Brief Review

Integration in the competency based undergraduate medical curriculum: A brief review

Rishab Reddy D [1], Ayeesha Sithika Thajudeen [1*]

[1] Department of Pathology, Chettinad Hospital and Research Institute, Chettinad Academy of Education and Research, Kelambakkam, India.

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[*]Corresponding author:
Ayeesha Sithika Thajudeen, Department of Pathology, Chettinad Hospital and Research Institute, Chettinad Academy of Education and Research, Kelambakkam, India.
Email: dr.ayeesha1@gmail.com

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Abstract

Background & Objective: Integrated teaching in undergraduate medical curriculum aims to support meaningful learning to the students as it provides relevance to basic sciences in clinical practice, by matching learning with the way knowledge is to be used. This review aimed to highlight the pros and cons of integrated teaching in undergraduate medical curricula with proposed solutions.

Materials & Methods: This was a brief review that was conducted by searching the database of PubMed with the keywords, Competency-based, Medical curriculum, Undergraduate, and Integration, from the year 2010 to 2022.

Results: The search resulted in a total of 34 articles. Sixteen articles were excluded because the target audience was not medical. Thus a total of 18 articles are compared and tabulated. Most of the reviews and studies highlighted that integrated teaching reinforces and breaks the complexities of the students in understanding the practical knowledge required to develop a professional dedication to the care of the patients and make them lifelong learners. Major challenges discussed are duration, special training for facilitators, and preparing an elaborate module with specific learning objectives.

Conclusion: The review highlights that integrated teaching has multiple benefits that are essential for a better understanding of the subjects and the academic performance of the students. However one must also acknowledge the existence of various challenges encountered at different levels of implementation and the proposed solutions that are addressed in this review.

Keywords: Competency-Based, Medical Curriculum, Undergraduate, Integration

Introduction

The medical field is such that its curriculum is vast and dynamic. This accompanied by the separation of the subjects into clinical, para-clinical, and basic sciences often puts a tremendous burden on students as they often over-emphasize details. This problem is expected to be solved by the introduction of curricular integration, which represents a collaboration between the various disciplines to establish a lucid and coherent curriculum (1). Integration can be horizontal or vertical, while the horizontal approach integrates subjects taught in the same year, the vertical approach goes on to integrate subjects of different years. With the newer updates in the guidelines for medical education laying more emphasis on this approach, although challenging, medical schools have to make sure to implement the integrated model in an effective way (2). This review aimed to highlight the pros and cons of integrated teaching in undergraduate medical curricula with proposed solutions.

Materials & Methods

Design and setting(s)

This study is a brief review conducted by searching the database of PubMed using the keywords; Competency-based, Medical curriculum, Undergraduate, and Integration. The search was done for the years 2010 to 2022, by using the keywords altogether.

Inclusion and Exclusion criteria

Only articles with the specified MeSH terms and database were included in the review.

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Other studies related to allied health sciences and disciplines were excluded.

Results

A total of 18 articles out of 34 articles were selected based on the PubMed search on the review topic of the impact on integrated teaching in undergraduate medical curriculum in the last 10 years.16 articles were excluded because the target audience was postgraduate, dental, pharmacy, nursing, bioethics, and other allied health sciences (Appendix 1).

Integrated teaching provides a holistic and conceptual understating of the competencies.Wijnen-Meijer et al. (3) define integrated teaching as "a deliberate educational approach that fosters a gradual increase of learner participation in the professional community through a stepwise increase of knowledge-based engagement in practice with graduated responsibilities in patient care" This definition goes on to highlight that integrated teaching along with its cognitive benefits also brings a variety of other advantages such as:

- When early learners are entrusted with small contributions to health care, it is more likely to boost their motivation which in turn leads to active engagement and learning
- It helps build students' professional identity formation, both at an individual and collective level.
- Vertical integration was found to induce responsibility in students towards clinical practice, solve medical problems, manage unfamiliar situations, prioritize tasks, and most importantly collaborate with others.
- It gives insight into attitude, ethics, communication, and team building.

All these proposed advantages are applicable only when the curriculum is designed and implemented properly. This requires a lot of meticulous planning and reforms in administration and education policies.

A simple yet effective way of checking the effectiveness of this curriculum is through a questionnaire. Studies across a few medical schools suggest that the perception of students for integrated teaching showed agreement by 71% of students for the technique and supported that approach gave them a better understanding of the topic. All participants agreed that it was an excellent experience and added a new flavor to their studies making them more interesting (21, 22).

Issues in implementing Integrated teaching

Realizing the shortcoming of the traditional teaching approach, medical schools across the globe are quickly switching to the integrative route of teaching. However, this does come with its own unique sets of challenges both from the students' and educators'/academic policymaker's sides. A significant number of students (40%) from an Indian study felt that vertical integration adds a burden to the learning process in the pre-clinical years (21). One must also acknowledge the fact that students have different learning paces and thus expecting all of them to develop the same level of critical thinking isn't practical.

Also, when drafting an integration-centric curriculum, a discipline taught scattered at many fragmented moments during the curriculum to serve the integration with other disciplines, may under- mine its big picture and internal logic students. For example, adding scattered bits of pharmacology to various clinical education courses creates better embedding, but also risks, if students can neglect pharmacology without failing integrated tests when the proportion of pharmacology in each test is small.

Along with this, there might be issues on the educator's side. These include lack of will, lack of good leadership support, inadequate infrastructure/resources, prefixed mindsets, and faculty resistance due to fear of more work (9). There are many myths associated with an integrated curriculum like multiple teachers will be required for one integrated session, an integrated curriculum will create more confusion, the department will lose its identity and faculty will lose its importance in discipline-based compartments (12).

Proposed solution

To prevent burdening students with extensive amounts of knowledge, the objectives of each session must be specific and feasible. Also to ensure a smooth transition from the traditional to the integrated form of teaching, initially at least there must be a healthy balance between integrated teaching sessions and traditional sessions so that students accustomed to the traditional form of learning are provided with adequate time to adapt. To ensure the effective implementation of the integrated curriculum, changes from the grass root upward must occur. It should start with the formation of a core committee consisting of members from both clinical and nonclinical settings who are given the responsibility of

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designing, coordinating, and implementing the curriculum. Then this committee should draft competencies that will set the objectives for the classes to be conducted and also decide upon the grade of integration. Lastly and most importantly a schedule must be drafted for that academic year where the competency to be taught, and the method and duration of teaching must be incorporated in its details. An example of the same is given below (Table 1).

Table 1. An example of integrated topics in Diabetes Mellitus is given below

TOPIC	DEPT.
Physiology of insulin secretion	Physiology
Pathogenesis of Diabetes Mellitus	Pathology
Lab diagnosis of Diabetes Mellitus	Biochemistry
Mechanism of action of insulin	Pharmacology
Management of Gestation Diabetes (GDM)	Obsteristics
Nutrition GDM	Nutrionalist

The objective of the medical college curriculum should be to provide an array of skill sets and knowledge that are the most required for effective patient care. The current medical system with its fragmented approach to teaching often brings disinterest in students as it fails to create an environment where the knowledge gained can be put to practice. This is where integrated teaching becomes a viable option as it holistically blends the biomedical sciences into clinical practice thus generating much-needed interest in students.

According to Neeli D et al.(2019), “Most of the students opined that integrated teaching is useful in gaining knowledge (Understanding, concept clarity and better performance in exams) as well as skill-based learning (Workshops, laboratory, clinical exercises, and case discussion) (23). This opinion is consistent across many medical colleges as students find integrated teaching to be the perfect solution to the problems that existed in the previous model. Not only this, but integrated teaching also reduced the academic burden as many cross-departmental topics are only studied once instead of multiple times throughout the course as in the previous model (24).

The alignment of interdepartmental teaching also plays a key role in the overall effectiveness of the curriculum. Students often find interdepartmental classes on the same topic to be most effective when they are taught in less than a week's gap. With an increasing gap between related lectures, students find it a burden as they have to constantly revise to get the maximum output from the next session (25).

The literature search was limited to PubMed only. Other databases can be explored for a vast review. Only the undergraduate medical curriculum was discussed.

Conclusion

As mentioned above integrated teaching does come with multiple benefits that are essential to producing better doctors/ healthcare workers in the future. However one must also acknowledge the existence of various challenges that exist at different levels of implementation. By working out a plan that addresses all the current roadblocks, successful implementation of the curriculum can be achieved.

Ethical considerations

Not applicable.

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Disclosure

No conflict of interest.

Author contributions

1&2 authors: design, manuscript writing, editing.

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Appendix 1: Review topic on the impact of integrated teaching in the undergraduate medical curriculum

	Authors, Year, Place	Design	A finding related to the research question	Challenges
1	Wijnen-Meijer et al; 2020. Germany (3).	Review on a broader perspective of vertical integration.	Review how vertical integration becomes the philosophy of education with the knowledge-based engagement of students to become lifelong learners and help them in efficient patient care.	Redefines vertical integration of curricular structure to improve patient care by introducing clerkships in the final year.
2	Arain et al; 2019. Saudi Arabia (4).	Cohort I-horizontal integrated topics of structure and functions in head and neck in II nd year Cohort II-vertical integrated topics of pathophysiology and clinicians in the same topic. *(n=170).*Questionnaire-based study.	Cohort II felt that the sessions were more effective(62.1 %vs 85.7%). However multiple choice scores were similar in both groups. Cohort I showed short answer question response better. (82.4 vs 70.7).	The introduction of early vertical integration had mixed responses in the study. An increase in module content and duration will help in attaining the clinical learning objectives.
3	Teichgräber et al; 2022. United States (5).	Aim was to design a curriculum to include ultrasonography through vertical integration. Kern's six-step	Students were asked to learn the competencies through videos in the first two levels of learning. Next two levels	Teaching staff should be provided with the resources required including time,

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		approach was used to identify problems, specify needs, define goals, outline strategies, and propose methods.	they were asked to use ultrasonography for patients under supervision. Thus in the final year, students confidently perform the technique.	learning spaces, ultrasonography devices, skills laboratory simulators, and administrative support, and senior tutors also can help in supervision.
4	Akram et al; 2018. Pakistan (6).	Various themes are divided into modules that are used to develop an integrated curriculum with basic medical science, simulation skills, clinical science, personality development, research, entrepreneurship, and pre-specialization.	Traditional teaching is mutated into various modules which enhance student-centered learning, helping them to understand clinical decisions and build entrepreneurship.	The critical evaluation of the proposal remains the limitation of the study.
5	Alsanosi et al; 2022. Saudi Arabia (7).	Implementing integrated curriculum of teaching clinical pharmacology at Umm Al Qura University – Faculty of Medicine (UQUMED).	The 'Use of Medicine' vertical module emphasizes rational prescribing, safe medical practice, and teaching clinical pharmacology in the early years of the medical curriculum. The adoption of newer and innovative teaching and assessment methods and the training of faculty/staff can help to better patient care.	One challenge the authors point out is that teachers are shifting from acting as information providers to acting as facilitators so that students become life-long learners.
6	Kumaravel et al; 2020. United Kingdom (8).	This study aims to test the feasibility of integrating an Evidence-based curriculum in the early years of an undergraduate medical school. This was subsequently evaluated using the validated 212-point Fresno test at end of years one and two at e University of Buckingham Medical School (UBMS).	18 students who had completed the Fresno at both time points, the average score increased by 38.7 marks ($p < 0.001$) after evidence-based integrated teaching. The student's perceptions of the clinical relevance and clinical questioning improved in their developing practice.	Only a small group of students participated. Students are instructed to do 1 to 3 hours of work in preparation for the flipped classroom session.
7	Paul de Cates et al; 2018. United Kingdom (9).	Proposed a four-dimensional curriculum at Warwick Medical School curriculum.	Apart from the spiral curriculum, the authors have highlighted the fourth integrated student-centered curriculum that breaks the complexities that the student encounters in practice.	It prepares the student to be equipped to face the challenges of problem-solving ability.
8	Schwartzstein et al;20 20. Harvard Medical School (10).	In this article, educational key faculty leaders describe how the Pathways curriculum at Harvard was conceived, designed, and implemented.	The curriculum was framed upon four principles: to enhance critical thinking; to ensure both horizontal integrations between courses and vertical integration between phases of the curriculum; to engage learners and reinforce the importance of student ownership and responsibility for their learning; and to develop a professional dedication to the care of the patients and make them live long learners.	By emphasizing professionalism, personal responsibility, and developing skills over content, the authors believe that this curriculum will prepare students for the future.
9	Ten Cate at al;2018.Utretch (11).	The study aimed to document 20 years of development of the Utrecht undergraduate medical curriculum with the SPICES model developed by Medical Teacher's Editor Ronald Harden and colleagues in 1984.	Horizontally integrated classroom teaching of basic sciences with clinical disciplines in groups of 12 thus limiting lectures. Stepwise Vertical integration module linking clinical experience with background knowledge.	Elective teaching rotation and clerkships in the final year and various peer-teaching arrangements throughout the curriculum.
10	Das M, Ettarh et al;2019.United States.(12).	The Liaison Committee for Medical Education (LCME) and the Commission on Osteopathic College Accreditation (COCA) advocate faculty provide a list of learning objectives in histology for each competency.	Online faculty from across the United State were assembled to develop a set of competencies for medical students in histology with specific learning objectives to integrate them.	A survey of the literature indicates that there is a paucity of knowledge about competencies, goals, and specific learning objectives for histology education in pre-clinical years.
11	Abdel-Misih et al;2018.United States.(13).	The Ohio State University College of Medicine (OSUCOM) compared the outcomes of a third-year traditional clerkship format to a revised combined Integrated Surgery and Obstetrics/Gynecology module. (*n=391*)	The outcome scores were higher in the revised integrated curriculum.	Future analyses are needed to assess the impact of OSUCOM curricular revision.

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12	Marz et al;2018.Vienna(14)	Review on the new integrated curriculum at the University of Vienna.	The revised curriculum introduced integrated classes than only theory classes, a research thesis, and a stronger clinical orientation in preclinical years.	The reform in the curriculum faced a period of inertia in the early setup.
13	Cooper et al; 2021. United Kingdom (15).	A consensus statement was produced by Members of the UK Clinical Reasoning in Medical Education group (CReME) based on the literature review, edited by the authors.	The proposed curriculum should consider implementing a formal clinical reasoning module that is horizontally and vertically integrated throughout the program.	The literature review of the previous curriculum demonstrated a lack of effectiveness in generating lateral thinking processes.
14	Ellayway et al; 2016. Canada (16)	Review of the empirical curriculum in 17 Canadian medical schools on integration, and longitudinally in their undergraduate programs.	12 out of the 17 schools implemented longitudinal integrated curriculum and found that to be productive with improved patient care.	Different clerkship designs resulted in different forms of integration, continuity, and longitudinally. A dichotomous view of rotation-based clerkships was found not to represent current practices in Canada.
15	Doomernik et al; 2017. Netherlands.(17)	The Radboud University Medical Center studied the retention of knowledge of 346 medical students in the first and second years for the anatomy of the gastrointestinal (GI) tract.	Anatomical knowledge vertical integrated and problem-based medical curriculum, declined by 15% approximately 1.5 years after the initial anatomy course.	An effective module with specific learning objectives must be included.
16	Fekadu et al; 2022. Ethopia.(18)	The authors compared by online questionnaire to students at Ethiopian medical schools by integrating radiology images into gross anatomy teaching.	The introduction of clinical medicine with the blending of basic science improved the interest score of the students.	73.5% of the teachers lacked any prior training in radiologic anatomy.
17	Benninger et al; 2014. California.(19)	The study investigated the millennial laboratory integration, implementation, and use of cadaver dissection, hospital radiology modalities, surgical tools, and AV technology in a 12-week contemporary anatomy course.	37 cadavers were imaged with full-body CT, and MRI scans and taught to students. The feedback from students was overwhelming.	Surgical and radiology instructors were required as instructors.
18	Cisternas et al; 2016. Chile. (20)	Review on reformation of the curriculum of Medicine at the Pontificia Universidad Católica de Chile	The new curriculum in 2015 was designed to orient students with integration specifying the learning objectives and introducing early clinical exposure in early years.	The previous curriculum had weakly integrated modules with extensive lecture hours.

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