

## Integrated undergraduate dental curriculum

Ashfaq Akram<sup>1</sup>, Ulfat Bashir<sup>2</sup>, Shahina Yasmin<sup>3</sup>, Kamran Sattar<sup>4</sup>, Sultan Ayoub Meo<sup>5</sup>

### Abstract

**Objective:** To develop a blueprint for producing an integrated undergraduate curriculum for dental schools in the region.

**Methods:** The study framework was designed at Islamic International Dental College- Riphah International University, Islamabad during May 2016-January 2017. Integrated curriculum was developed by using themes described as modules, such as organs, science of oral diagnosis, aesthetics and dental rehabilitation. Contents or topics from different disciplines having similar focussed learning outcomes were united in one particular module. Horizontal and vertical homogenisations of various modules were achieved by displaying them in a specific way on Bloom's ladder.

**Results:** All modules were free of boundaries of traditional subjects. For example, dental emergency was a theme (module) which carried assorted contents associated with dental emergency from endodontic, oral surgery, prosthetic disciplines etc.

**Conclusions:** The framework provided an outline and pattern to develop integrated undergraduate curriculum for dental schools.

**Keywords:** Basic sciences, Curriculum, Dental sciences, Dentistry, Integration, Module.  
(JPMA 69: 1330; 2019)

### Introduction

Discipline-based dental curriculum, known as 'traditional curriculum', is being followed in majority of dental schools in South East Asia region. The contents in subject-based curriculum are united according to subject boundaries. For example, human structures and their functions are taught in anatomy and physiology respectively. Despite the advancements in teaching strategies, especially in medical schools around the world, subject-based curriculum format still persists in many dental schools either as four- or five-year arrangement. Scarcity of curriculum specialists and insufficient infrastructure hinder this transformation from traditional to integrated curriculum. Rote learning (memorisation) of medical and dental theory-based knowledge in the first few years (the Basic Science years) followed by Clinical Science years, wherein the students again memorise clinical knowledge along with extensive clinical work, are prime concerns of the traditional dental curriculum.<sup>1</sup> In many dental schools of the region, a four-year undergraduate dental curriculum model has been

the norm with no change until now. Basic Sciences are taught in the first two years and dental skills are introduced in the 3rd and 4th years of the programme. Forgetting the basic dental knowledge by learners in clinical years is one of the great and vital pitfalls of the traditional curriculum. This is regarded as inadequate curriculum to produce future dental doctors who are lacking substantial psychomotor skills to perform a wide range of dental procedures for diversified patients.<sup>2,3</sup> Attaining dental skills and retention of knowledge are achieved by breaking down the bar between Basic and Clinical sciences.<sup>4</sup> There is a need for dental surgeons to possess safe and comprehensive skills with deep understanding of dental sciences and an exemplary attitude.<sup>5</sup> Integrated medical curriculum, having been introduced in 1984, was supported and accredited by international organisations.<sup>2-8</sup> Dental education is a new norm and there is a scarcity of professionally-trained personnel. The traditional academicians are not sure how to achieve this marriage of Basic and Clinical sciences and thus are unable to develop integrated dental curriculum. Dental physicians possessing application of knowledge, proficiency of basic skills and exemplary behaviour are the needs of today's environment.<sup>4,5</sup>

1,2,3Islamic International Dental College, Riphah International University- Pakistan; 4Medical Education, King Saud University- Saudi Arabia; 5Department of Physiology, College of Medicine, King Saud University, Riyadh-Saudi Arabia.

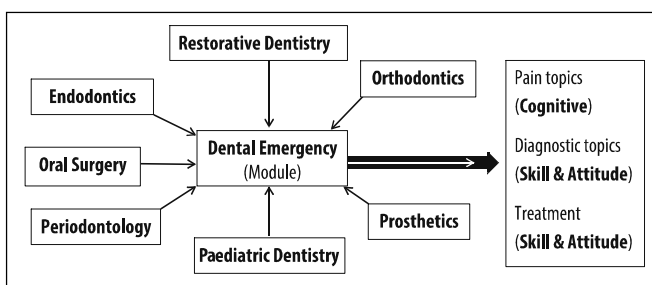
**Correspondence:** Sultan Ayoub Meo. email: sultanmeo@hotmail.com

The current study was planned to construct a theoretical blueprint to develop an integrated undergraduate dental curriculum.

### Materials and Methods

The study framework was designed at Islamic International Dental College- Riphah International University -Islamabad during May 2016 - January 2017. Dental-oriented and medical-manifested themes were put together in a specific fashion on Blooms learning ladder.<sup>9</sup> Medical science, fundamental dental science, dental simulated treatment, clinical dental science, ethics and professionalism, society and dental services, scientific investigations, data analysis, entrepreneurship and pre-specialisation were the major themes representing contents taken across the boundary of various traditional dental disciplines. Module formation 'dental emergency'

was taken as an example (Figure). Each theme was further divided into segments called module.



**Figure:** Topics of traditional disciplines (Restorative dentistry, Oral Surgery, Periodontology, Paediatric dentistry, Prosthetics, Orthodontics) are split into different segments. For example, topics of endodontic discipline are classified as pain, diagnostic and treatment. Similar ways, topics of other clinical discipline are separated. Then pain related topics from all disciplines are put together into one module termed as dental emergency or dental pain module. This way a unique module is drafted by uniting teaching activities focusing on one particular aspect.

**Table-1:** Themes and modules planted in integrated undergraduate dental curriculum.

Year	Themes and (Modules)*			
Year 5	Clinical Dental Science V (*Oral cure II, Dental emergency)	Scientific Data Analysis	Entrepreneurship	Pre specialization
Year 4	Clinical Dental Science III (* Oral cure I, Dental emergency)	Scientific Investigation (Research)	Clinical Dental Science IV (Occlusion, Rehabilitation)	
Year 3	Fundamental Dental Science (*Oral Diagnosis II)	Clinical Dental Science I (Aesthetics / Itfaal)	Sickness and Treatment	Clinical Dental Science II (Social Dental Health)
Year 2	Medical Sciences (*Infectious diseases, Disease mechanism, Drugs)	Fundamental Dental Science (Oral Diagnosis I)	Dental Simulated Treatment II (Impression & Denture work / Biomaterial)	Professionalism II
Year 1	Medical Sciences (*Basic foundation, Hemostasis, Organ & organ, Body system)	Fundamental Dental Science (*Oral Diseases)	Dental Simulated Treatment I (*Cavity work / Biomaterial)	Professionalism I

Themes are segmented into smaller parts called modules. e.g., Fundamental dental science theme is divided into oral diseases, oral diagnosis I and II. Similarly theme 'Clinical Dental Science' is divided into modules e.g., aesthetic, rehabilitation, dental emergency, etc. Modules\* are distributed in multiple ways to align horizontal and vertical integration. Time spans of modules should vary from 2 -8 weeks. Academic teaching load and duration should be 40 - 50 credit hours and 34-42 weeks each year respectively.

**Table-2 A:** Presentation of theme 'Module Summary' (Face 2 Face; Non Face 2 Face; Course Learning Outcomes).

1	Year (Year 4)	Name of Course / Module : Dental Emergency	Module Code: DDE 4018	Name(s) of Academic Staff
2	Rationale of the module: is to provide a focus for the pulpal pain mechanism, its orofacial sign and symptoms, its investigation, treatment and postoperative care necessary for saving a life and giving a relief from pain to the patients.			
3	Student Learning Time (SLT)	Face to face	Independent Learning	Total Guided and Independent Learning
	L= Lecture S= Seminar T=Tutorial CP= Clinical Practice CBS= Case Based Study O= Others	L 15 Hrs S 16 Hrs CP 50 Hrs T - CBS 12 Hrs O 6 Hrs	L 30 Hrs S 32 Hrs CP 100 Hrs T - CBS 24 Hrs O 18 Hrs	99 + 204 = 303 Hrs Credit Value 08

- Pre-requisite (if any) having been passed 3rd professional examination
- Module / Course Learning Outcomes (CLO):** At the end of this module, students would be able to
  - CLO1:** Apply diagnostic methods, taking history with professional ethics on various types of dental emergency cases individually as well as group
  - CLO2:** Demonstrate the treatment planning of dental emergency, interpret clinical features and correlate with diagnostic investigations as team as well as individuals
  - CLO3:** Perform the basic features of surgical technique used as emergency cure as group after identifying various dental emergency cases.
- Transferable skills:** practical skill, communication, professional ethics, team work
- Summary:** This module will cover hands 'on' experience in management and treatment of emergency dental problems, sign and symptoms, pulpal considerations, investigations, provision of appropriate therapy and post-operative instructions to the dental patients.
- Mode of Delivery:** Lecture, Practical, Tutorial, Seminar, Case base study

**Table-2 B:** Dental Emergency DDE 4018 (Mapping, Teaching methods, Assessments).

9 Mapping of the Course to the Programme Learning Outcomes (PLO)									
CLO / PLO	PLO1 (Knowledge)	PLO2 (Skills)	PLO3 (Critical thinking)	PLO4 (Communication)	PLO5 (Team work)	PLO6 (Ethics)	PLO7 (Lifelong learning)	PLO 8 (Business)	PLO 9 (leadership)
CLO 1	√	√			√	√			
CLO 2	√	√	√	√	√				√
CLO 3		√		√	√		√		√
CLO 4									
10	<b>Lectures (1Hr)</b> Pulpitis Trauma Impaction Facial Pain Exodontia TMJ problem	<b>Lectures (1Hr)</b> Periapical diseases Local Anaesthesia Endo perio lesion Trigeminal Neuralgia Dental traumatic injuries		<b>Seminar ( 2Hrs)</b> Over dentures Root resorption Pulp regeneration Atypical RPDs Rest and rest seats Periapical periodontitis		<b>Tutorial/ Case Based Study ( 2Hrs)</b> " TMJ examination " Endodontic mishaps " Obturation techniques " Irrigation in endodontics " Canal preparation techniques " Classification of partially edentulous arches			
11	Assessment and References (Dental Emergency)			Summative Assessment (60%)		Main References / Recommended Books			
	Formative Assessment (40%)			Final Professional Exam at end of Year 4					
	Written Test (15%)								
	OSCE I (10%)								
	OSCE II (10%)								
	Log Book (5%)								

\*Module 'dental emergency's learning outcomes are in aligning of World Federation for Medical Education (WFME). Teaching methodology are lecture, seminar, tutorial, problem based learning, case base learning, skill labs etc which are adopted for each module accordingly. Formative assessment (40%) is added after summative assessment (60%). The marks of formative + summative are calculated in making Grade Point Average (GPA). Adding up the marks of formative assessment provides opportunity to study the whole academic year rather than a limited study period before summative assessment is commenced.

CLO: Course learning outcome, OSCE: Objective structured clinical examination, TMJ: Temporomandibular joints, RPD: Removable partial denture

## Results

Boundaries of traditional subjects were broken down into themes. For example, 'organ and organ' was a theme and contained teaching and learning topics from anatomy, physiology, biochemistry together. 'Diagnosis' was a theme and represented certain ventures from periodontology, restorative dentistry, prosthetics, orthodontics, oral surgery etc. 'Medical science' was a module that was further split into Basic foundation, Haemostasis, Organ and organ, Body system, Mechanism of disease modules (Table 1). Multiple subheadings used to describe module information were: 'title, code of module, module learning outcomes, rationale and summary of the module, contents to be taught by various teaching methods like lecture, seminar, tutorial, problem-based learning (PBL), self-directed learning (SDL), bedside teaching, team-based learning (TBL), etc. Assessment strategy for contents to be taught was also worked out. Module summary of 'dental emergency' was separately highlighted (Tables 2A-B). In an academic year, four to six modules should be planned. For an undergraduate four-year dental programme, 180-220 credits hours were suggested. Credit hour was the total time of teaching and learning activities to achieve a learning outcome.

## Discussion

The integrated dental curriculum gives the opportunity to organise contents of different disciplines into a particular theme. For example, 'dental pain' module contains teaching contents from endodontic, restorative dentistry, prosthetics, orthodontic, paediatric dentistry, oral surgery and periodontology. Similarly, 'oral diagnosis' module is composed of specific topics taken from multiple clinical disciplines. There is no boundary separating traditional disciplines while teaching these modules. Students get information about dental pain and oral diagnosis in one particular time span from different teachers for various disciplines. Segmented parts of cognitive and psychomotor skills are difficult to combine into a whole. Integrated approach is suitable once there is flexibility to apply knowledge and a range of varied circumstances, including practical settings and situations.<sup>10</sup> Traditional dental curriculum lacks interconnection of cognition of Basic with Clinical science psychomotor application. This gap is filled by joining Clinical sciences with Basic sciences using tutorials, PBL, simulated dental skills and case-based learning (CBL) strategies. PBL is a functional and engaging instructional method for cognitive and affective domains of learning. Positive

learning outcomes of PBL include critical thinking, communication, self-learning and team work, and stronger understanding of the difference between popular and scholarly resources. This tool is effective, useful and easily adoptable in any module.<sup>11</sup>

Implementing integrated curriculum is a major challenge, with involvement of various teaching methods. This could be solved by synthesising the faculty as a whole team rather than dividing them into pre-Clinical and Clinical faculty. Therefore, facilitating PBL sessions, all faculty members, regardless of their expertise in any particular subject, should be involved. There is a question about distributing contents with different textual formats. In this manner, the most difficult concept is added in lecture, the easiest text matter is put into seminar, and text in between these two extremes is put into tutorial or with a clinical logic as a case-based study. PBL covers various disciplines across that scenario. This debate needs evidence and requires another study.

Credit hours are the boundaries of a programme and represent the teaching learning load by the students. Higher credit hours mean learners bear more teaching and learning load. Teaching activities are face to face (F2F) and non-face to face (NF2F). The former represents lectures, seminars, tutorials, practicals, bedside teaching etc. On the other hand, the learning either in campus or out of campus done by students themselves (self-learning) is NF2F. The suggested F2F teaching is 4-6 hours daily, making average 22-30 hours per week. However, this factor also needs review and evidence from learners' aspect. Here we take an analogue to describe F2F and NF2F aspects. Learning outcome in driving lessons = F2F (lecture and practical skills + NF2F (self-study and self-practice). We suppose there are 2 hours of lectures and 20 hours are for practical skill employed by a driving school. The applicant passes the theory exam by taking 2 lectures plus 4 hours of self-study, but fails in the road test having taken all 20 hours of practical sessions. He spends 60 hours in self-practice of driving and then again appears in the road test and is awarded the license. His F2F and NF2F activities are 86 hours (2 hours of lectures + 4 hours of self-study + 20 hours of practice + 60 hours of self-practice) and one hour for assessment, thus learning hours (driving) are calculated to be 87 hours, and is divided by 40, which is the number of hours spent by a full-time working week. Assessment is via theory and practical (driving) exam and this learning outcome (driving) is a 2

credit hour.

Over the last decade, research, defined as new knowledge, became an emerging trend in developing countries of the world. Research activity by undergraduate dental students enhances their basic inquiry skills and attitude requisite for future postgraduate studies. This is a high-impact educational practice to achieve an attitude for lifelong learning skill through enquiry.<sup>12</sup> Research module is, thus, not just merely pursuit of academic career; rather it is advancement of knowledge, skills and attitudes.<sup>13</sup> Professional ethics is a basic component in integrated curriculum. It ensures patient's confidence that he is in safe hands. It also ensures that dental procedures are carried out efficiently to meet the benchmarks and patient's expectations.<sup>14</sup> This is primarily associated with affective domains of the learning triangle and should be run partly along the entire dental programme. This module has produced highly reputed dental physicians with enhanced writing skills and logical thinking.<sup>15,16</sup> Postgraduate dental programmes are required to meet special needs of society that cannot be delivered by general dental practitioners. Postgraduate studies are taken as electives and are based on personal decisions. Intellectual contents, challenging diagnostic problems and having special skills for a particular specialty are the factors valued by dental students.<sup>17,18</sup> Therefore, postgraduation specialty trainings may be pursued immediately prior to entering practice or several years after graduation. They should be planned and developed according to the needs of society. Dental specialists should improve and expand their knowledge and expertise in order to provide the highest level of dental care.<sup>19</sup> Unfortunately, dental graduates choose their specialty based on environmental conditions.<sup>20</sup> In our template, pre-specialisation module (2-4 weeks) is suggested to give the opportunity to students in their last semester of the programme to select the career as specialists of their natural choice keeping in view cognitive, psychomotor and affective domains.<sup>19,20</sup>

Today's era demands an increased attention by human resource management for better and sustainable healthcare systems which is built by human resources, budget elements and expenditures. The interrelated balance between human and physical resources is argued for delivering quality health services.<sup>21</sup> The trend is to promote administrative and medical management in the new healthcare model. Dental physicians acting as health

managers are required to perform complex managerial responsibilities. A considerable number of health managers believed that they were hardly prepared through their formal education to be a competent health manager.<sup>22</sup> A short module focussing on the described elements is included to meet the needs of the present era. It would provide basic cognitive and affective domains about health inputs, budget elements and expenditure to handle the business phase of their career because their role is to be healthcare managers also.<sup>23</sup>

The integrated themes originating from different disciplines are assessed more likely by adding cognitive clinical reasoning and psychomotor aspects. Multiple choice questions (MCQs), one-best answers, short-essay questions (SEQs), structured long-essay questions (SLEQs), objective structured practical examination (OSPE), objective structured clinical examination (OSCE), structured oral viva voce, portfolio, writing assignments etc. are the different assessment tools to assess specific learning outcomes of modules set by medical education units or faculty of dental schools. Variety of factors influences the operationalisation of curriculum outcomes; therefore the explicit concept of integrated dental curriculum has to be evaluated after implementation in controlled and structured environment to yield the particular style of learning awards. Another limitation is related to the assessment aspect. This is a blueprint of integrated curriculum. the reliability and validity to achieve the learning outcomes of presenting modules will be discussed later. However, the debate on this issue needs further studies.

## Conclusion

The suggested integrated dental curriculum is an approach that segregates traditional disciplines into themes in compliance with cognitive, psychomotor and affective domains of the Blooms taxonomy.<sup>24</sup> The modules represent and support the teaching and learning activities to ensure the graduates are knowledgeable and prepared to provide high-quality oral care, aspiring to higher standards of professional ethics as a good team member having strong communication skills. Developing leadership qualities, maintaining good team work ethics and instigating the importance of lifelong learning through continued professional development are also part of curriculum.

## Acknowledgment

The authors are thankful to the Deanship of Scientific Research, King Saud University, Riyadh, Saudi Arabia for supporting the work through research group (RGP-VPP 181).

**Disclaimer:** None.

**Conflict of Interest:** None.

**Source of Funding:** Deanship of Scientific Research, King Saud University, Riyadh, Saudi Arabia.

## References

1. Brauer DG, Ferguson KJ. The integrated curriculum in medical education: AMEE Guide No.96. *Med Teach* 2015; 37: 312-22.
2. Mays KA, Maguire M. Care provided by students in community based dental education: Helping meet oral health needs in underserved communities. *J Dent Educ* 2018; 82: 20-8.
3. Knevel R, Gussy MG, Farmer J. Exploratory scoping of the literature on factors that influence oral health workforce planning and management in developing countries. *Int J Dent Hyg* 2017; 15: 95-105.
4. Chan WC, Ng CH, Yiu BK, Liu CY, Ip CM, Siu HH, et al. A survey on the preference for continuing professional dental education amongst general dental practitioners who attended the 26th Asia Pacific Dental Congress. *Eur J Dent Educ* 2006; 10: 210-6.
5. Drugan CS, Chestnutt IG, Boyles JR. The current working patterns and future career aspiration of specialist trainees in dentistry. *Br Dent J* 2004; 196: 761-5
6. Harden RM, Sowden S, Dunn WR. Educational strategies in curriculum development: the SPICES model. *Med Educ* 1984; 18: 284-97
7. The Association of American Medical Colleges (AAMC).Report IV-Contemporary issues in medicine: basic science and clinical research; Medical school objectives project. Washington DC: AAMC; 2001.
8. Leggate M, Russell E. Attitudes and trends of primary care dentists to continuing professional development: a report from the Scottish dental practitioners survey 2000. *Br Dent J* 2002; 193: 465-456.
9. Climbing Bloom's Ladder of Learning- One Stop Learning. [Online] [Cited 26 Feb 2019]. Available from: URL: <https://onestolearning.blogspot.com/2011/03/climbing-blooms-ladder-of-learning.html>.
10. Quintero AG, Vergel J, Arredondo M, Ariza MC, Gomez P, Barrios AMP. Integrated medical curriculum: Advantages and disadvantages. *J Med Educ Curric Dev* 2016; 3: 133-7.
11. Zhang Y, Zhou L, Liu X, Liu L, Wu Y, Zhao Z, et al. The effectiveness of the problem based learning teaching model for use in introductory Chinese undergraduate medical courses: A systemic review and meta -analysis. *PloS One* 2015; 10: e0120884.
12. Zimbardi K, Myatt P. Embedding undergraduate research experiences within the curriculum: a cross disciplinary study of the key characteristics guiding implementation. *Stud High Educ* 2012; 39: 233-50.
13. Murdoch-Eaton D, Drewery S, Elton S, Emerson C, Marshall M, Smith JA, et al. What do medical students understand by research and research skills? Identifying research opportunities within undergraduate projects. *Med Teach* 2010; 32: e152-60.
14. Cowpe J, Plasschaert A, Harzer W, Vinkla-Puhakka H, Walmsley AD. Profile and competencies for the European dentist-update 2009. Association for Dental Education in Europe; 2009.

15. Al-Zain SA, Al-Sadhan SA, Ahmedani MS. Perception of BDS students and fresh graduates about significance of professional ethics in dentistry. *J Pak Med Assoc* 2014; 64: 118-23.
  16. Shamim MS, Zubairi NA, Sayed MH, Gazzaz ZJG. Innovation in ethics and professionalism course: early experience with portfolio work. *J Pak Med Assoc* 2016; 66: 1149-53.
  17. Zarchy M, Kinnunen T, Chang BM, Wright RF. Increasing predoctoral dental students' motivation to specialize in prosthodontics. *J Dent Educ* 2011; 75: 1236-43.
  18. Saeed S, Jimenez M, Howell H, Karimbux N, Sukotjo C. Which factors influence students' selection of advanced graduate programs? One institutions' experience. *J Dent Educ* 2008; 72: 688-97.
  19. Dhima M, Petropoulos VC, Han RK, Kinnunen T, Wright RF. Dental students' perceptions of dental specialties and factors influencing specialty and career choices. *J Dent Educ* 2012; 76: 562-73.
  20. Banabilh SM. Career decisions of undergraduate dental students at the University of Science and technology, Yemen. *J Dent Educ* 2013; 77: 331-6.
  21. Ashri NY, Al-Moslem RK, Al-Mujel MH. General dental practitioner's interest in postgraduate dental education, Riyadh, Saudi Arabia. *J Pak Dent Assoc* 2007; 16: 82-9.
  22. Kabene SM, Orchard C, Howard JM, Soriano MA, Leduc R. The importance of human resources management in healthcare: a global context. *Hum Resour Health* 2006; 4:20.
  23. Osman S, Izet M. Management knowledge and skills required in the health care system of the Federation Bosnia and Heregovina. *Mater Sociomed* 2012; 24: 106-11.
  24. Anderson LW, Krathwohl DR, Airasian PW, Cruikshank KA, Mayer RE, Pintrich PR, et al. *Taxonomy for learning, teaching, and assessment: A revision of Bloom's Taxonomy of educational objective*. New York: Pearson, Allyn & Bacon, 2001.
-