**ORIGINAL ARTICLE**

# Integrated Medical Curriculum: Design, Delivery and Assessment during First Two Years of Medical Education - A Review at AJK Medical College, Muzaffarabad, Pakistan

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## ABSTRACT

The popularity of the term ''integrated curriculum'' has greatly increased in medical education in past twenty years, but what the term actually implies and what should be its design, implementation, and evaluation system, is still evolving. Integration means to resolve and remove the subject and curriculum difficulties so that students can get better learning opportunities for development of relevant and meaningful knowledge, being well learned, retrievable, as a part of an ongoing lifelong learning process. It is necessary to further review and improve the integrated curriculum in medical education according to international demands. In addition, we need to evaluate the impact of an integrated curriculum on the learner particularly in first and second years of medical education. The exploding knowledge, fragmented teaching schedules, concerns about curriculum relevancy, and a lack of coordination and relationships among disciplines have all been cited as reasons for a move towards an integrated curriculum. This Guide is presented to assist educators in learning, implementation, and evaluation of a thoroughly integrated medical college curriculum particularly during first two years of medical education of students.

**Keywords:** Integration; Curriculum, Cognitive; Medical education; Learning theories

## INTRODUCTION

An integrated curriculum is defined as "system which cuts across different subject matters in a way that all aspects of the curriculum are designed in a meaningful association to focus upon broad areas of study." Discussion is going on to adopt discipline based or integrated medical curriculum[1]. In conventional methods of teaching medicine, students first get knowledge of basic medical sciences and then move to clinical sciences; but patients present not in this way. Most common drawback of this system is that students fail to apply knowledge of basic medical sciences to clinical practice, therefore it is more useful for students to get practical knowledge right from beginnings[2]. In vast majority of curriculum reforms, vertical integration combines basic and clinical sciences, early clinical experience, and incorporation of sciences in the later years of the course which is undoubtedly an advantage[3] whereas horizontal axis represents the defined learning outcomes. New trivium included three areas of analytical thinking into the curriculum: cognitive–linguistic skills, learning how to learn, and oral-written communication skills[4]. Furthermore, in the vertical integration axis, the basic/biomedical, clinical, socio-humanistic, and population health sciences were also merged[5]. It is of the view that such a change from the traditional learning mode towards new integrated learning model is more helpful for bringing medical curriculum closer to and more in line with the current health-illness concept. AJK Medical College was established in 2011-12 and it is a remarkable achievement for a institution in that, it is the first public sector medical institution, affiliated with University of Health Sciences (UHS), Punjab, in particular, which has adopted integrated undergraduate medical curriculum, right from its inception. Considering the diverse background of the new first year medical students coming from each nook and corner of Pakistan as well as from aboard; the orientation to new systems is mandatory. Most of the fresh students coming from traditional teaching system need to adapt quickly from passive to active learning system. The curriculum integration design was reformed adopting, strategies such as problem-based learning (PBLs), large group integrated studies (LGIS), small group discussions (SGDs) student-centered learning such as self direct learning (SDL) and direct self learning (DSL), community-based education and elective programs. In this article, particularly, more emphasis has been given on the integrated curriculum in the first and second years of medical education which integrates the basic sciences with clinical sciences through self-directed and small group case-based learning as well as interpersonal and communication skills. The current article, aims to present the design and implementation of the integrated curriculum at AJK Medical College particularly, in the past three years and to discuss the advantages and disadvantages faced in this endeavor

**Foundation module:** A foundation module of two weeks, exposes first-year medical students to issues regarding the role of the physician in society in prevention of disease in a population. The students acquire the lifelong skills to critically appraise and integrate the best evidence into clinical practice through the application of evidence-based medicine. They learn about epidemiology and biostatistics such as sources of error and bias in data, study design and the use of basic statistical procedures in the understanding of the medical literature. Moreover, the introduction to Information and Communication Technology (ICT), inter-personal Communication skills, history of medicine, professionalism and community interaction has been integral components of this module.

**Course modules:** During the first and second years of medical education, three basic subjects, Anatomy, Physiology and Biochemistry are taught to students. The syllabus of both classes, in the integrated curriculum, has been divided into three study blocks. Each study block has been further subdivided into two or three learning modules depending upon the specific block. In each block and module, anatomical, physiological and biochemical aspects of different human body systems are taught, simultaneously according to their importance, correlation and basic and clinical applications.

**Study guide:** Before start of each regular module, a study guide is published for introduction, help and guidance of

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students regarding ongoing module. The study guide, for each module essentially comprises of following components:

1. Module Team (chairperson, planner, coodinator, 4-6 members, ME and EXM members)
2. Rationale of the module
3. Table of specifications (TOS)
4. Learning objectives (LOs)
5. List of PBLs
6. Learning resources/visit of attached hospitals AIMS/SKBZH/Rehabilitation Centre
7. Skills Videos (department of medical education, DME on Request)
8. Dissection Videos
9. Pedigree symbols
10. Genetic counselling
11. Time table
12. Assessment plan
11. Recommended books
10. Trouble shooting

**Learning strategies:** Each module is composed of different study themes, having specific learning objectives. Different teaching modes are applied, which are briefly described below. Major emphasis is given on discussion, analysis and deduction, well guided by teaching faculty. Following learning/teaching strategies have been employed.

**Large group interactive sessions (LGIS):** Large group interactive sessions mostly of one hour duration, are conducted during each module to deliver major topics by senior faculty using modern and innovative tools of multimedia.

**Small group discussions (SGDs):** In small group discussions, spanning in two hours, whole class is divided into 5-6 small groups. Each group consisted of 15-20 students and is supervised by a faculty member. Students discuss, analyse, question and answer about different topics, which they could not understand properly during large interactive sessions. Moreover, each module theme has an associated case, which is also discussed by the passive learning mode. Depending upon the case, students might be required to deduce objectives or learning issues. Every group will have a facilitator assigned to it. Small group discussions will be followed by a wrap up session by senior faculty member.

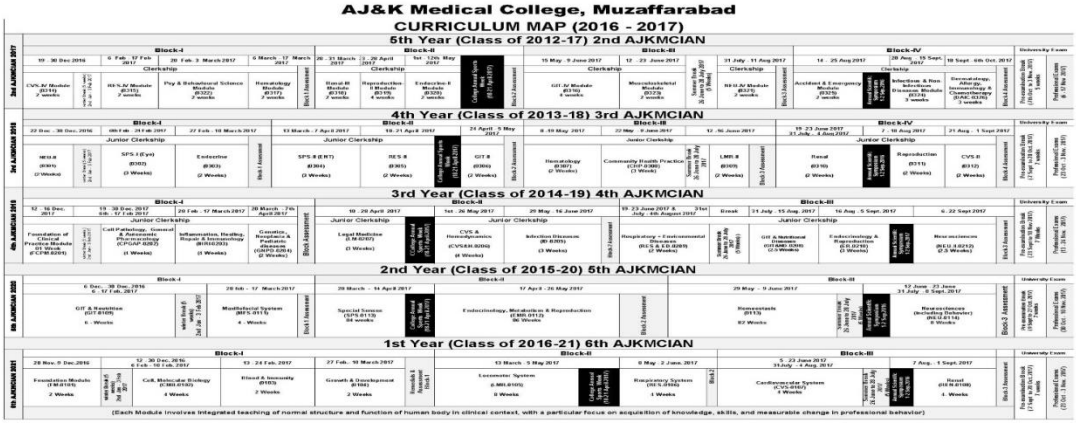
**Hands on activities/practical:** Practical activities, linked with particular modules and case, will take place. Students attend schedule Lab activities and perform different practical to correlate their theoretical knowledge through their practical performance in laboratory.

**Problem based learnings (PBLs):** Problem based learning is an unique method of learning which is being widely used now a days and is becoming highly popular among students. Each modules has been well designed to include specific case related clinical scenarios and problems. During ongoing module, in each week, two PBL sessions are conducted as PBL a, under guidance of a teacher and all aspects of a particular clinical problem are discussed with the students. In PBL b, different student groups are assigned a specific, case/PBLs and each group presents the case with the help of power point slides and then is discussed in the presence and guidance of a faculty member.

**Self directed learning (SDLs**): A few self directed learning topics (SDLs) have been added in between, their active studies to create an environment for students to search literature as well as to deduce and synthesize information from different sources to meet the learning objectives.

**Curriculum map:** All academic activity during whole year for each class is provided in curriculum map for the guidance, facilitation and smooth conduction of learning activity for both faculty and students.

**Syllabus division:** The First year and Second year MBBS syllabus has been divided into three study and assessment blocks. Each study block comprised of two or three modules. Duration of each module extends from 1 - 6 weeks depending upon importance of different study contents of three basic subjects, being covered in the integrated curriculum.




**First Year MBBS:** The three study blocks and their component modules, undertaken during First year MBBS class are summarized below.

**Integrated Block-1:** The block I for First year MBBS has been divided into three course modules:

**Module: 1 Cell & Molecular Biology (CMB)-4 wks:** Includes 5 basic themes; unit of life (20%), nucleus (25%), enzymes (10%) genetic abnormalities (20%), & cellular organelles & homeostasis (25%) It covers fundamental concepts about the structures and functions of proteins, genes and membranes along with basic principles of signal transduction in response to hormones and factors which control growth and differentiation. This module also covers histologic types of cells and tissues which provides the basis of histology in the integrated system modules.

**Module 2: Growth and Development (G&D) - 2 weeks:** Introduce students to embryology, physical development and dermatology. They learn how a single cell (zygote) divides, grows and differentiates into a complete human being, mechanism of fertilization and implantation, the germinal layers and their derivatives etc. The module includes 2 core themes; Early Human Development (70 %) and Basic and Specialized Tissues (30%),

**Module 3. Blood and Immunity (B&I)-3 weeks:** It integrates the basic science knowledge of the blood and hematopoietic systems with basic concepts of immunology and body defense mechanisms and consists of 5 main themes as; Composition of blood (25%), Coagulation Systems (20%), Blood groups & transfusion (15%), RES (15%), Immunity and Allergy (25%).

**Integrated Block-2**

**odule: 1. Locomotor System & Rheumatology Module (LMR)- 8 wks:** Unfolds the structure, functions, congenital anomalies, disorders, mechanisms and biochemical basis of neuromuscular transmission and drugs, neurotransmitters acting at this level. Moreover, core knowledge of osteology, common fractures, radiographs and histology is delivered through demonstrations on models, dissection of the limbs and study of different types of muscle and bone tissues under microscope. Clinical examination of musculoskeletal system is also performed by students. It Has five basic themes as: Neuro-skeletal system (20%), Locomotive apparatus & dysfunctions (15%), Painful Joints and Myopathies (20%), Painful and Numb limbs (30%), Hunched back (15%).

**Module:2. Respiratory Module (RES)-4 wks:** This module integrates the basic sciences into a study of the pulmonary system in both health and disease. Each of the basic science topics is incorporated into an integrated body of knowledge utilizing both didactic and self directed learning methods, and clinical models. It also includes the radiological and clinical examination of the respiratory system utilizing simulated patients and peers. It comprises of 5 basic and clinical themes as; Upper respiratory tract (15%), LRT and chest pain (20%), Breathlessness (25%), Rusty sputum (25%), Acclimatization (5%) and Periodic breathing (10%).

**Integrated Block-3**

**Module:1. Cardiovascular module (CVS)-4 wks:** Integrates relevant principles from anatomy, physiology, biochemistry, pathology, pharmacology and microbiology about normal circulation and its responses to the stress of injury and disease. Both expert directed and student directed methodologies are employed and a select set of clinical cases are used to guide students

1. Identify normal and abnormal findings in the heart and blood vessels on gross, microscopic and radiologic examination
2. General physical examination of CVS recognize common disorders
3. Examine the peripheral pulses and JVP
4. Record blood pressure Record and recognise normal ECGs.

The CVS module is composed of four important core themes as: Cardiac muscle and chest pain (25 %), Cardiac diseases, arrhythmias and ECG (25%), Circulatory system and its abnormalities (25%), Breathlessness with pedal swelling/shock (25%).

**2. The Renal and Reproduction module - 4 weeks:** Is based on six themes The BF Compartments & Edema (10%), Urine Formation by Kidneys - GFR, Tubular system (20%), Renal body homeostasis (20%), Renal disorders and diuretics (15%), Male reproductive system (15%), Female reproductive system, pregnancy and lactation (20%). Hazardous waste products, drugs, toxins, excessive amounts of water and electrolytes are excreted by kidneys and carried to the exterior through a system of tubular passages and reservoir. The Reproductive System, shares embryological development and reproductive passages with 'The Urinary Systems'. It makes one system more susceptible to many diseases affecting the other one. The Renal & Reproductive Module has better content and learning facilities and save some valuable time in curriculum.

**Assessment and Evaluations:** Students are regularly assessed by surprise quizzes and formative assessments. Comprehensive written assessment (SAQs &MCQs) is conducted at the end of each component module, whereas, regular viva & performance assessment (IPE) is held at the completion of each integrated block. The marks obtained in the written and IPEs in each block, contributes, to the Internal Class Evaluation, which is an integral constituent of Professional University Examinations and carries 30 % marks to all Professional Examination Awards held at end of each academic year.

**1st Professional MBBS, Written Assessment Distribution**

**Block - I**

| Module Name | % | Anatomy | | Biochemistry | | Physiology | |
|---|---|---|---|---|---|---|---|
| | | SEQs | MCQs | SEQs | MCQs | SEQs | MCQs |
| CMB | 45% | 0.5 | 05 | 2.5 | 35 | 0.5 | 05 |
| G&D | 25% | 1.5 | 10 | 0.5 | 05 | 0.5 | 05 |
| B&I | 30% | 0.5 | 05 | 01 | 05 | 2.5 | 25 |
| Total | 100% | 2.5 | 20 | 04 | 45 | 3.5 | 35 |

**Block -II**

| Module Name | % | Anatomy | | Biochemistry | | Physiology | |
|---|---|---|---|---|---|---|---|
| | | SEQs | MCQs | SEQs | MCQs | SEQs | MCQs |
| LMR | 60% | 4 | 35 | 0.5 | 10 | 1.5 | 10 |
| RES | 40% | 1 | 15 | 1 | 5 | 2 | 25 |
| Total | 100% | 5 | 50 | 1.5 | 15 | 3.5 | 35 |

**Block-III**

| Module Name | % | Anatomy | | Biochemistry | | Physiology | |
|---|---|---|---|---|---|---|---|
| | | SEQs | MCQs | SEQs | MCQs | SEQs | MCQs |
| CVS | 50% | 1.5 | 15 | 01 | 10 | 2.5 | 25 |
| Renal | 50% | 1.5 | 15 | 1.5 | 15 | 02 | 20 |
| Total | 100% | 3 | 30 | 2.5 | 25 | 4.5 | 45 |

**1st YEAR MBBS IPA DISTRIBUTION**

| Block | Anatomy | | Biochemistry | | Physiology | |
|---|---|---|---|---|---|---|
| | Static | Interactive | Static | Interactive | Static | Interactive |
| Block-I | 1 | 3 | 3 | 2 | 3 | 3 |
| Block-II | 3 | 3 | 1 | 2 | 3 | 3 |
| Block-III | 3 | 2 | 1 | 2 | 3 | 4 |

**Second Year MBBS**

**Integrated Block I:** The block I for second year MBBS has been divided into two course modules:

**1. Gastrointestinal and Nutritional Module (GIT) - 8 weeks:** The GIT module consists of 8 basic and clinical themes as; Dysphagia (10%), Dyspepsia (15%), Jaundice (15%), Acute Pancreatitis (10%), Acute Abdomen (25%), Diarrhea (10%), Lower GIT bleeding (10%), Inguino-scrotal swellings (5%). GIT disorders are most common cause of death in our society.

**2. Maxillofaciallary Module (MFS) - 4 weeks:** The MFS module is structured under six themes, each having its explicit LOs. The module themes include; Facial Trauma & Facial Asymmetry (40%), Facial Pain (5%), Cleft Lip/ Cleft Palate (10%), Odynophagia (5%), Neck Swellings (25%) and Neck Stiffness (15%). The MFS determines person's facial beauty and is an "intersection" for many organ systems. Facial and verbal communications (phonation, articulation, and resonance), falls in the domain of MFS. The MFS trauma due to multiple causes is major burden in ER of hospitals. ABCs of facial trauma involves; to secure **Airways**, ensure **Breathing**, maintain **Circulation** and provide safe reconstruction to maximize both functional and aesthetic rehabilitation. It is critically important for a young physician/Resident to follow the basic tenets of initial trauma stabilization, also known as the ABCs of Advance Trauma Life Support (ATLS), which can't be applied without "Know how" of MFS normal structure.

**Integrated Block II:** This is designed under two core modules.

**1. Special senses (SPS) - 4 weeks:** The module consists of 8 component themes which are; Watering eye (10%), Painful eye (10%) Diplopia (10%), Diminished vision (20% ), Deafness (20%), Vertigo (10%). Anosmia (10%), and Taste (10%). The SPS allows us to detect and analyze light, sound, and chemical signals in the environment and to signal the position of head. The present module has been designed to unfold the structural organization, functional and biochemical complexities and congenital and acquired anomalies of special senses with the help of real life scenarios.

**2. Endocrinology, Metabolism and Reproduction (EMR) - 6 weeks:** This module carries 8 integrated themes including; Short stature (15%), Polyuria and polydipsia (15%), Obesity (10%), Heat and cold intolerance (15%), Psychic moans (10%), Stress (10%), Infertility (15%). Nipple discharge (10%).

**Integrated Block III:** The block III carries two core modules.

**1. Homeostasis Module: 2 weeks:** This course module 6 integrated themes which are; Equilibrium (5%) Salt & Water Balance (20%), Temperature Control (20%) Acid-Base Balance (20%), Endocrines in Homeostasis (15%), Homeostasis Disruption and Management (20%). The term homeostasis is applied to the maintenance of the internal environment and regulation of normal standard values according to the age and sex of the organism.

**2. Neurosciences & Behaviour Module: 8 weeks:** This module is organised under 6 core themes which are; Spinal Trauma (10%), Stiff Neck with Fever (10%), Pain/Numbness/ Strokes and Rehabilitation (25%), Consciousness/Sleep/ Memory 25%), Emotional balance and support (20%), Higher brain centers (10%). The human nervous system is the most complex product of biological evolution and controls homeostasis. Research on the nervous system and rapid advances in this field, provides prospects of better prevention and treatment of many neurological disorders in the future. This module integrates horizontally the disciplines of Anatomy, Physiology and Biochemistry and vertically, it links with Paediatrics, Medicine, Neurology, Neurosurgery and Psychiatry. This module is designed to deliver the contents regarding neuroscience and behaviour in a clinical perspective. The special content of neuro psychiatry and behaviour sciences has also been added to the module which is upcoming new science in the world and yet unattended.

**2nd Professional MBBS -Written Assessment Distribution**

**Block - I**

| ModuleName | % | Anatomy | | Biochemistry | | Physiology | |
|---|---|---|---|---|---|---|---|
| | | SEQs | MCQs | SEQs | MCQs | SEQs | MCQs |
| GIT | 60% | 3 | 30 | 1 | 10 | 2 | 20 |
| MFS | 40% | 3.5 | 40 | 0 | 0 | 0.5 | 5 |
| Total | 100% | 6.5 | 70 | 1 | 10 | 2.5 | 25 |

**Block -II**

| Module Name | % | Anatomy | | Biochemistry | | Physiology | |
|---|---|---|---|---|---|---|---|
| | | SEQs | MCQs | SEQs | MCQs | SEQs | MCQs |
| SPS | 40 | 2.5 | 20 | 0.5 | 05 | 1.5 | 20 |
| EMR | 60 | 2 | 20 | 02 | 15 | 2 | 20 |
| Total | **100** | **4.5** | 40 | 2 | 20 | 3.5 | 40 |

**Block-III**

| ModuleName | % | Anatomy | | Biochemistry | | Physiology | |
|---|---|---|---|---|---|---|---|
| | | SEQs | MCQs | SEQs | MCQs | SEQs | MCQs |
| Homeostasis | 20 | 0.5 | 05 | 0.5 | 05 | 1.5 | 15 |
| Neurosciences | 80 | 04 | 40 | 0.5 | 05 | 3 | 30 |
| Total | **100%** | **4.5** | **45** | **1** | **10** | **4.5** | **45** |

**2nd YEAR MBBS IPA DISTRIBUTION**

| Block | *Anatomy* | | Biochemistry | | Physiology | |
|---|---|---|---|---|---|---|
| | *Static* | *Interactive* | Static | Interactive | Static | Interactive |
| Block-I | *4* | *4* | 1 | 2 | 2 | 2 |
| Block-II | *3* | *3* | 2 | 2 | 2 | 3 |
| Block-III | *3* | *3* | 1 | 1 | 3 | 3 |

## DISCUSSIONS

**Advantages of integrated:**

**Curriculum:** Interaction with students and examination results, have indicated, many advantages of an integrated curriculum. The present article, reviewed, only the most relevant advantages. These advantages were noted through curriculum assessment, using evaluation tools such as surveys of perception, interviews of students and different focal groups. One of the advantages of our integrated curriculum is a good perception of learning environment, by enrolled students, their satisfaction with the curriculum and their academic success[6]. A survey was conducted about perceptions of students to identify deficiencies in the learning atmosphere. The survey included 30 questions and the analysis of the survey, of first and second year students, revealed that about 80 % students expressed their complete satisfaction with study environment which implies that healthy educational environment increases learning abilities during medical school[7] than conventional model. The students of AJMC have shown outstanding results in First and Second Professional UHS examinations and have attained 94.6% results in First professional UHS Annual 2017 examination and 92.5% results in Second Professional UHS 2017 examinations, that is quite remarkable achievement. The curriculum reforms were useful to lower students' desertion rate from 35% to 1.4%, owing to positive perception and the mentorships implemented in the preclinical phase. Low attrition rate causes a significant reduction in economic and emotional costs for students, faculty, and society[8].

**Role of Medical Education and Examination departments:** Medical Education and examination department have played a vital role in organization of annual academic maps, synchronization of curriculum, preparation, arrangements and timely condition of written and IPE assessments. Well organised modular curriculum also proved helpful to minimises work load and anxiety and stress of examinations on students. They were well prepared, confident and showed excellent results in university assessments. The modular system is also time saving and provides more time for students for preparations of evaluations and assessments. When compared with other institutions, using more convention modes of medical education, it was observed with great satisfaction, contentment and pride that our students proved their mettle.

**Disadvantages of Integrated Curriculum:** New education models and reforms mostly entail resistance by those who oppose change[9] and there were no exceptions in this case. It was noted that modular curriculum, is more conducive in teaching for both faculty and students but poses some difficulties in assessment conduction which created some resistance by faculty and students in the begining. Another problem was shortage or non-availibility of trained faculty for the curriculum. One objection was raised by some, that "decreasing number of lectures by integrating medical curriculum and teaching in small groups, may miss mant y important topics, for students, which will affect the quality of medical teaching." These minor problems can be solved by more syncronized reforms[10]. Therefore, detailed module themes with course percentages and learning perspectives were inducted in the reforms and are reviewed each year by different module teams. Moreover, as students learn in different ways, just as different teachers deliver differently, multimodality techniques such as LGIS, PBLs, SGDs and SDLs, in curriculum design and delivery, may improve learning aptitudes[11]. One real challenge faced, is oraganised conduction of curriculum assessments and evaluations, which requires hard work, full cooperation, coherent and dedicated efforts by involved departments to design and implement mechanisms and schedule to hold well planned and comprehensive assessments of students. It is believed that the current curriculum approach will enhance learning and academic success.

## CONCLUSION

We assess that current model offers solutions to three common demerits of integration ensuring synchronous presentation of material, maintaining the importance of the basic sciences, and using unified definitions and outlined methods of evaluation to objectively address, curriculum's progress and effectiveness. We expect, this presentation will help and promote critical discussion among scientific educators in all fields to develop, implement, and evaluate modern integrated curricula in medical institutions around the globe with the aim of facilitating learners with the knowledge and skills required for the upcoming challenges of constantly evolving field of medicine.

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