

## Integration in Medical Education

MUSHARRAF HUSAIN,<sup>1,3</sup> SABINA KHAN<sup>2,3</sup> AND DINESH BADYAL<sup>4</sup>

From Departments of<sup>1</sup>Surgery, <sup>2</sup>Pathology and <sup>3</sup>Medical Education Unit, Hamdard Institute of Medical Sciences and Research (HIMSR), Jamia Hamdard, Delhi, India: and <sup>4</sup>Department of Pharmacology and Medical Education, Christian Medical College, Ludhiana, Punjab, India.

Correspondence to: Dr Musharraf Husain, Professor and Head, Department of Surgery HIMSR, Jamia Hamdard, Delhi 110 062, India. [drmusain1@jamiahamdard.ac.in](mailto:drmusain1@jamiahamdard.ac.in)

The term integration has gained importance in Medical education over the last two decade, and is believed to facilitate knowledge, that is more meaningful to clinical practice. A move towards integration in medical education is likely to reduce fragmentation of the medical course and motivate students towards better learning, It aims to improve medical education by bridging the traditional barrier between basic and clinician sciences. Integration is one of the major changes incorporated in the new competency based curriculum for undergraduate medical program in India. There are associated changes in the assessment system too in relation to integration. However, the concept of integration/integrated curriculum lacks significant clarity as how to implement it in medical institutions with added paucity of literature on this important topic. Integrated teaching is the integration of the concepts wherein various subject-based knowledge or aspects of one theme or topic are assimilated to provide the holistic approach. Our review focusses on the need for integration with comparative analysis of the two most important models of integration (Fogarty and Harden) which are being followed, delving on their common features for simplifying this complex topic as well as for better understanding of the concept. We have also proposed six steps for implementation of integration. We conclude that the proposed change from conventional to new integrated curriculum requires robust planning and coordination amongst the various stakeholders in medical institutions.

**Keywords:** *Competency-based medical education, Curriculum, Multi disciplinary.*

---

All of us are aware of the importance of term “integration”. The concept of life or even the whole universe is non-existent without integration. We cannot compartmentalize our body into various systems or organs, everything in the body has to work in coordination with each other just to stay alive. This is not only true for human lives but also holds true for all kinds of system in the universe- be it natural or man-made. We have given this example of human body just to stress upon the importance of integration in medicine as medical education is all about dealing with human body, its function, diseases and treatment.

Integration in medical education is best described by Harden as ‘the organization of teaching matter to interrelate or unify subjects frequently taught in separate academic courses or departments’ (Harden et al, 1984) [1]. Shoemaker also defines an integrated curriculum as “education that is organized in such a way that it cuts across subject matter lines, bringing together various aspects of the curriculum into meaningful association to focus upon broad areas of study” [2].

Undertraditional curriculum in India, majority of the medical colleges teach subjects in isolation without much effort to integrate the basic/paraclinical with the clinical subjects. An integrated curriculum provides a platform

where learning takes place in a context (contextual learning). It also promotes a holistic approach to patients and their problems. The learning theory ‘constructivism’ behind the integration of basic and clinical sciences states that learner needs to understand the concepts in basic sciences and make connections with its applicability in clinical sciences. There should be development of construction of understanding the relevance of learning basic sciences [3].

In this review, we will discuss, how to develop, implement and evaluate an integrated curriculum. Let us start by reviewing the importance of integrated curriculum and why it is the need of the hour.

### Purpose of Integration

Knowledge is most effective when the organization of that knowledge matches the way in which the knowledge is to be used [4]. It is believed that the current system of medical education is fragmented, the subjects are taught in isolation with unnecessary repetitions and there is no structured or systematic effort to interrelate the concepts of various diseases [5,6]. For example, when students are taught about liver in different disciplines without any integration, they may develop the concept of anatomical liver, physiological liver, pathological liver and so on

without getting the holistic concept of the body and various diseases in the context of liver. As a result, it is left to the students to understand or develop the correlation between the topics taught in various disciplines.

Human body is a perfect example of integration. The knowledge learnt in isolation remains to be applied to a complex system like human body. The basic idea of integration is to develop a holistic approach to treat that particular disease affecting human body. It is true that body is divided into systems and organs but they always work in unison with highest level of coordination possible. Similarly, it is important to have coordination between subjects to understand the body and the diseases better, so that when a student sees a patient, it should all come together.

An integrated approach in medical education captures students' attention and creates more excitement in learning, prevents repetition, enhances reinforcement of important areas or topics, and improves retention of learning [7]. The long-pending demand of students that basic and clinical sciences should be integrated can be achieved with this approach. Basic sciences' role is well documented for learning of clinical sciences [8]. The students trained with such an integrated curriculum, make more accurate diagnosis than students trained in a conventional curriculum as they learn to apply their knowledge to clinical practice as a result of more contextual learning. This promotes a holistic approach to patients and their problems. It also promotes interdepartmental collaboration and helps in rationalization of teaching resources [9,10]. It was interesting to note that in various workshops conducted at various medical colleges, few faculty members got introduced to each other for the first time; although, they had been working in the same institute for long.

Here, it is important to understand that in our body, each and every cell, every tissue, organ and system has its own importance and they need to develop fully for any kind of coordination to be successful. Similarly, each and every discipline or subject is important and should also have their identity maintained but never in isolation. It is just like a rainbow where the different colours maintain their identity but are very closely assimilated to showcase their features. The impact of a rainbow is different than the single colours. In medical curricula also there has to be a balance between integrated teaching and discipline-based teaching.

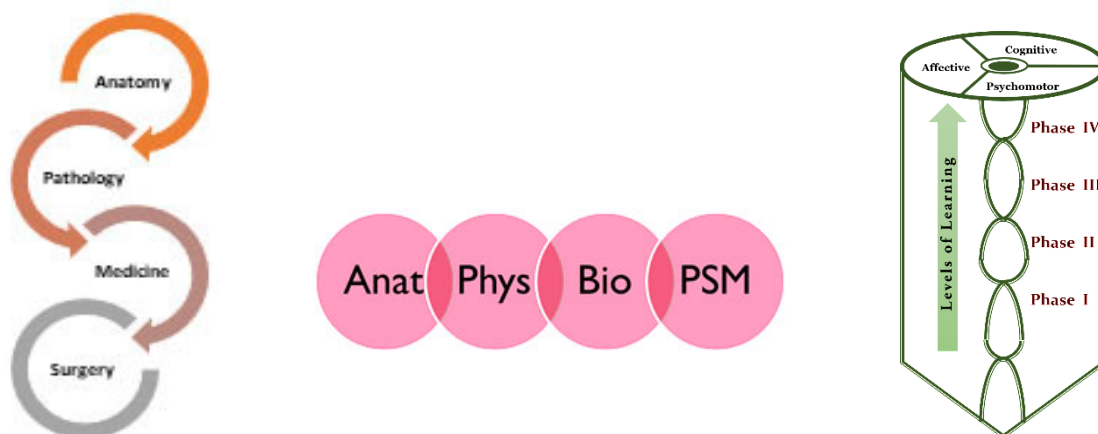
**TYPES OF INTEGRATION**

Integration has traditionally been divided into three types based on two basic components of curriculum as reference points that is time frame and clinical disciplines/ subjects [11].

*Horizontal Integration:* Integration that occurs across disciplines/subjects but within a finite period of time. For example, integration among subjects of first phase of undergraduate curriculum in India. (**Fig. 1a**).

*Vertical Integration:* Integration across time – it breaks the traditional divide among the basic science and clinical subjects and brings them together. For example, integration among subjects of different phases (**Fig. 1b**).

*Spiral Integration:* This is the integration across time and disciplines. It is the most complete form combining both horizontal and vertical integration. The major advantage of this model is the better reinforcement of topics through a natural progression from simple to complex using a curriculum that breaks down the barriers and boundaries between the courses and the departments [12] (**Fig. 1c**).



**Fig. 1** (a) Vertical Integration; (b) Horizontal Integration; (c) Spiral Integrated model

**Table I Comparison of Two Common Models of Integration**

| <i>S.No.</i> | <i>11 steps on the integration ladder (Harden, 2000) [14]</i> | <i>Common description</i>  | <i>Ten ways to integrate curriculum (Fogarty, 1991) [14]</i> |
|--------------|---|--|--|
| 1            | Isolation   | Various disciplines /departments organize their teaching without considering other departments or subjects   | The fragmented model   |
| 2            | Awareness   | Teacher is made aware of what is covered in other subjects through appropriate documentation about aims and objectives of each course  |  |
| 3            | Harmonization   | The Disciplines remain separate but the teacher may make explicit connection within the subject areas to other subjects  | The connected model  |
| 4            | Nesting (Infusion)  | The teacher targets within a subject based course, few objectives relating to other subjects. Contents drawn from different subjects are used to enrich the teaching of a particular subject   | The nested model   |
| 5            | Temporal coordination   | The related topics within a subject are taught separately but are sequenced / arranged/scheduled at same time in consultation with other subjects.   | The sequenced model  |
| 6            | Sharing   | Two disciplines may agree to plan and jointly implement a teaching program using overlapping concepts or ideas as organising elements  | The shared model   |
| 7            | Correlation   | Within the subject based framework, integrated teaching sessions are introduced. These sessions bring together areas of common interest in each subject.   |  |
| 8            | Complementary programme                                       | It has both subject based and integrated teaching. The basic difference with correlation is that the percentage of integrated sessions are increased   | Webbed   |
| 9            | Multidisciplinary   | This step brings together a number of subject areas in a single course with themes, problems or issues as the focus of teaching. The subjects/ disciplines still preserve their identity and demonstrate how they contribute to the understanding of the theme or problem.   |  |
| 10           | Inter-disciplinary  | The subject/discipline boundaries become blurred. There may be no reference to individual subjects or disciplines as they are not identified in the timetable. Interdisciplinary teaching implies a higher level of integration, with the content of all or most subjects combined into a new course with a new menu [15]. | The integrated model   |
| 11           | Trans-disciplinary  | There are no subjects or discipline. There is only one subject for education, and that is Life in all its manifestations [16].The teacher provides the framework of learning opportunity and the integration takes place in the mind of the students based on situations of the real world.                                | Immersed   |

## MODELS OF INTEGRATION

Over the last few decades, medical educationists have realized the importance of integration and understand that integration is a key factor in the delivery of an effective educational program [9]. The two most discussed models for the development of integrated

curriculum are the ten ways to integrate Curriculum by Robin Fogarty [13], and the integration ladder by Harden [14].

We have tried to compare and correlate these two models for better understanding and simplification (**Table I** and **web table I**).

Two integrated teaching models given by Fogarty which are not correlating with any of the steps of Harden ladder are the threaded model and the networked model. The threaded model of integration thread various concepts and skills throughout various disciplines. Teaching sessions are planned according to the identified skills or concepts. In the networked model, the learners themselves, knowing the intricacies and dimensions of their field, can target the necessary resources as they explore within and across their areas of specialization [13]. For example, the option of selecting electives in a course. Students chooses their own areas of interest and during the electives, he or she may come across number of experts in the field and develop the networking.

### **Integrated Curriculum vs Integrated Teaching**

The difference between integrated curriculum and integrated teaching is almost similar to the difference between syllabus and curriculum. Integrated teaching is limited to one particular session or topic which can be achieved either by individual efforts or collectively by the concerned departments, while integrated curriculum requires effort at larger level, mostly institutional with multiple sessions of integrated teaching. Nesting, the fourth step in the Harden ladder is an example of integrated teaching while the temporal coordination, the fifth step in the ladder is not an integration in true sense as there is no connection between the subjects or the topics, they merely are aligned together. Actual curricular integration starts from the seventh step *i.e.*, Correlation. Integrated teaching is an all or none phenomenon, either it is integrated, or not integrated while integrated curriculum is a continuum from incomplete to complete.

This is usually documented during the development of curriculum whether all the teaching sessions will be integrated or a particular percentage of the curricular delivery will be integrated. Medical Council of India (MCI), in their recent revision of curriculum, have suggested that at least 20% of the curriculum should be integrated and they have also provided examples of the areas where integration can take place [17].

### **IMPLEMENTATION OF THE INTEGRATED CURRICULUM**

Integration is represented as a continuum with full integration at one end, discipline-based teaching at the other end, and intermediate steps between the two extremes [18]. Integrated curricula can also be labelled as complete or incomplete. Horizontal and vertical integration are examples of incomplete integration while spiral integration is an example of true or complete integration.

The change from traditional subject-based

curriculum to an integrated curriculum should be gradual and starts with the understanding of one's place in the integration ladder. Most of the teachers agree with the value and importance of integration but are not sure about the extent of integration required and how to go about it. The institution should take into consideration the existing curriculum, experience and training of the teachers, existing infrastructure and most importantly the aim of the curriculum, before deciding on the level of integration. The higher one moves up the integration ladder, the greater coordination and communication is required amongst different disciplines [14].

Before actually going for its implementation, it is important to understand that integrated teaching or curriculum is the integration of the concepts where various subject based knowledge or aspects of one theme or topic is assimilated to provide the holistic approach. Integration does not mean that multiple teachers from different subjects are delivering their lectures in the same session. Planning of the session is usually done before the actual teaching session by subject experts/ teachers about the content and delivery methods. It is not always necessary to actually involve the teachers of different subjects during the teaching sessions; they are mostly involved at the planning level only. However, if you think that getting a surgeon into anatomy class can encourage/motivate students to learn anatomy in context, then that can be done.

### **Six Steps of Integration in Curriculum-implementation**

1. *Train the teaching faculty:* Implementation of integrated curriculum requires lot of dedication and coordination among faculty members of different disciplines. Still there are lot of reservations and doubts about the utility of the integrated curriculum. Faculty members should be sensitized about the importance and objectives of integrated curriculum. They should be explained about their roles and responsibilities towards the integrated curriculum. The new undergraduate medical curriculum implementation in India is being supported by MCI by training teachers in MCI affiliated medical colleges through Curriculum Implementation Support Program (CISP). The programme trains teachers in integrated teaching too. However, training requires longer sessions as well as refresher courses at all levels.
2. *Level of integration:* Integration is possible only when the components or the building blocks are ready. In medical education, basic sciences are our building blocks and that is the why most educationists feel that there is a need for both subject based as well as integrated experience in the curriculum, and it is not

advisable to have an integrated curriculum where individual disciplines completely lose their identity [1]. We should also understand that higher level of integration is difficult in basic sciences/phase I undergraduate course, so the integration level should also be different at different phases of undergraduate education. Harden ladder is a good guide to decide on the level of integration. Nesting and temporal coordination (incomplete horizontal integration) are easily possible at basic science level, while correlation, complementary program and multi-disciplinary steps are better suited for last phases of the undergraduate curriculum. Medical Council of India has given us freedom to choose between nesting, temporal coordination, sharing and correlation (Steps 4-7 of Harden ladder) at various phases of the undergraduate course [17]. The level will also depend on the topic and competencies chosen for integration.

3. *Assign the responsibilities:* The next step is to create committees or groups of faculty members across different disciplines. There should be an adequate representation from both basic sciences and concerned clinical subjects. The committee should not only be responsible for developing the integrated modules of teaching but also coordinating in its actual implementation. In the new MBBS guidelines, this responsibility has been assigned to Alignment and Integrated Topic (AITo) team.
4. *Develop integrated teaching modules or sessions:* The most crucial step in the integrated curriculum is to develop the teaching modules. A module is a set of learning opportunities with respect to a well-defined topic or problem that contains specific objectives, teaching learning activities and assessment strategies [19]. Integrated modules may include body systems like cardiovascular system, life cycles like childhood, core problem based like chest pain, thematic like organ failure [8,20,21]. The module should be developed for all phases together so that integration is pre-decided for all phases for a particular topic.
5. *Design Integrated Assessment:* Though development of a complete module includes assessment, we have decided to mention it as a separate step just to stress upon the importance of assessment in the curriculum. What is assessed and which methods are used for assessment will play an important role in what is learnt and how it is learnt [21]. The success of integrated curriculum depends on the implementation of integrated assessment [1]. Methods assessing the higher level of cognitive domain should be used. Various assessment methods suggested for integrated

teaching are Reflective writing [23], Clinical Reasoning Exercises [24], Concept maps [25], Long essay questions [26], Progress tests [27], and Problem-based multiple-choice questions [28].

6. *Delivery of the integrated curriculum:* A timetable should be prepared for all the integrated teaching sessions inclusive of theme of the integrated teaching session, teaching learning methods with duration of each methodology along with the name of the faculty member. This time table should be incorporated in the main time table of each phase for the purpose of implementation.

### Challenges

There are many challenges in developing and implementing integrated teaching in a curriculum. These include lack of will, lack of good leadership support, inadequate infrastructure/resources, prefixed mindsets, and faculty resistance due to fear of more work. There are many myths associated with integrated curriculum like multiple teachers will be required for one integrated session, integrated curriculum will create more confusion, department will lose its identity and faculty will lose its importance in discipline-based compartments *etc.*

However, the challenges provide opportunities to innovate and experiment with various models of integration and evaluate their utility in the Indian context, especially in the new curriculum.

### CONCLUSION

Integration in medical education is the need of the hour as we move towards holistic healthcare. The two main models of integration given by Fogarty and Harden are compared and commonalities discussed for better understanding of the concept. The various levels and models of integration provide a lead to innovate more in integrating the disciplines for better contextual learning. Integration can be implemented from the early years of the undergraduate teaching, and higher level of integration is possible as the learners progress through the course. The process of change from conventional to new integrated curriculum is difficult, yet achievable, and requires robust planning and coordination amongst the medical educationists at all the levels.

*Acknowledgement:* Dr Fatimah BV for designing the figures.

*Contributors:* All the authors were involved in reviewing the literature and preparing the article.

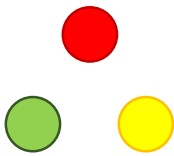
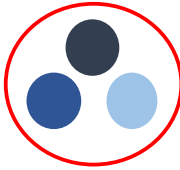
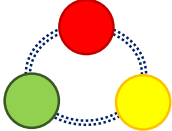
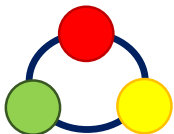
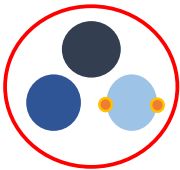
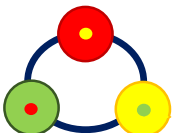

*Funding:* None; *Competing interest:* None stated.

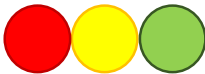
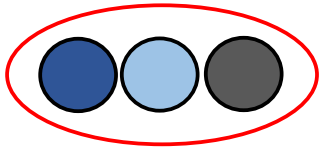

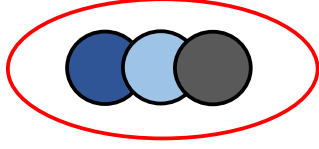
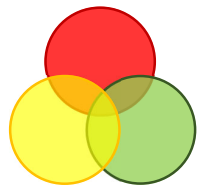
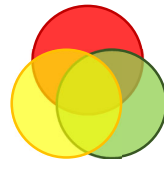

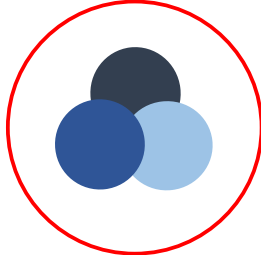
### REFERENCES

1. Malik AS, Malik RH. Twelve tips for developing an integrated curriculum. *Med Teach.* 2011;33:99-104.


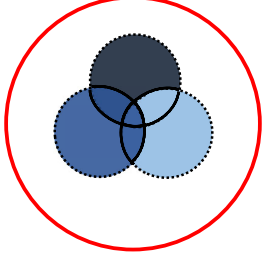
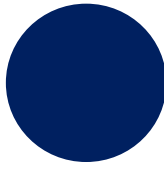
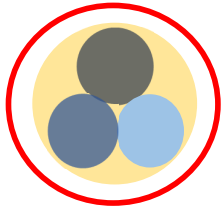
2. Shoemaker BJE. Integrative education: A curriculum for the twenty-first century. *OSSC Bulletin*. 1989;33:n2.
3. Badyal DK, Singh T. Learning theories. The basics to learn in medical education. *International Journal of Applied and Basic Medical Research*. 2017;7:S1-S3.
4. Ambrose SA, Bridges MW, DiPietro M, Lovett MC, Norman MK. 2010. *How learning works: Seven research-based principles of smart teaching*. San Francisco, CA: Jossey-Bass, 2010.
5. Raman VLM, Raju KS. Study on effectiveness of integrated lecture module versus didactic lecture module in learning skills. *IOSR Journal of Dental and Medical Sciences*. 2015;14:14-6.
6. Doraisamy R, Radhakrishnan S. The effectiveness of integrated teaching over traditional teaching among first year MBBS students: A preliminary study. *Med JDY Patil Univ*. 2013;6:139-41.
7. Koens F, Custers EJ, Ten Cate OT. Clinical and basic science teachers' opinions about the required depth of biomedical knowledge for medical students. *Med Teach*. 2006;28:234-8.
8. Badyal DK, Singh T. Teaching of basic sciences in medicine: The changing trends. *National Med J India*. 2015;28:137-4.
9. Schmidt HG, Machiels-Bongaerts M, Hermans H, ten Cate TJ, Venekamp R, Boshuizen HP. The development of diagnostic competence: Comparison of a problem-based, an integrated, and a conventional medical curriculum. *Acad Med*. 1996;71:658-64.
10. Nagdeo N. Integrated teaching. *J Educ Technol Health Sci*. 2014;1:23-6.
11. Brauer DG, Ferguson KJ. The integrated curriculum in medical education: AMEE Guide No.96. *Med Teach*. 2015;37:312-22.
12. Harden RM, Stamper N. What is the spiral curriculum? *Med Teach*. 1999;21:141-43.
13. Fogarty R. Ten ways to integrate curriculum. *Educ Leadership*. 1991;49:61-65.
14. Harden RM. The integration ladder: A tool for curriculum planning and evaluation. *Med Educ*. 2000;34:551-57.
15. Vars GF. Integrated curriculum in historical perspective. *Educ Leadership*. 1991;49:14-15.
16. Whitehead AN. *The Aims of Education*. New York: The Free Press, 1929.
17. Regulations on Graduate Medical Educations (Amendment)2019, The gazette of India, Part II, Section 4;Nov 2019.
18. Harden RM, Sowden Susette, Dunn WR. Some educational strategies in curriculum development: The SPICES model. *ASME Medical Education Booklet number 18*. *Med Educ*. 1984;18:284-97.
19. Kaliaperumal K, Annapurna K, Bupathy A, Rajagovindan D. Integrated modular teaching in undergraduate medicine. *The National Medical Journal of India*. 2014;27:90-94.
20. Shafi R, Quadri KH, Ahmed W, Mahmud SN, Iqbal M. Experience with a theme-based integrated renal module for a second-year MBBS class. *Adv Physiol Educ*. 2010;34:15-9.
21. Vyas R, Jacob M, Faith M, Isaac B, Rabi S, Sathishkumar S, *et al.* An effective integrated learning programme in the first year of the medical course. *Natl Med J India*. 2008;21:21-6.
22. McAleer S. Choosing assessment instruments. *In: Dent JA, Harden RM, eds. A practical guide for medical teachers*. Edinburgh: Churchill Livingstone. 2001;303-13.
23. Goldman E, Schroth WS. Deconstructing integration: A framework for the rational application of integration as a guiding curricular strategy. *Acad Med*. 2012;87:729-34.
24. Wood TJ, Cunnington JPW, Norman GR. Assessing the measurement properties of a clinical reasoning exercise. *Teach Learn Med*. 2009;12:196-200.
25. McGaghie WC, McCrimmon DR, Mitchell G, Thompson JA, Ravitch MM. Quantitative concept mapping in pulmonary physiology: Comparison of student and faculty knowledge structures. *Adv Physiol Ed*. 2000;23:72-81.
26. Ferguson KJ. Beyond multiple-choice questions: Using case-based learning patient questions to assess clinical reasoning. *Med Educ*. 2006;40:1142.
27. Williams RG, Klamen DL, White CB, Petrusa E, Fincher RME, Whitfield CF, *et al.* Tracking development of clinical reasoning ability across five medical schools using a progress test. *Acad Med*. 2011;86:1148-54.
28. Swanson DB, Case SM. Assessment in basic science instruction: Directions for practice and research. *Adv Health Sci Educ*. 1997;2:71-84.

**Web Table 1 Comparison of Models by Fogarty and Harden**

|   | <b>11 steps on the integration ladder (Harden 2000)</b>   | <b>Common Description</b>  | <b>Ten ways to integrate curriculum (Fogarty 1991)</b>   |
|---|---|--|--|
| 1 | Isolation<br>            | Various disciplines /departments organize their teaching without considering other departments or subjects   | The Fragmented Model<br>  |
| 2 | Awareness<br>            | Teacher is made aware of what is covered in other subjects through appropriate documentation about aims and objectives of each course  | _____  |
| 3 | Harmonization<br>      | The Disciplines remain separate but the teacher may make explicit connection within the subject areas to other subjects  | The Connected Model<br> |
| 4 | Nesting (Infusion)<br> | The teacher targets within a subject based course, few objectives relating to other subjects. Contents drawn from different subjects are used to enrich the teaching of a particular subject | The Nested Model<br>    |

|   |  |  |  |
|---|--|--|--|
| 5 | <p>Temporal Coordination</p>      | <p>The related topics within a subject are taught separately but are sequenced / arranged / scheduled at same time in consultation with other subjects.</p>                            | <p>The Sequenced Model</p>  |
| 6 | <p>Sharing</p>                    | <p>Two disciplines may agree to plan and jointly implement a teaching program using overlapping concepts or ideas as organising elements</p>   | <p>The Shared Model</p>     |
| 7 | <p>Correlation</p>               | <p>Within the subject based framework, integrated teaching sessions are introduced. These sessions bring together areas of common interest in each subject.</p>                        | <p>_____</p>   |
| 8 | <p>Complementary Programme</p>  | <p>It has both subject based and integrated teaching. The basic difference with correlation is that the percentage of integrated sessions are increased</p>                            | <p>_____</p>   |
| 9 | <p>Multidisciplinary</p>        | <p>This step brings together a number of subject areas in a single course with themes, problems or issues as the focus of teaching. The subjects/ disciplines still preserve their</p> | <p>Webbed</p>             |



|    |   |  |   |
|----|---|--|---|
|    |   | identity and demonstrate how they contribute to the understanding of the theme or problem.   |   |
| 10 | Inter-disciplinary<br><br>   | The subject/ Discipline boundaries become blurred. There may be no reference to individual subjects or disciplines as they are not identified in the timetable. Interdisciplinary teaching implies a higher level of integration, with the content of all or most subjects combined into a new course with a new menu[15]. | The Integrated Model<br><br> |
| 11 | Trans-disciplinary<br><br> | There are no subjects or discipline. There is only one subject for education, and that is Life in all its manifestations [16]. The teacher provides the framework of learning opportunity and the integration takes place in the mind of the students based on situations of the real world.                               | Immersed<br><br>           |