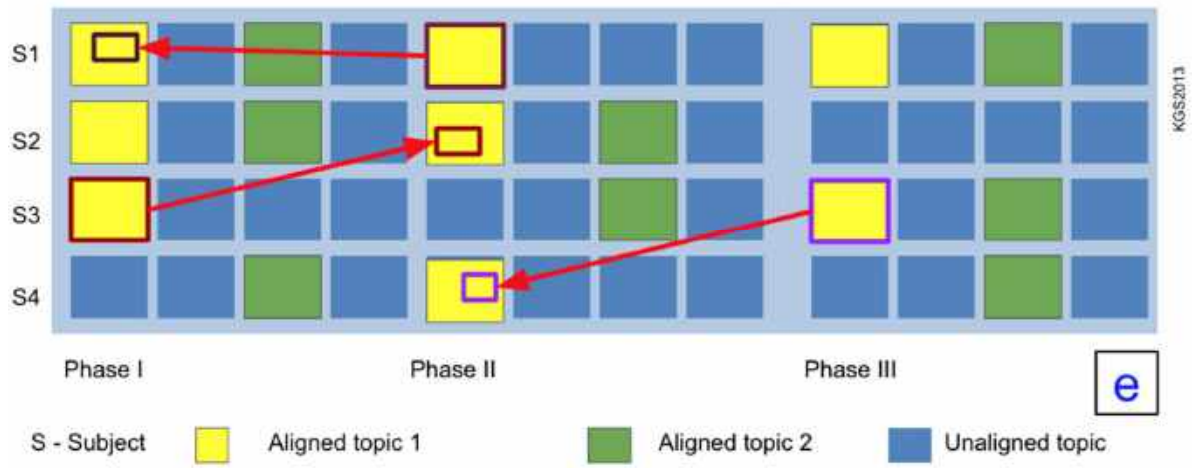


Figure 3e: Appropriate concepts from other phases can be brought into a phase: to increase relevance at a lower phase or increase prior recall or reinforce the fundamental basis at a higher phase. This is done by nesting some learning objectives from the topic in other phases into a learning session.

Steps in the development of Aligned and Integrated Topic (AITo) (Figure 4)

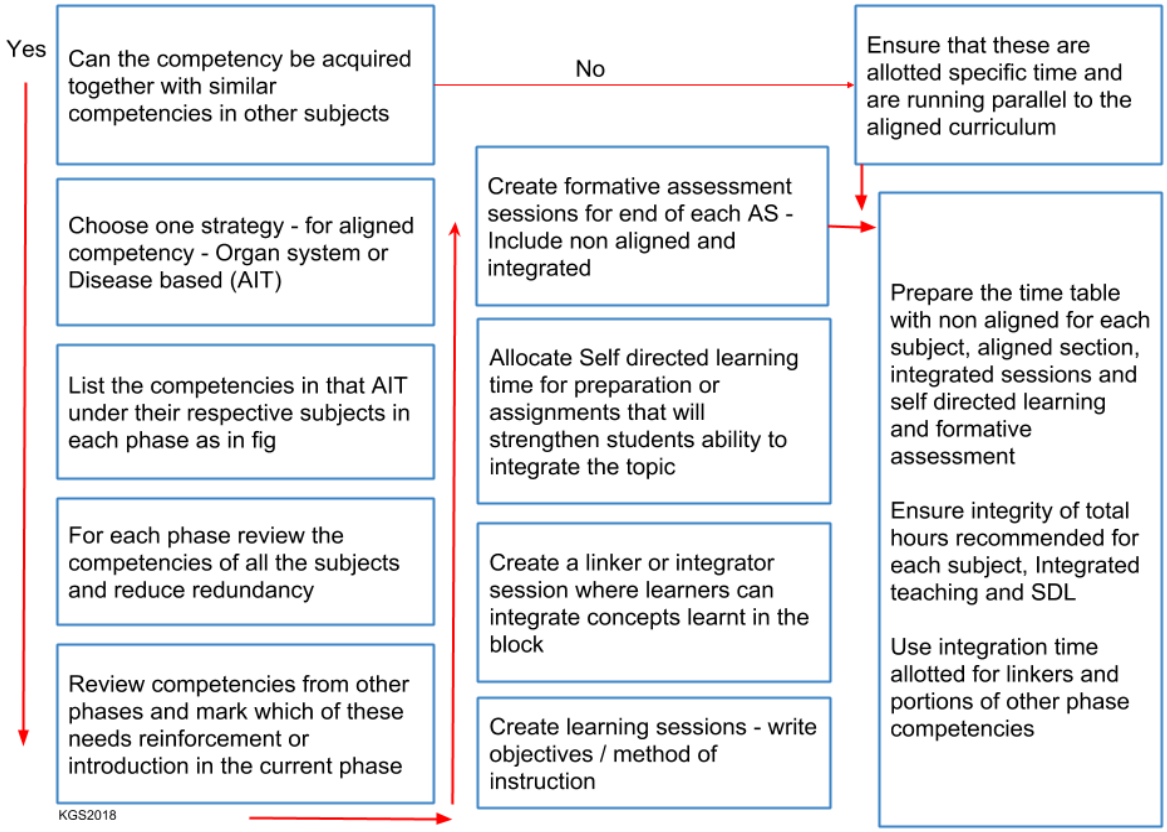


Figure 4: Overview of process to create an aligned and integrated topic

Step 1: Identify a list of topics or organ systems that will be accommodated in the timetable as aligned and integrated topics (AITo). Examples of such topics included: Anemia, Febrile illnesses, Trauma etc. are provided in Appendix 1 **of this book**. Examples of organ system are Cardiovascular System, Gastro-intestinal system, Endocrine system.

Step 2: From the subject-wise competency document book developed by the MCI, transfer the competences that address the topic into a template. Arrange these competencies according to phase and subject (see Appendix 3 for an example).

Examples for the topics are available in Appendix 1. A glossary to understand competency is available in Appendix 2. A comprehensive list of competency for the AITo Anemia is available in Appendix 3.

Step 3: For each competency, derive learning objectives, learning sessions and assessment methods.

a. A learning session is created by putting together a bunch of objectives that can be accomplished in the allotted time and/or require a similar method of instruction.

b. A bunch of learning sessions that are put together that address the topic from different subjects in the phase form an Aligned and Integrated Topic (AITo).

(See Figures 5-8 extracted from the Competency based UG curriculum document published by the Medical Council of India that illustrates this process).

Step 4: In each AITo of the phase, it is important to review competencies from the previous phase that will bear reinforcement in the current phase. Similarly, it is important to ensure that competencies in the next higher phases are reviewed to explore if some of these require introduction in this phase. Integration sessions allotted in each phase may be used to deliver these competencies.

a. By reviewing objectives / competencies in a phase, redundant ones and those in each subject that can be taught together without a subject demarcation can be identified for horizontal integration (**Sharing).**

b. Similarly, by reviewing objectives or competencies across phases, those with a common thread can be identified for vertical integration (**Nesting and Correlation**).

c. Objective writing and session planning must be done with teachers of all subjects involved in the aligned and integrated topic (AITo) and their inputs taken for the integrated session.

d. It is important to remember that ***the concept and not necessarily teachers*** have to be integrated. Using different teachers in each integrated session is nice but rarely required.

Step 5: Consider adding a **linke**r to each AITo. A linker, as defined above, is a session that aptly links the various related stand-alone elements represented in an AITo and helps **Correlate**. In the medical curriculum, the linker is most commonly a case. A case that is creatively written can be used in each phase (often the same case) to allow students to correlate what they have learnt and apply into understanding disease process, diagnosis and care. Using a case-based discussion in small groups will, in addition, encourage collaborative and self-directed learning. Using the case discussion at different time points in AITo, will allow students to reinforce and link concepts appropriately.

An example of creating learning sessions with objectives incorporating principles of alignment, sharing, nesting and correlation is illustrated in figure 9 (1-8).

Step 6: Ensure that adequate time for the AITo is created in the time table. It is important to consider the inclusion of an end of block assessment that will count towards formative/internal assessment.

Important: While creating the timetable ensure that topics in each subject that cannot be aligned are also taught simultaneously in each subject and that the timetable accommodates these topics appropriately.

An example of timetable incorporating an aligned and integrated topic is available in Appendix 4. The functions of the AIT team in collaboration with phase-wise Curriculum subcommittee and Curriculum Committee in creating the AIT is illustrated in figure 11 in the section on governance.

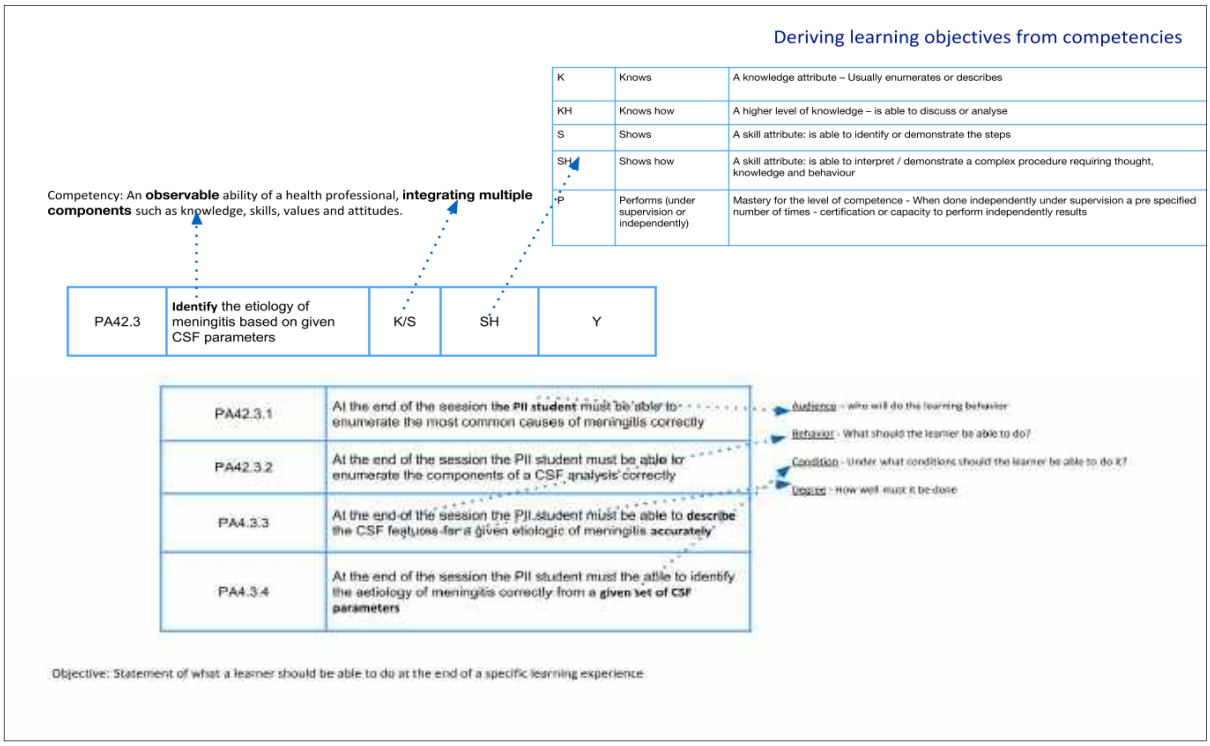


Figure 5 - Deriving learning objectives from competencies

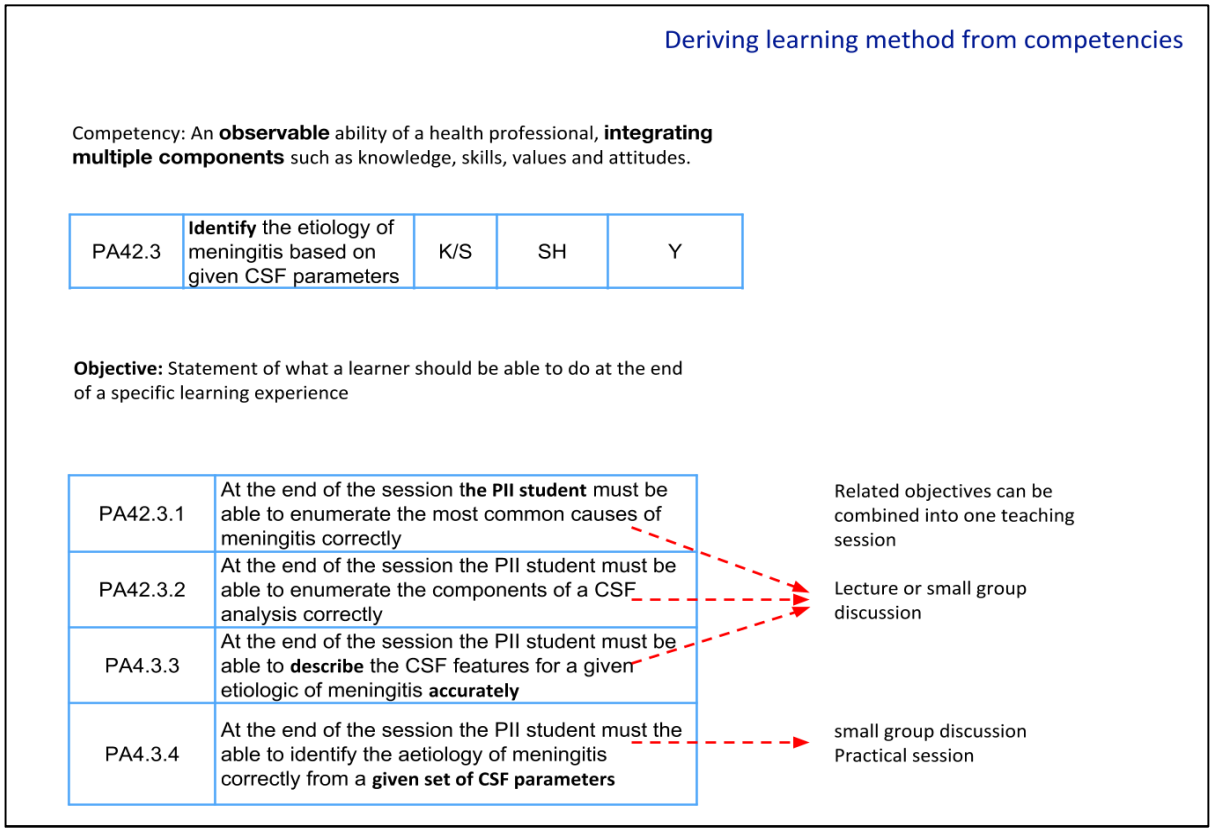


Figure 6. Deriving learning methods from competencies

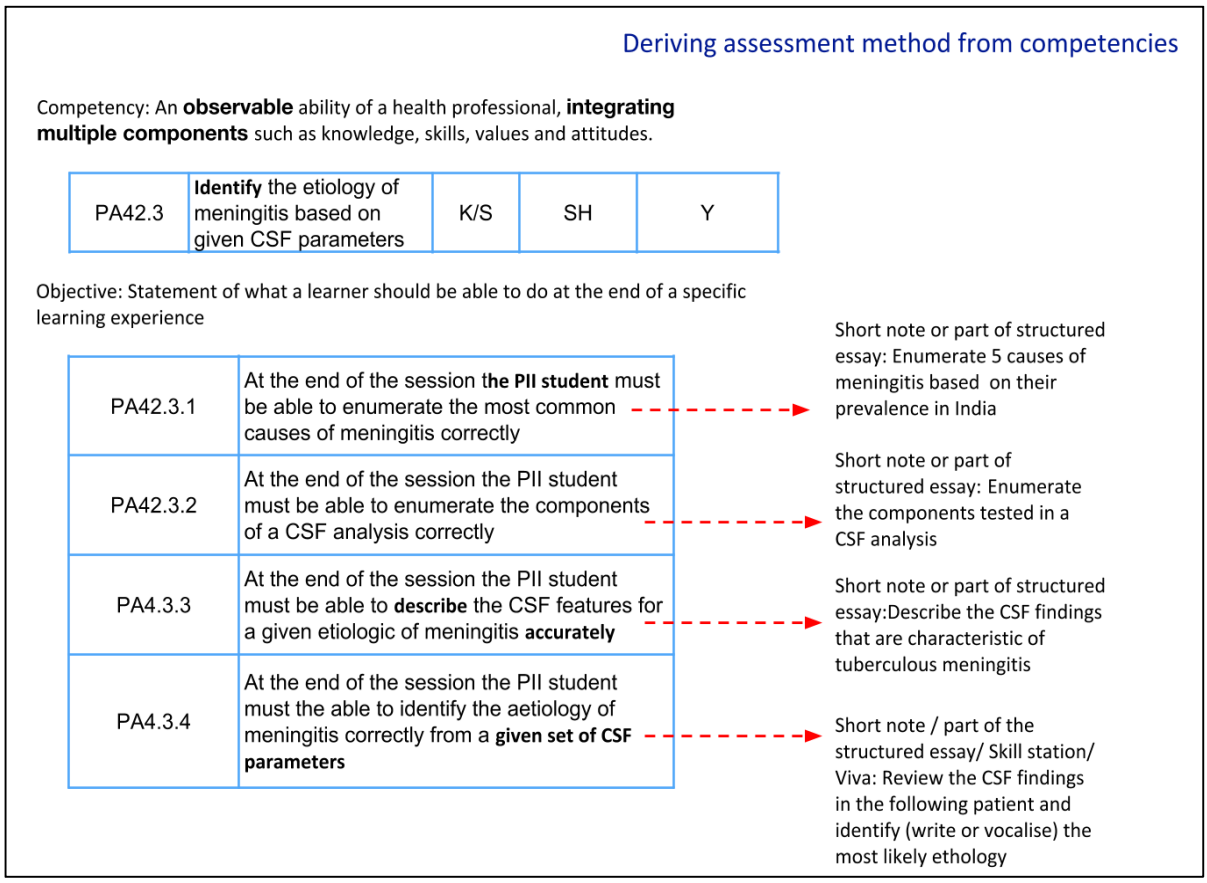


Figure 7: Deriving assessment methods from competencies

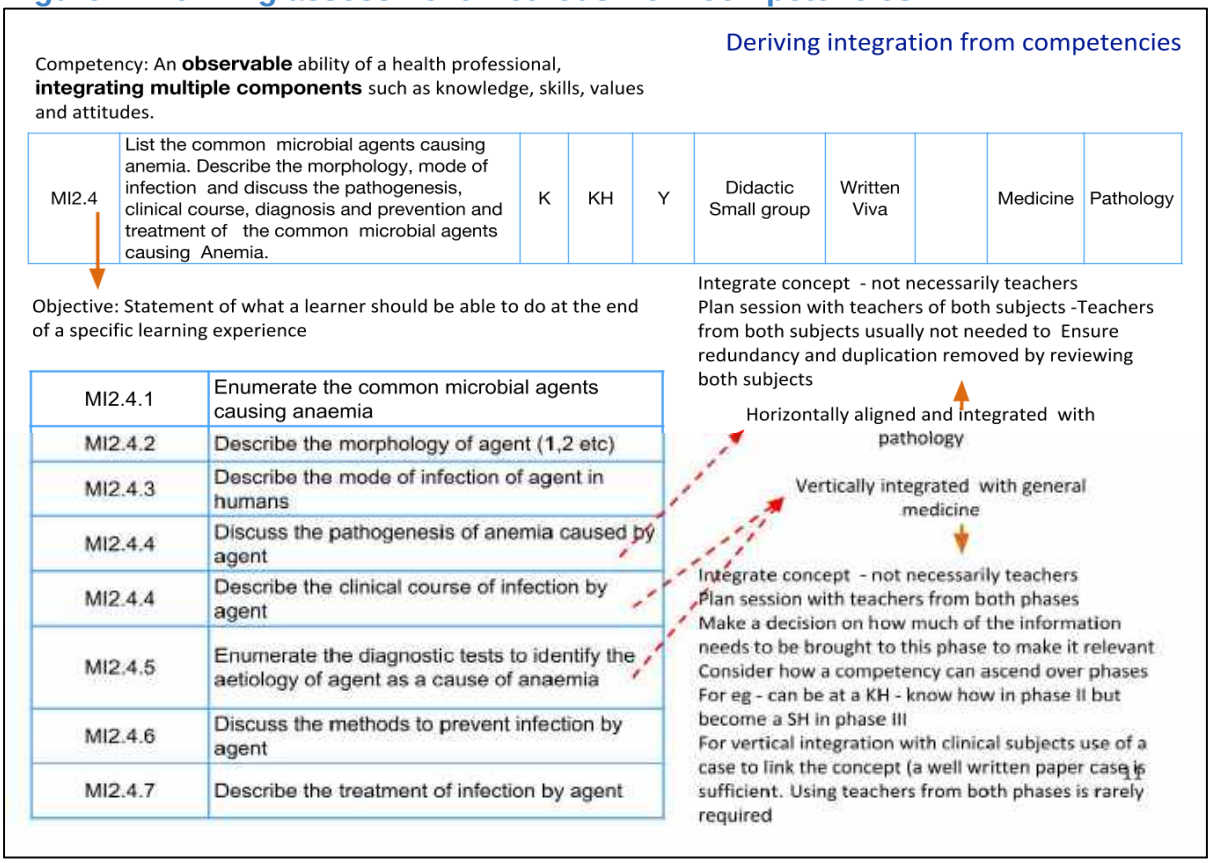


Figure 8: Marking objectives/ competencies for integration

Figure 9 (1-8) has used anemia as an example for creating an Aligned and Integrated topic.

Note: A comprehensive list of competencies for the topic anemia gleaned from the competency booklet is presented in Appendix 3.

For illustrative purposes only

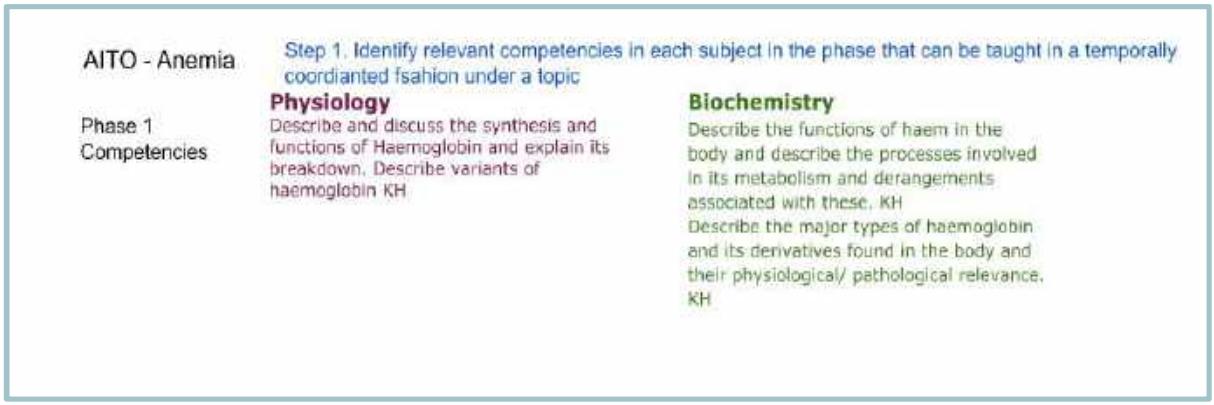


Figure 9.1 In this example two related competencies are identified from physiology (purple) and Biochemistry (Green) from the competency booklet

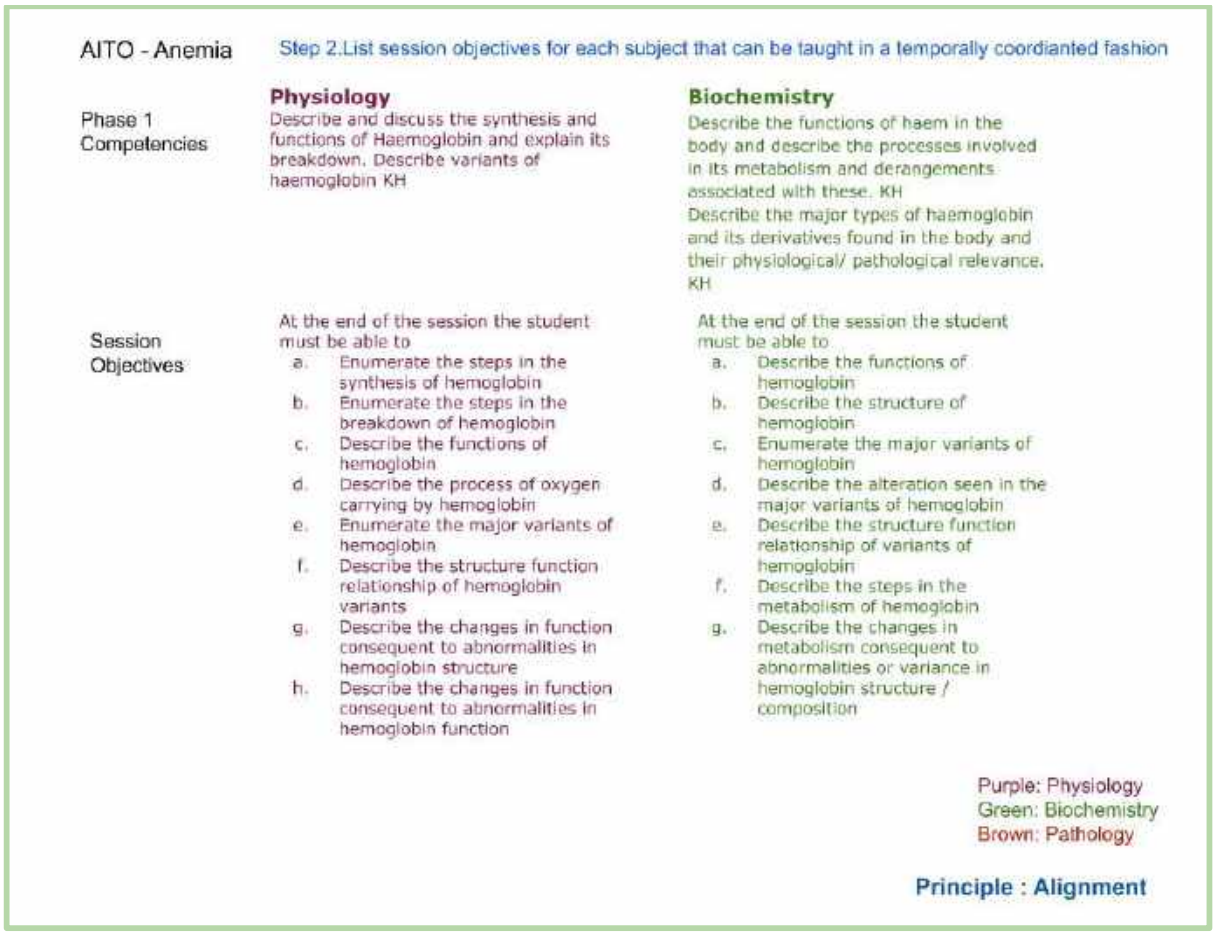


Fig 9.2 Session objectives are derived for each competency are identified

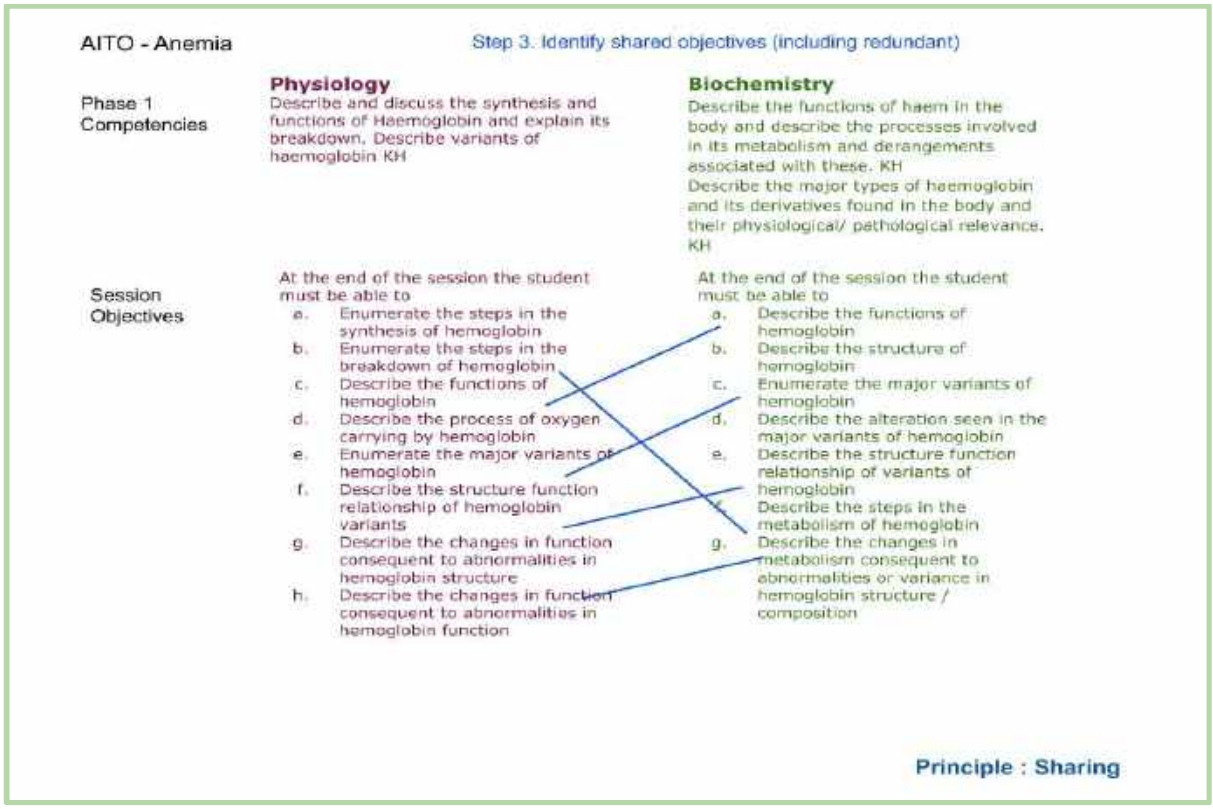


Fig 9.3 Objectives that are similar to both subjects are marked for redundancy and sharing

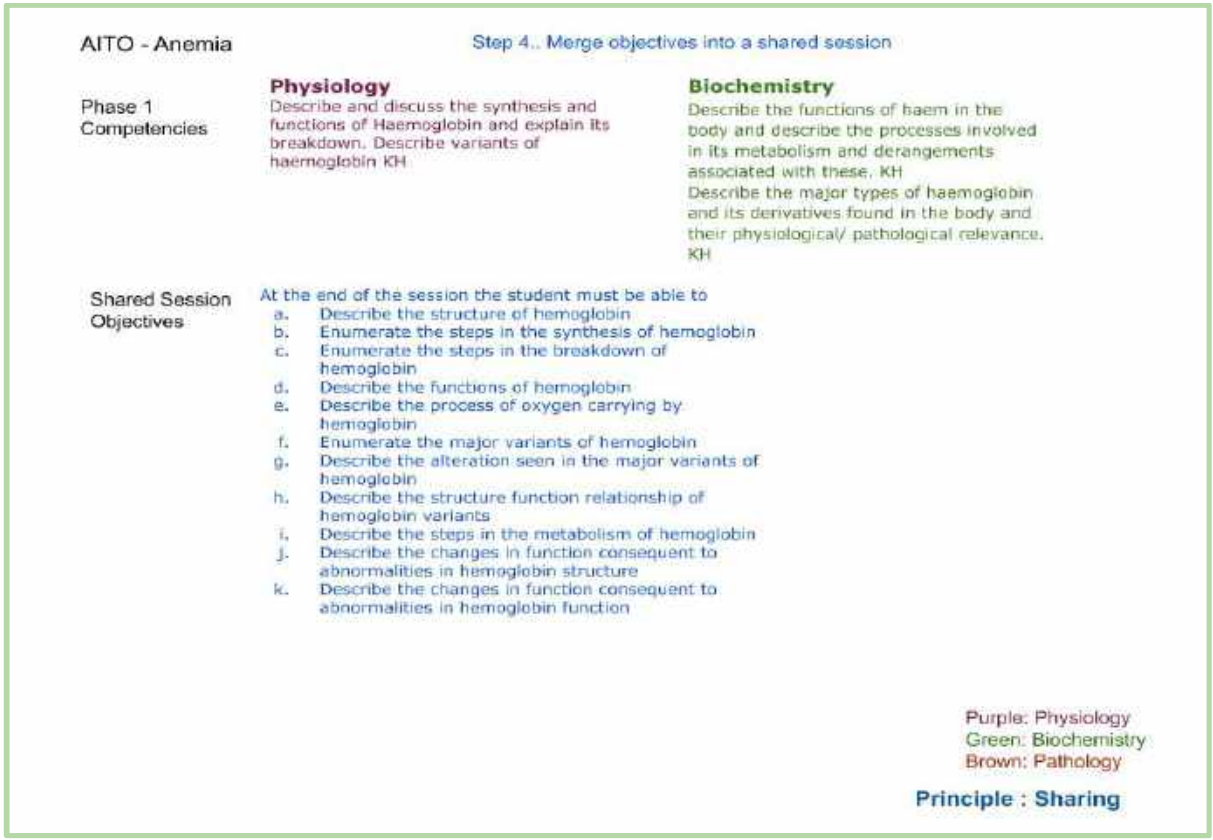


Fig 9.4 A new shared session is created merging the objectives from both subjects by removing redundancy

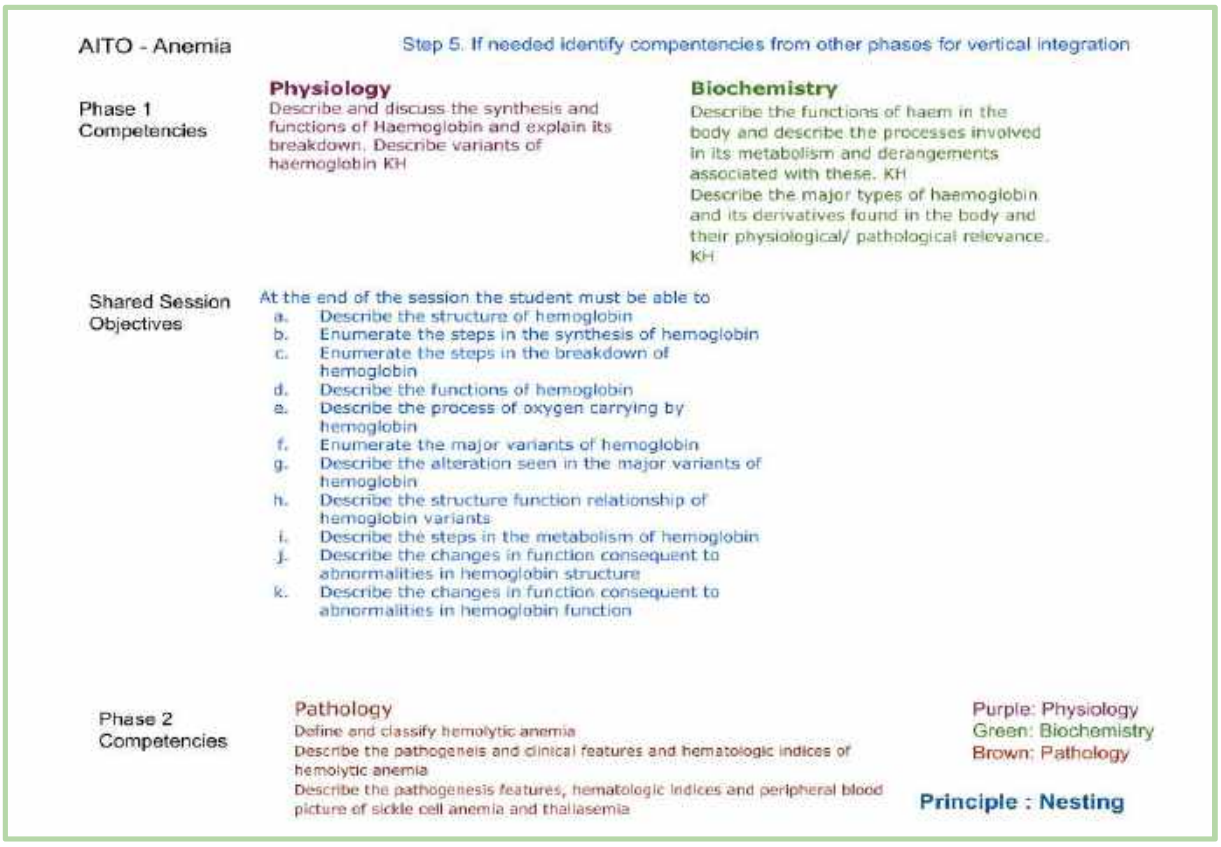


Fig 9.5 If desired, subjects from other phases are reviewed for competencies that will enhance the value of the learning session - in this instance a few competencies from pathology are brought into phase I to enhance the value of learning in the shared session.

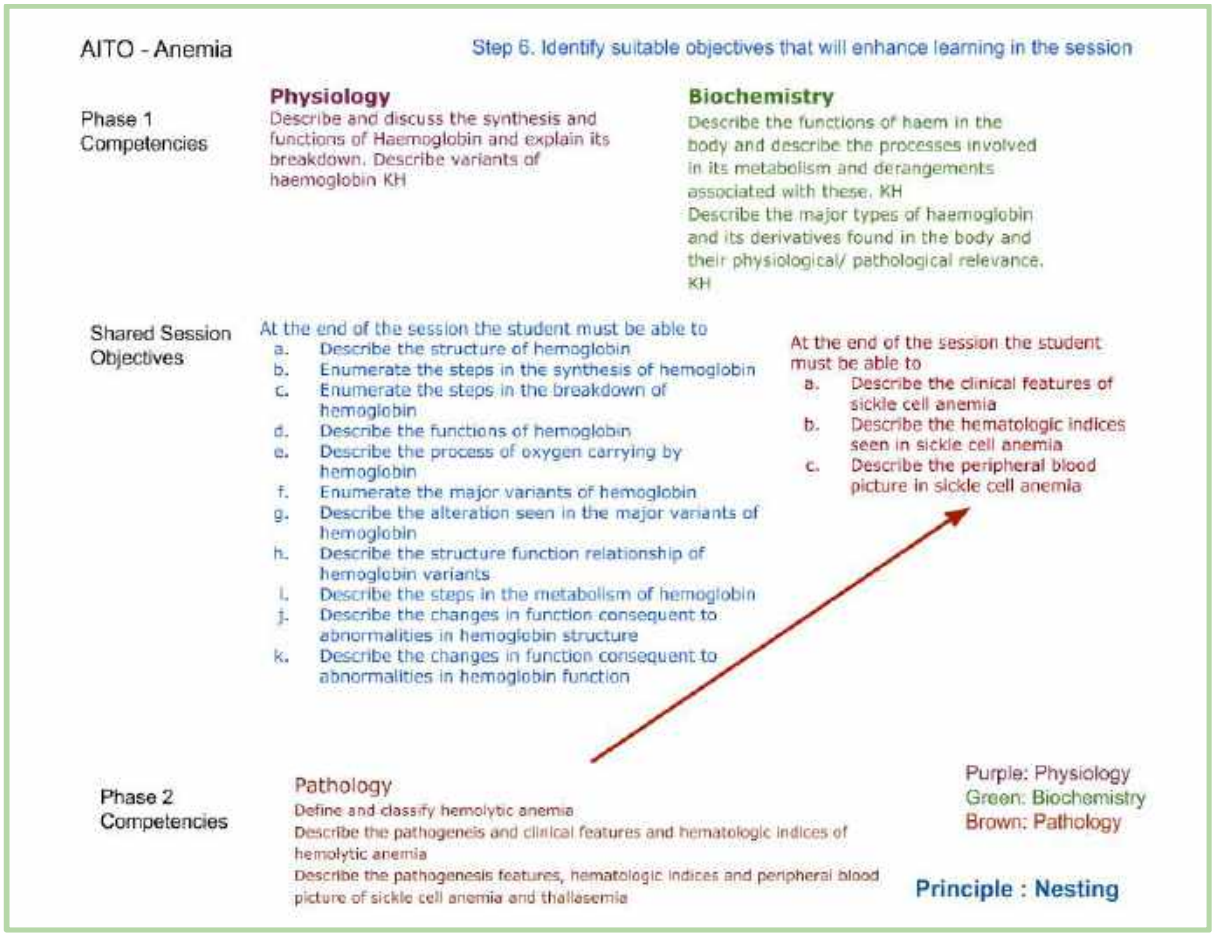


Fig 9.6 Objectives from the pathology (brown) competencies are listed

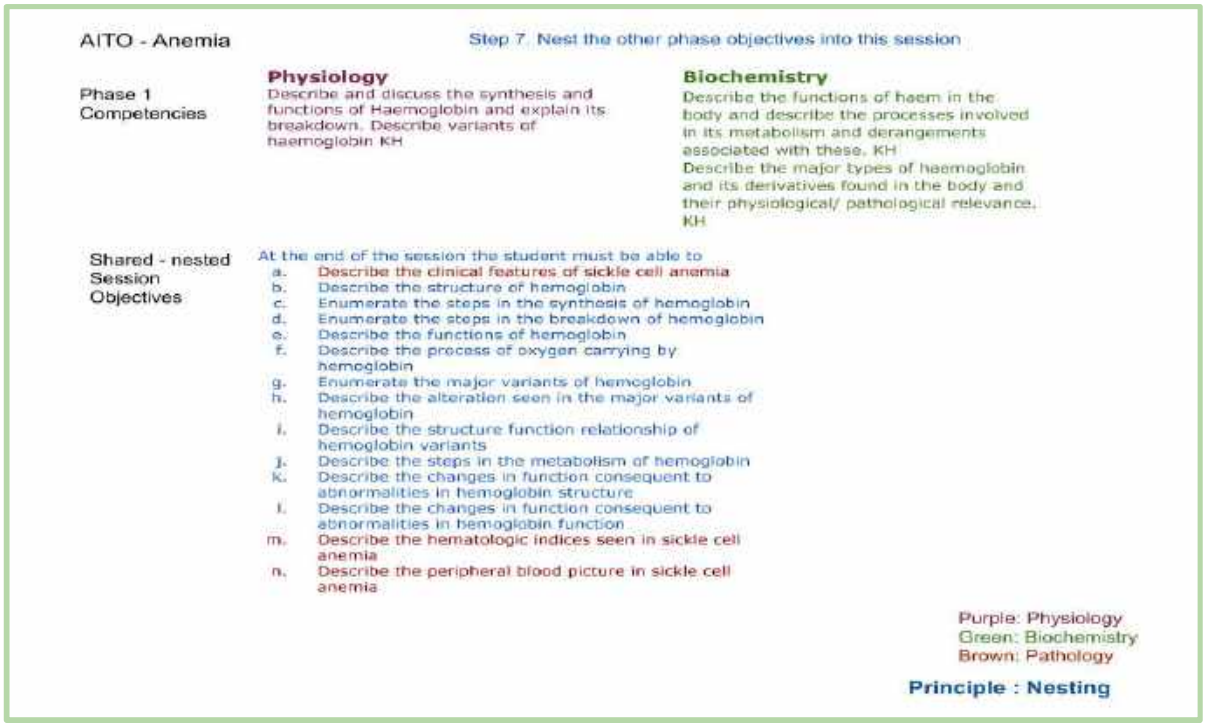


Fig 9.7: Selected objectives are “nested” to the shared session

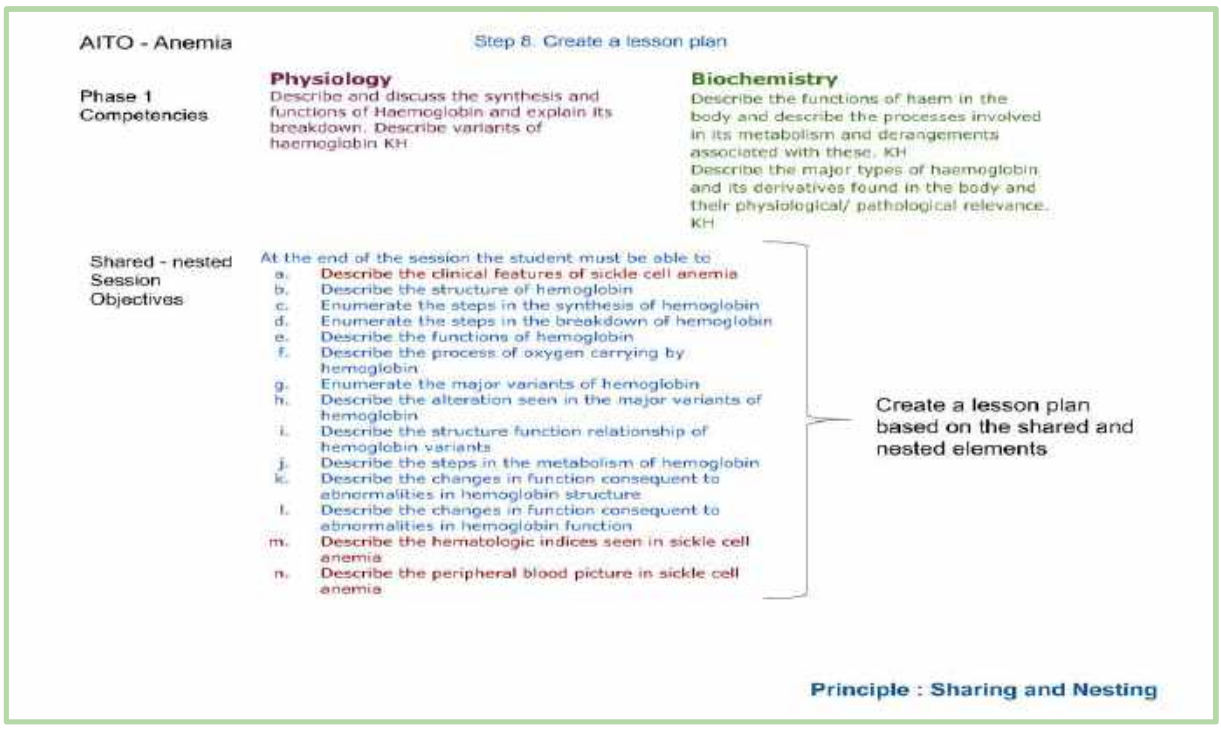


Fig 9.8 A lesson plan is created for the integrated session

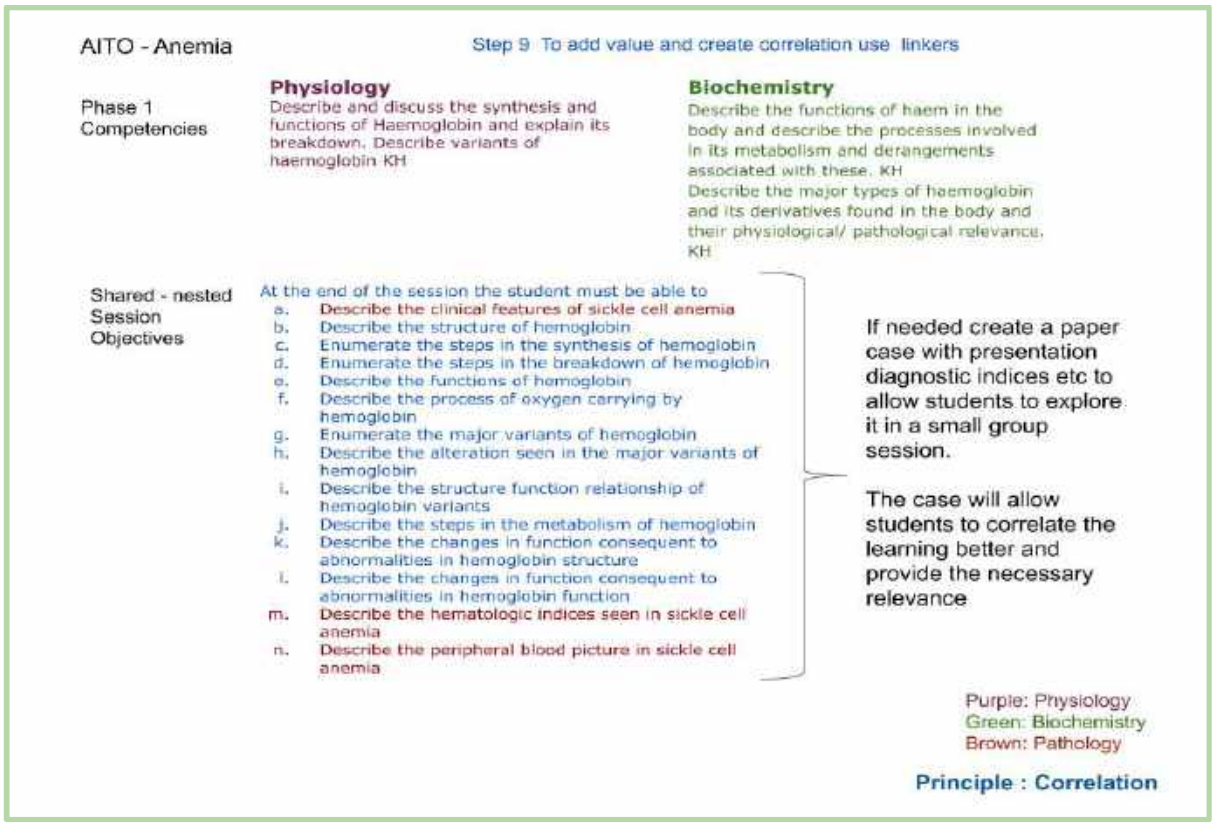


Fig 9.9 A paper case is often used as a linker to improve the relevance and allow greater correlation

Curricular Governance required to create and implement an Aligned and Integrated Curriculum

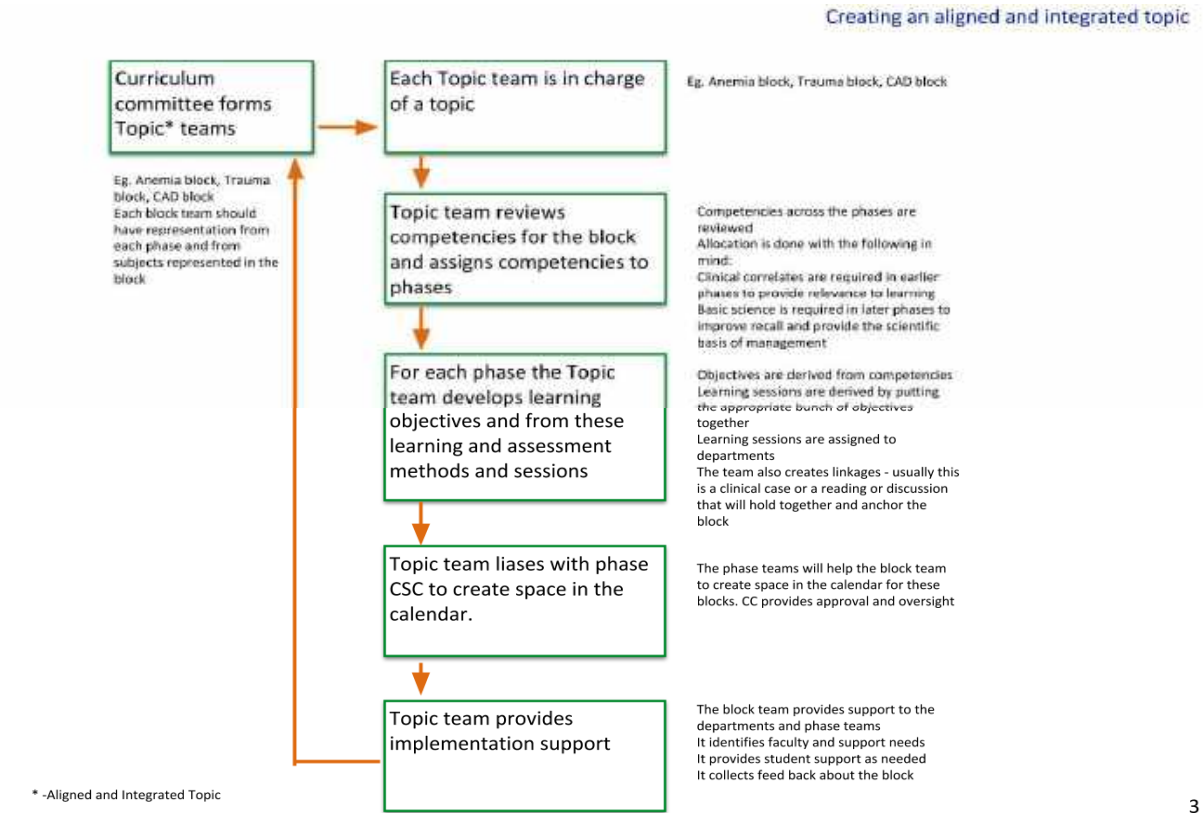


Figure 10: Steps and oversight required in development of Aligned and Integrated Topic

The development of an aligned and integrated curriculum will require significant collaboration from all stakeholders. In addition, curricular oversight will be required for its smooth implementation.

1. The Dean as the head of the institution and also as the Chairman of the Curriculum Committee will be responsible for the overall development, implementation and oversight of the curriculum.

2. The Curriculum Committee as constituted in accordance with the directives of the MCI will:

    a. Develop a strategy for creating and implementing the curriculum and providing oversight,
    b. Decide if the alignment will be topic or organ system based,
    c. Create a phase-wise Curriculum Subcommittee (PWCSC) to oversee the creation and delivery of aligned and integrated curriculum,
    d. Create and support topic teams which will develop objectives and learning sessions for each topic across the phases,
    e. Approve and release the annual timetable for each phase,

f. Liaise with the Medical Education Unit or Department for required faculty support.

3. The Phase-wise Curricular Sub-committees (PWCSC) may be constituted with heads of Departments or key faculty in each phase with adequate representation from other phases and reporting to the Curriculum Committee. The PWCSC should:

    a. Review competencies for each phase and convert them into learning objectives,
    b. Align the curriculum as much as possible and enlist help from other phases in creating necessary vertical integration and links,
    c. Reduce redundancy across the phase by integrating overlapping teaching elements,
    d. Develop learning and assessment methods for each phase,
    e. Prepare the timetable for the phase and present it to the Curriculum Committee for approval.

4. If needed, topic teams or Alignment and Integration (AIT) teams may be created. These teams will have at least one member from each department across phases and is responsible for delivery of the topics identified. The AIT team will:

    a. Create learning and assessment sessions of the Aligned and Integrated Topics (AITo) identified across phases,
    b. Represent the Aligned and Integrated Topic (AITo) to the phase-wise Curricular subcommittee and/or Curriculum Committee,
    c. Review competencies and develop learning objectives for the topic,
    d. Assign learning objectives to each phase and teaching session,
    e. Develop learning and assessment methods for the AITo,
    f. Help faculty with delivering session appropriately and in a collaborative manner across phases,
    g. Collect feedback for the AITo, and
    h. Provide student support.

Further reading

Required Reading

1. Ronald M Harden, The integration ladder: a tool for curriculum planning and evaluation, Medical Education 2000;34:551-557.
2. Alam Sher Malik & Rukhsana Hussain Malik, Universiti Teknologi MARA, Malaysia Twelve tips for developing an integrated curriculum". Medical Teacher 2011; 33: 99–104.
3. David G. Brauer & Kristi J. Ferguson 1, Washington University School of Medicine, USA, University of Iowa, USA; The integrated curriculum in medical education: AMEE Guide No. 96.
4. Integration of basic and clinical sciences - AMEE 2008 Paul Bradley and Karen Mattick, Peninsula College of Medicine and Dentistry, UK, https://amee.org/getattachment/Conferences/AMEE-Past-Conferences/AMEE-Conference-2008/Introduction-to-Medical-Education-Bradley-Mattick.pdf.

Additional reading

1. Gustavo A. Quintero, John Vergel, Martha Arredondo, Maria-Cristina Ariza, Paula Gomez & Ana-Maria Pinzon-Barrios, Integrated Medical Curriculum: Advantages and Disadvantages. Journal of Medical Education and Curriculum Development 2016; J Med Educ Curric Dev 3:S18920 (online).

Appendix 1

Examples of aligned and integrated topics (indicative)

Anemia
Jaundice
Diabetes
Thyroid Diseases
Nutrition
Febrile Illness
Tuberculosis
Malaria
Diarrhoea
Ischemic Heart Disease
Polycystic Ovarian Syndrome

Appendix 2

Understanding the competencies table

1	2	3	4	5	6	7	8	9	10
No.	**Competencies**	**Domain**	**K/KH/SH/ P**	**Core**	**Suggested Teaching Learning method**	**Suggested Assessment method**	**No req to certify P**	**Vertical Integration**	**Horizontal integration**
Physiology									
Summary **Name of Topic: General Physiology** **Number of competencies: (08)**							**Number of procedures that require certification: Nil**		
PY1.1	Describe the structure and functions of a mammalian cell	K	KH	Y	Lectures, Small group discussion	Written/viva			Biochemistry
GM25.4	Elicit document and present a medical history that helps delineate the aetiology of these diseases that includes the evolution and pattern of symptoms, risk factors, exposure through occupation and travel	S	SH	Y	bed side clinic, DOAP	Skill assessment		Community Medicine	

Unique number of the competency
First two alphabets represent the subject (see list)
Number following alphabet reflects topic
Number following period is a running number

Description of competency

Identifies the domain or domains addressed
K - Knowledge
S - Skill
A - Attitude
C - Communication

Identifies the level of competency required based on the miller's pyramid
K - Knows
KH- Knows How
S - Skill
SH - Show How
P - Perform independently

Identifies if the competency is core or desirable. Y indicates Core

Identifies the suggested learning method.
DOAP -
Demonstrate (by student) **O**bserve **A**ssist **P**erform

Identifies the suggested assessment method
Skill assessment - Clinics, Skills lab, Practicals etc

no of times a skill needs to be done independently to be certified for independent performance
Rarely used in UG

Subject(s) in other phases with which the competency can be vertically integrated to increase relevance or improve basic understanding

Subject(s) in the same phase with which the competency can be horizontally integrated or aligned to allow a more wholesome understanding

7

Appendix 3

How to choose competencies from different subjects in various phases for a given topic

(illustrative example)

Competencies for the topic anemia from various phases from the competency booklet volumes 1-3

Year	No.	Competencies*	No.	Competencies*	No.	Competencies*
1		**Physiology**		**Biochemistry**		
	PY2.1	Describe the composition and functions of blood components				
	PY2.2	Discuss the origin, forms, variations and functions of plasma proteins	BI5.2	Describe and discuss functions of proteins and structure-function relationships in relevant areas eg, hemoglobin and selected hemoglobinopathies		
	PY2.3	Describe and discuss the synthesis and functions of Haemoglobin and explain its breakdown. Describe variants of haemoglobin	BI6.11	Describe the functions of haem in the body and describe the processes involved in its metabolism and describe porphyrin metabolism.		
	PY2.4	Describe RBC formation (erythropoiesis & its regulation) and its functions	BI6.12	Describe the major types of haemoglobin and its derivatives found in the body and their physiological/ pathological relevance.		
2		**Pathology**		**Pharmacology**		**Microbiology**
	PA13.1	Describe hematopoiesis and extramedullary hematopoiesis	PH1.35	Describe drugs used in hematological disorders and discuss mechanism/s of action, types, doses, side effects, indications and contraindications, like 1. Drugs used in anemias 2. Colony Stimulating factors	MI2.4	List the common microbial agents causing anemia. Describe the morphology, mode of infection and discuss the pathogenesis, clinical course, diagnosis and prevention and treatment of the common microbial agents causing Anemia.

	PA13.2	Describe the role of anticoagulants in hematology		
	PA13.3	Define and classify anemia		
	PA13.4	Enumerate and describe the investigation of anemia		
3		**Medicine**		**Pediatrics**
	IM9.1	define describe and classify anemia based on red blood cell size and reticulocyte count	PE13.1	Discuss the RDA, dietary sources of Iron and their role in health and disease
	IM9.2	describe and discuss the morphological characteristics aetiology and prevalence of each of the causes of anemia	PE13.2	Describe the causes, diagnosis and management of Fe deficiency
	IM9.4	describe and discuss the genetic basis of some forms of anemia	PE13.3	Identify the clinical features of dietary deficiency of Iron and make a diagnosis
	IM9.5	elicit document and present a medical history that includes symptoms, risk factors including GI bleeding, prior history, medications, menstrual history, and family history	PE13.4	Interpret hemogram and Iron Panel

* List of competencies only representative, not complete.

Appendix 4 Sample time table with AIT

Time	Day1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	DAY 8
8-9 am	**Blood and its components by a Hematologist** Linker-Case 1 PY 2.1 Describe the composition and functions of blood and its components		Linker Part A of case 1 addresses PY 2.1 PY 2.2 PY 2.9 small group discussion + Formative assessment					Written Assessment PY 2.5 PA 13.3
9-10 am	**Blood groups , Principles of Blood transfusion and banking** PY 2.9 Describe different blood groups and discuss the clinical importance of blood grouping, blood banking and transfusion	**Blood groups , Principles of Blood transfusion and banking** PY 2.9 Describe different blood groups and discuss the clinical importance of blood grouping, blood banking and transfusion	**Erythropoiesis** - Linker part B PY 2.5 Describe RBC formation (erythropoiesis & its regulation) and its functions PA 13.1 Describe hematopoiesis and extra medullary hematopoiesis	**Role of Iron and Vit A B12 in Erythropoiesis** PA 14.1 Describe iron metabolism PA 15.1 Describe the metabolism of Vitamin B12 and the etiology and pathogenesis of B12 deficiency	**Heam synthesis and metab** PY2.3 Describe & discuss synthesis & functions of Hb & explain its breakdown. Describe Hb variants BI 6.11 Describe the functions of haem in body and describe the processes involved in its metabolism and derangements associated. Porphyrins	**Types of hemoglobin and their clinical significance** BI 6.12 Describe the major types of Hb and its derivatives found in body and their physiological/ pathological relevance.	**Physiology of Hemolysis and Anemia** PA 13.3 Define and classify anemia PY 2.5 Describe different types of anemias & Jaundice	Linker Part B of case 1 addresses PY 2.3 , BI 6.12 ,PY 2.9 , PA 13.3 small group discussion + Formative assessment
10 - 11 am 11-12.00	PY 2.9 Group A) Visit to the blood bank Group B) PY 2.11 Blood Grouping cross matching DOAP session	PY 2.9 Group B) Visit to the blood bank Group A) PY 2.11 Blood Grouping cross matching	**Peripheral smear examination** Group A PY 2.1 Describe the composition and functions of blood and its components OBJ A) Identify RBC , WBC and platelet in normal peripheral smear B) Discuss their functions Group B Visit to Hematology lab / Or ALC animation	**Physiology practical** Group A PY 2.11 Estimate RBC count and interpret normal Group B PY2.11 Estimate Hb, RBC indices and interpret PA 13.4 Enumerate and describe the normal blood parameters	**Physiology practical** Group B PY 2.11 Estimate RBC count and interpret normal Group A PY2.11 Estimate Hb, RBC indices and interpret PA 13.4 Enumerate and describe the normal blood parameters	**Physiology practicals** Group A PY 2.12 Demonstrate the tests for ESR, Hematocrit. Note the findings and interpret the results Group B PY 2.12 Demonstrate Osmotic fragility test . Note the findings and interpret the results	**Physiology practical** Group B PY 2.12 Demonstrate the tests for ESR, Hematocrit. Note the findings and interpret the results Group A PY 2.12 Demonstrate Osmotic fragility test Note the findings and interpret the results	Skill assessment PY 2.9, PY 2.11, PY 2.1, PA 13.4 ,PY 2.12
1-2 pm	**Plasma Proteins** PY 2.2 Discuss the origin, forms, variations and functions of plasma proteins	**Blood groups , Principles of Blood transfusion and banking** PY 2.1 ,2.2 PY 2.9 Formative Assessment Reflective exercise						Feedback-
2-3 pm	Non Aligned sessions in Anatomy					Radiological ANATOMY	Osteology	Remedial
3-4 pm						Surgical Anatomy	Surface Anatomy	
Submissions					PY 2.5 PA 14.1 PA 15.1 Assignment- 1 on Erythropoiesis and factors regulating	PY 2.3 BI 6.11BI 6.12 Assignment 2 on Haem synthesis and metabolism		