

BASIC-CLINICAL INTEGRATION IN MEDICAL EDUCATION: LIMITS OF FRAGMENTED CURRICULA AND THE POSSIBILITIES OF A SPIRAL CURRICULUM

Integração básico-clínica na educação médica: limites dos currículos fragmentados e possibilidades do currículo em espiral

Integración básico-clínica en la educación médica: límites de los currículos fragmentados y posibilidades del currículo en espiral

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INTRODUCTION

Medical education in Brazil faces the challenge of simultaneously responding to the rapid expansion of technical and scientific knowledge, local and regional particularities, and the growing complexity of health systems, in a context marked by constant innovation. Added to this scenario is the demand for professionals with a solid, critical, and reflective education, ethically committed to science, social responsibility, and the country's socioeconomic development.

Article 5 of the current National Curriculum Guidelines for the undergraduate medical program (DCNs-2025)¹ states that “The physician must be capable of integrating clinical, scientific, and technological knowledge with empathy and responsibility, acting as an agent of social transformation.” The same document, when addressing expectations for graduates, highlights in Article 7 that “the physician is expected to be capable of integrating diverse knowledge in an interdisciplinary and collaborative manner, committed to the quality and safety of care provided to individuals and communities.”

In this context, the medical school curriculum assumes a strategic role as a mediating entity between contemporary challenges, the DCNs, and the pedagogical practices adopted by institutions.

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In the field of education, the curriculum can be understood as a social and pedagogical construct that organizes and articulates knowledge, expertise, competencies, skills, formative experiences, and guiding values of the educational process. More than a simple selection of content, the curriculum expresses certain conceptions of knowledge, human formation, and society, being influenced by specific historical, political, economic, and cultural contexts. In this sense, it constitutes a structuring mechanism for educational practices, mediating the aims of education and the processes of professional and civic formation of individuals².

It is within the curriculum design that basic-clinical integration, the progressive development of competencies, and the social commitment of medical education are inextricably linked—central elements for the quality of healthcare and the strengthening of Brazil's Unified Health System (SUS). However, although the National Curriculum Guidelines constitute the main regulatory framework for medical education, it is observed that many programs still operate under traditional models, marked by the fragmentation of knowledge and predominantly multidisciplinary approaches. In this context, the contrast between the traditional curriculum and the spiral curriculum serves as a relevant analytical framework for understanding the different levels of curricular integration effectively achieved in medical education, as well as for discussing, in light of available evidence, more consistent approaches to integrated curriculum planning.

The Fragmented Medical Curriculum

The fragmented medical curriculum has historically been characterized by a rigid separation between the basic and clinical cycles, a predominantly multidisciplinary organization, and the centrality attributed to the basic biomedical basic sciences, often dissociated from professional practice and social health needs. This model, strongly influenced by the Flexner Report³, established a linear teaching structure in which students are initially exposed to basic scientific content and only later gain access to clinical settings. Although it legitimately recognizes the relevance of basic sciences to medical education, such an organization tends to favor the fragmentation of knowledge and hinder the articulation between theory and practice, resulting in limitations in the retention, transfer, and application of scientific knowledge in real-world care settings⁴.

Studies indicate that, in this model, content is often learned in an episodic and loosely connected manner, which contributes to significant information loss over time. It is estimated that, in fragmented curricula, knowledge retention may drop to less than 40% after two years, especially when there is no structured review of the topics⁵. Furthermore, the multidisciplinary approach reinforces the division between departments and fields, hindering interdisciplinary teaching and the development of an integrated view of the health-disease process.

Curricular integration: concepts and levels

Curricular integration can be understood as a continuum, ranging from minimal forms of coordination between disciplines to broadly integrated and transdisciplinary models. Harden proposed a well-known typology of integration levels, often represented as a “ladder,” in which the isolated, fragmented curriculum occupies the lowest level, and interdisciplinary and transdisciplinary models occupy the highest levels⁶.

In the Brazilian context, research indicates that, although most medical schools claim to adopt integrated curricula, a large proportion operates at intermediate levels of integration, such as thematic correlation or partial integration through clinical cases. A national study with medical program coordinators showed that only a portion of institutions achieve effective integration between basic and clinical sciences, while many remain in hybrid models, in which fragmentation persists in a veiled form⁷.

This gap between the formal curriculum, as prescribed in course pedagogical projects, and the curriculum in practice, as experienced on a daily basis, is also evident in qualitative studies with faculty members, which highlight conceptual, epistemological, and organizational difficulties in achieving curricular integration. In many cases, the integrated curriculum is understood merely as an administrative rearrangement of content, and not as a paradigmatic shift in the organization of teaching and learning⁸. Furthermore, the lack of training, institutional incentives, resources, and appropriate assessments is highlighted⁹.

Levels of curricular integration

A study conducted by Fogarty¹⁰ and expanded upon by Harden⁶ made it possible to categorize the level of curricular integration on a scale of increasing intensity. The combination of these two frameworks gave rise to a curricular categorization table, in which the levels of integration were defined as: 1. Isolated fragmented, 2. Conscious fragmented, 3. Connected, 4. Nested, 5. Sequential, 6. Shared, 7. Correlated, 8. Complementary program, 9. Integrated multidisciplinary, 10. Interdisciplinary, and 11. Transdisciplinary (Table 1).

Table 1 - Categories of curricular integration and their characteristics according to Fogarty (1991) and Harden (2000), with examples contextualized in medical education.

INTEGRATION CATEGORIES	CHARACTERISTICS
1. ISOLATED FRAGMENTED	The content is organized in isolation into specialized disciplines, without considering the overall context. Teachers have little knowledge of what is being covered by other disciplines. Each topic is addressed only once and viewed as an entity in itself. There is no explicit attempt to help the student gain an integrated understanding of the subject.
2. FRAGMENTED CONSCIOUSNESS	The content is still isolated, but teachers are explicitly aware of what is taught in other curricular components, even though there is no joint planning of integrated activities. Since the specific teachers are aware of what is taught by the others, redundancies and contradictions are avoided.
3. CONNECTED	The curricular components are separate, but teachers make explicit connections between the content covered in different disciplines, deliberately linking topics. Teachers engage in informal dialogue or through formal curriculum planning committees and contribute to achieving curricular objectives. For example, pathology and histology teachers discuss and plan their courses so that the topics covered in one are valued in the other due to the natural connection that exists between these areas of science, in a deliberate effort to ensure that students automatically understand these connections.
4. NESTED	The curricular components are separate, but, when relevant, the content covered goes beyond the limits of the specialty, recognizing and valuing broad and common curricular objectives. Such content may involve theoretical or practical subjects, or desired generic skills such as communication or conflict resolution. Example: In the pediatrics discipline, there are moments to revisit the embryological, genetic, and cellular bases related to the etiology of congenital anomalies.
5. SEQUENTIAL	Each curricular component remains isolated, but there is an intentional approach to the timing of the content so that related subjects are discussed concurrently. For example, in the first semester of a medical course, there are subjects such as embryology, histology, anatomy, and physiology, and the timing of the approach to the content, for example, those related to the nervous system, occurs simultaneously in the subjects.
6. SHARED	Two or more curricular components begin to jointly plan and implement a teaching program focused on shared elements. The components cease to focus on isolated specialties and begin to integrate distinct areas in the approach to common or complementary content. Example: Instead of the curriculum having subjects in histology, embryology, anatomy, and physiology, it has subjects with morphofunctional content, such as the morphofunctional study of the digestive system, in which the integration between specialties becomes natural and the specialist teachers no longer see themselves as "owners" of the subject.
7. RELATED	The curricular components still remain throughout the curriculum or occupy the majority of it, allowing moments when teaching transcends disciplinary organization. One example is a medical science program in which students first study from an isolated disciplinary perspective and then come together for integrated sessions where they discuss common problems. Another example is a discipline-based program in which a task or project is given to students to integrate the disciplines.

8. SUPPLEMENTARY PROGRAM	At the supplementary program level, integrated activities are official and represent characteristics as important as, or even more important than, the subjects themselves, considering both the time required for completion and the weight of the assessments. The teaching focuses on skills and competencies from which students are challenged. The components occur separately, but are intentionally planned to address content that helps students complete the challenge. Assessments emphasize both the integrated activities and the content covered in the subjects.
9. INTEGRATED MULTIDISCIPLINARY	At the integrated multidisciplinary level, a group of components work together to address common themes in a meta-curricular way, focusing on skills, content, and attitudes, and using methods that stimulate competency-based learning, such as project-based learning. In this aspect, the theme is explored through challenges that involve understanding relevant basic and applied sciences, as well as the technical skills foreseen in clinical sciences. An example is the approach to the theme of life stages, from conception to death, through a project that must be developed by students over the course of a semester or cycle. The theme is the focus of student learning, but the disciplines preserve their identity, and each demonstrates how its subject contributes to the student's understanding of the theme or problem. The contributions of individual disciplines are implicitly declared in the pedagogical project; however, these disciplines relinquish much of their own autonomy.
10. INTERDISCIPLINARY	Curricular components disappear as isolated entities, and the focus of study and learning becomes exclusively on topics based on skills and competencies. Students are autonomous, seeking information in all areas of knowledge to build their "arsenal" of learning, and teachers tutor the process as a whole. Learning is personalized, although the study topics are explicit in the curricular organization. The separations between different components cease to make sense. The community-based education method can contribute to an immersive curriculum.
11. TRANSDISCIPLINARY	There are no specific curricular components. Students cooperate with each other and with the external community, forming networks of individuals with similar interests, in an intense exchange of information and experiences. The study topics are not explicitly stated in the curriculum, but are chosen at the students' discretion, who have access to teachers who tutor them in their personalized learning path.

Source: the authors, 2026.

In the integration model proposed by Harden⁶, as one progress through the different levels, there is a progressive reduction in the centrality of isolated curricular components, traditionally organized around specialties, concurrent with increased demands for integrated curriculum planning, institutional coordination, and faculty development. In this sense, Harden does not prescribe a single or normative curricular model, but rather provides an analytical framework that supports the planning, implementation, and evaluation of the degree of integration most consistent with the educational objectives and institutional conditions of each medical program⁶.

Based on the analysis of the categories, it is evident that although organizing the curriculum around the proximity of related content represents an advance over the traditional fragmented model, this strategy, on its own, is not sufficient to ensure effective integration. Curricula structured into thematic blocks overcome the logic of isolated disciplines by fostering coordination between related fields; however, when accompanied by limited communication between tutors and faculty and the absence of jointly planned activities with shared educational objectives, they tend to produce gaps in training. Under these conditions, it becomes difficult to consistently achieve the conceptual, procedural, and attitudinal objectives expected in medical education¹¹. As a consequence, such models often prioritize horizontal integration at the expense of basic-clinical integration, which remains delayed and concentrated in the clinical years of the program.

Contemporary evidence indicates that more robust pedagogical strategies, such as clinical exposure from the beginning of undergraduate studies, task-based learning, and the systematic inclusion of integrated practical activities, contribute to meaningful learning, knowledge retention, and the development of clinical reasoning¹². These effects are enhanced when such strategies are sustained longitudinally throughout the program, through consistent vertical integration across educational cycles¹³.

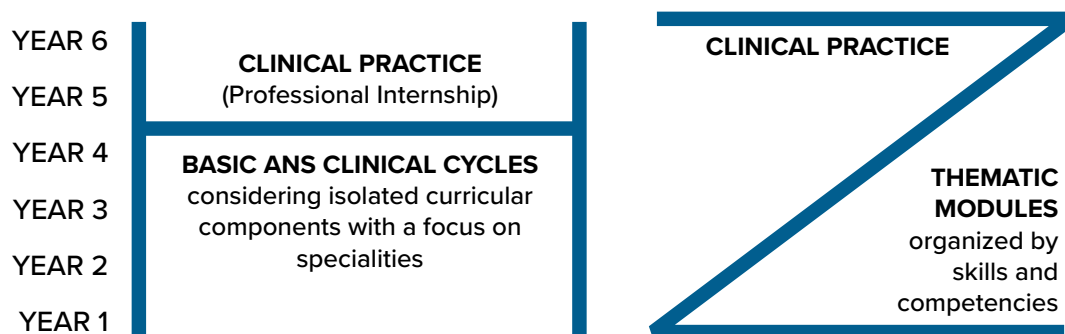
In this sense, an ideal integrated curriculum in medical education is characterized by a longitudinal, competency-based organization in which basic and clinical sciences are continuously linked around relevant clinical problems and situations, including the progressive integration of students into real-world work environments from the earliest years of undergraduate study. Such a model goes beyond the mere juxtaposition of content by intentionally and cumulatively promoting the horizontal and vertical integration of the curriculum, moving toward higher levels of interdisciplinarity, educational coherence, and alignment between teaching, learning, and professional practice^{6,12}.

The relationship between spiral curricula and basic-clinical integration The concept of the spiral curriculum, originally formulated by Bruner and widely disseminated by Harden, proposes the systematic revisiting of content and skills throughout the course, with progressive levels of complexity, depth, and student autonomy. Unlike mechanical repetition, the spiral assumes that each new encounter with the content explicitly connects to prior learning, expanding its clinical applicability and educational significance^{13,14}.

Spiral curricula adopt a more comprehensive conception of curricular integration, favoring knowledge retention and the development of clinical competencies. In these models, the clinical context is present throughout the entire training, serving as a structural axis for the teaching of basic sciences, which are revisited in successive cycles with increasing levels of depth, clinical complexity, and practical contextualization. This approach promotes continuous integration between basic and clinical knowledge from the initial phases through to the most advanced stages of the program¹⁴. International reviews indicate that curricula organized according to the spiral model contribute to meaningful learning, critical thinking, decision-making, and the consolidation of long-term memory¹⁵.

In the context of spiral-organized curricula, these aspects are enhanced throughout successive learning cycles, in which students revisit clinical problems and situations with increasing levels of complexity and responsibility. This progression fosters the gradual development of professional autonomy, enabling students to act with increasing independence, solve complex problems, handle unfamiliar situations, set priorities, collaborate with physicians and other healthcare professionals, recognize their limitations, and identify when they need support, as well as critically reflect on their professional responsibilities¹⁶. Figure 1 illustrates this logic of progression by contrasting the traditional medical curriculum—inspired by Flexner and organized in an “H” format—with a spiral curriculum, horizontally and vertically integrated and structured in a “Z” format, in which learning is built cumulatively and in an interconnected manner throughout the course.

Figure 1 - Comparison of H-shaped and Z-shaped medical curricula, in the context of clinical exposure from the beginning of the program and curricular integration.



Source: the authors, 2026. Adapted from Wijnen-Meijer et al., 2020.

Finally, in an effectively integrated curriculum, continuous collaboration among faculty, students, and administrators constitutes a structural element that must be present from the conception through the implementation of curricular proposals. From this perspective, curriculum updates should occur through dialogic and participatory processes, in which the definition of educational objectives and the problems that guide learning result from collective construction and the sharing of institutional responsibilities¹⁷.

Empirical evidence and implementation challenges

Despite its theoretical and empirical advantages, the implementation of the spiral curriculum is not without its challenges. A study conducted in the United States showed that, although medical students recognize the value of spaced repetition and longitudinal integration, the way the spiral curriculum is implemented directly influences its acceptance. Interventions that are overly centralized or perceived as an overload can generate student resistance⁵.

In the Brazilian context, reports on the implementation of integrated and interdisciplinary curricula point to additional obstacles, such as a fragmented multidisciplinary faculty culture, limitations in academic management systems, and a lack of structured faculty development programs. Such factors can compromise the coherence between the curriculum design and the pedagogical practices actually adopted¹⁸.

These findings reinforce the idea that the spiral curriculum should not be understood as a merely technical or organizational solution, but as part of a broader institutional project involving changes in the conception of teaching, learning, assessment, and the role of the faculty member. In this context, curricular integration is also linked to the need to promote interprofessional education, fostering the development of collaborative attitudes and teamwork skills, by recognizing the complexity of healthcare and the complementary roles of the different professionals who make up the healthcare system¹⁹.

FINAL CONSIDERATIONS

The analysis developed throughout this essay allows us to affirm that curricular organization is not a neutral or merely administrative element, but a structuring component that decisively conditions the levels of integration effectively achieved in medical education. Traditionally oriented curricula, characterized by linearity, the separation of cycles, and disciplinary centrality, tend to reinforce the fragmentation of knowledge and hinder the articulation between scientific foundations and clinical practice. In contrast, the spiral curriculum presents itself as a pedagogical alternative capable of challenging this logic by promoting the vertical and horizontal integration of content, meaningful learning, and the progressive development of competencies throughout the course.

However, the adoption of the spiral curriculum cannot be reduced to a formal rearrangement of the curriculum matrix or to the simple repetition of content at different points in the program. Its effectiveness depends on concrete institutional conditions, such as faculty development policies, spaces for collective planning, coherent assessment systems, and epistemological clarity regarding the profile of the graduate one intends to produce. Without these elements, there is a risk that the spiral curriculum will remain a normative or rhetorical construct, disconnected from everyday pedagogical practices.

In light of the National Curriculum Guidelines, the convergence between the spiral curriculum and the competency-based curriculum proves particularly promising. By articulating learning progression, the contextualization of knowledge, and the integration of different bodies of knowledge, the spiral model directly addresses the development of cognitive, psychomotor, and attitudinal competencies, while also fostering the inseparability of teaching, service, and community. This perspective reinforces the social commitment of medical education and its connection to the principles of the Unified Health System by aligning the educational process with the real needs of the population.

In this sense, the spiral curriculum should be understood not only as a didactic- pedagogical strategy but as a structural pillar of educational projects committed to greater curricular integration, educational coherence, and social relevance. By overcoming fragmented models and promoting a longitudinal and integrated view of learning, this curricular arrangement contributes to the training of more physicians prepared to deal with the complexity of contemporary healthcare contexts.

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