Revue-IRS

Revue Internationale de la Recherche Scientifique (Revue-IRS)

ISSN: 2958-8413

Vol. 4, No. 3, Mai 2026

Beyond Pedagogy: Toward an Integrated Ecology of Medical Learning

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Abstract:

Medical education is currently undergoing profound transformations in a context characterized by the increasing complexity of knowledge, the diversity of learners, and the demands of clinical competence. This article presents an integrated ecological model of medical learning that brings together five approaches from the educational sciences: pedagogy, andragogy, heutagogy, peeragogy, and didactics. Pedagogy and andragogy are presented as complementary and form the pillars of a continuum ranging from structured teaching to autonomous learning, while heutagogy and peeragogy further extend this dynamic by placing the learner at the center of the process, in a logic of self-directed learning and co-construction of knowledge. Didactics, finally, ensures the coherence of the system through content structuring, instructional design, and the integration of theory and practice.

This conceptual model aims to go beyond the simple opposition between teacher-directed instruction and self-determined learning to establish an educational ecology in which teachers and students co-evolve toward competence, responsibility, reflexivity, and professional adaptability — conditions for effective, sustainable, and humanistic medical training.

Keywords: medical pedagogy; andragogy; heutagogy; peeragogy; didactics; integrated model

Digital Object Identifier (DOI): https://doi.org/10.5281/zenodo.**20461112**

1. Introduction

The training of health professionals, particularly physicians, is a field in which academic excellence, clinical competence, and ethical reflection must converge to ensure high-quality care. Medical education has had to adapt to new educational paradigms in response to evolving health systems, both in terms of teaching methods and learning objectives (Irby *et al*., 2010). Nevertheless, it continues to face numerous challenges, including the rapid expansion of scientific knowledge, the emergence of new technologies, and the increasing diversity of learner profiles.

Medical education relies on a progressive learning process, beginning with the acquisition of foundational knowledge and culminating in the mastery of advanced clinical competencies. Although medical students are young, they are often considered adult learners, as they are placed in situations requiring autonomy, critical thinking, and self-directed learning. Historically, medical training was grounded in traditional pedagogical models, where teachers transmitted knowledge to students in a passive manner (Cooke *et al*., 2010). However, the evolution of health systems—coupled with the essential need for strong clinical and professional competencies—has led to a reassessment of this model. Andragogy has emerged as a recommended approach for adult learners, who are more autonomous and able to apply their knowledge immediately (Knowles *et al*., 2015).

This distinction between pedagogy and andragogy is crucial for medical educators seeking to identify the most appropriate approaches to train competent and autonomous physicians. This article therefore aims, first, to explore the fundamental differences between these various teaching-learning frameworks and, second, to assess their relevance in the context of medical learning in order to propose a coherent and context-appropriate model for medical training systems.

2. Methodology

This article is based on a literature review exploring the main learning paradigms in medical education, including pedagogy, andragogy, heutagogy, peeragogy, and didactics. To conduct this documentary research, we consulted international databases such as PubMed and Google Scholar, using combined keywords such as medical education, andragogy, heutagogy, peeragogy, didactics, self-directed learning, and competency-based education.

The selected publications included scientific articles, reference books, and systematic reviews, mainly published between 2000 and 2025, along with a few earlier foundational references. The selection criteria were based on their relevance to medical learning, the scientific quality of the sources, and their contribution to understanding the educational approaches examined. This analysis made it possible to highlight the convergences and complementarities among these different approaches, with the aim of proposing an integrated conceptual model for medical learning.

The ecological model proposed here differs from existing models in that it unifies pedagogy, andragogy, heutagogy, peeragogy, and didactics—traditionally examined separately—within a single conceptual framework. It offers educators an operational guide for adapting their strategies to learners evolving needs by articulating guidance, autonomy, collaboration, and self-directed learning. This model thus addresses a major gap in medical education: the absence of a coherent framework capable of linking paradigms and aligning learning environments with competency-based development.

3. Understanding Pedagogy and Andragogy

As medical curricula evolve to meet the specific demands of contemporary health systems, educators are required to find a balance between pedagogical structure and andragogical flexibility. Distinguishing pedagogy from andragogy involves examining the strengths and limitations of each approach within medical learning, while highlighting evidence-based strategies that can optimize educational outcomes for future health professionals.

The need for an innovative and holistic approach to medical learning has become increasingly evident in recent years, driven by the growing demand for competency-based programs, interdisciplinary education, and lifelong learning in the health professions (Douglas & DeLuca., 2022).

Pedagogy originates from the Greek *paidagogos*, meaning the art of teaching children. Traditional pedagogical methods often rely on a teacher-centered approach, in which the instructor is the primary source of knowledge and students are passive recipients. Key features of pedagogy include structured curricula, teacher-directed learning, and the assumption that learners possess limited prior knowledge and therefore require direct instruction and close guidance (Freire, P. (1970). In contrast, andragogy—introduced by Malcolm Knowles in the 1960s—emphasizes the principles of adult learning, recognizing that adults learn differently due to their life experiences, intrinsic motivation, and readiness to learn (Knowles *et al*., 2015).

Andragogy assumes that adult learners are self-directed, practical, and goal-oriented, bringing valuable experience into the educational process—experience that should be integrated into teaching strategies. Andragogical principles therefore promote a learner-centered approach, valuing collaboration, problem solving, and the concrete application of knowledge—all essential elements in medical learning, where practical skills and clinical decision-making are fundamental.
In summary, pedagogy rests on a structure in which the teacher holds the knowledge and guides the learning process, whereas andragogy acknowledges that adult learners bring their own experience and must be actively involved in defining their learning objectives (Knowles *et al*., 2015).

3.1. Pedagogy in Medical Education

Pedagogy traditionally refers to teaching methods oriented toward young learners, emphasizing structured instruction, direct guidance, and a progression shaped by assessments. These pedagogical methods are widely used in the early preclinical years, where students acquire foundational sciences through lectures, memorization, and teacher-directed instruction.

Key characteristics of pedagogy in medical learning:
- Teacher-centered learning
- Fixed curriculum and structured content
- Emphasis on memorization and knowledge acquisition
- External motivation (grades, assessments)

Examples of pedagogical methods in medical learning:
- Traditional lectures
- Textbook-based learning
- Standardized multiple-choice examinations

3.2. Andragogy in Medical Learning

In medical education, andragogy is particularly relevant during clinical training, internships, and continuing professional development.

Key characteristics of andragogy in medical learning:
• Learner-centered approach
• Self-directed and problem-based learning
• Integration of prior knowledge and experience
• Intrinsic motivation (professional development, patient care)

Examples of andragogical methods in medical learning:
• **Problem-Based Learning (PBL):** case-based discussions requiring critical thinking
• **Simulation-based education:** the use of clinical scenarios in simulation centers
• **Workplace-based learning:** clinical placements and rotations

3.3. Integrating Pedagogy and Andragogy in Medical Curricula

Modern medical education integrates both pedagogical and andragogical principles to optimize student learning across different stages of their training. Hybrid models include:

• **Flipped Classroom:** combining traditional lectures (pedagogy) with active learning activities (andragogy).
• **Competency-Based Medical Education (CBME):** shifting from time-based to mastery-based training, highlighting self-directed learning.
• **Blended Learning:** using online modules for foundational knowledge (pedagogy) and case-based discussions (andragogy).

Thus, the combined use of pedagogical and andragogical approaches in medical education must be seen as complementary rather than exclusive. Pedagogy retains its relevance, particularly in the initial stages of medical training, where acquiring foundational knowledge is essential. For example, lectures and textbooks help introduce basic sciences, anatomy, and pathology domains in which novice learners require structured guidance. However, as students progress into clinical training, andragogical principles become increasingly pertinent, as learners must apply their knowledge in dynamic and authentic care settings.

Adult learners in medicine often seek greater autonomy, requiring strategies based on self-directed learning, reflective practice, and collaborative work. Despite the contributions of both paradigms in shaping medical curricula according to learner profiles, they remain insufficient when applied in isolation. Medical students are not a homogeneous group ; they evolve across multiple stages of cognitive, emotional, and professional development. Furthermore, the growing complexity of health care requires that medical learning extend beyond cognitive competencies to include professional identity formation, communication skills, and the capacity for lifelong learning (Bawani *et al., 2023*). Medical learning therefore cannot be reduced to a binary opposition between pedagogy and andragogy.

4. Heutagogy and Peeragogy: Two Complementary and Evolving Approaches

4.1. Heutagogy in Medical Education

Heutagogy, introduced by Hase and Kenyon in 2000, is an approach grounded in self-determined learning and metacognition. In this model, the learner becomes the primary agent of their own learning, planning, implementing, and evaluating their educational trajectory. In contrast to andragogy—which emphasizes guided autonomy—heutagogy focuses on the ability to *learn how to learn* and on the development of adaptive competence, a central requirement in complex environments such as medicine (Blaschke., 2012).

In the context of medical learning, heutagogy integrates experiential learning, reflexivity, and self-assessment. Students identify their own training needs, explore diverse learning resources, and construct knowledge by combining clinical practice, research engagement, and digital tools. This approach is particularly relevant in continuing medical education and lifelong professional development, where physicians must continuously update their competencies in an ever-evolving environment.

Key characteristics of heutagogy in medical learning:
• Self-determined and reflective learning
• Emphasis on developing adaptive and metacognitive competencies
• Flexible trajectories and co-construction of knowledge
• Intrinsic motivation and continuous self-evaluation

Examples of heutagogical approaches in medical learning:
• Reflective learning portfolios and individualized development plans
• Self-directed clinical project-based learning
• Use of personalized digital resources (MOOCs, simulation, interactive e-learning)

4.2. Peeragogy in Medical Learning

Peeragogy—also referred to as *peeragogy* in English—is a collaborative learning approach in which knowledge is co-constructed among peers. Conceptualized by Corneli *et al (2016)*, it is grounded in mutual support, shared expertise, and dialogue-based knowledge exchange. In medical education, peeragogy promotes horizontal learning, interdisciplinary collaboration, and collective intelligence within healthcare teams.

Although peeragogy extends active learning and collaborative pedagogies, it distinguishes itself through the absence of hierarchy between “teacher” and “learner.” In medical training settings, peeragogy manifests through peer-learning groups, reciprocal mentoring, and communities of practice in which students and professionals exchange knowledge and discuss clinical reasoning.

Key characteristics of peeragogy in medical learning:
• Horizontal and collaborative learning
• Social construction of knowledge through interaction
• Development of communication and reflective skills
• Mutual engagement and shared responsibility

Examples of peeragogical approaches in medical learning:
• Peer-led clinical discussion groups
• Peer tutoring or mentoring
• Interprofessional collaborative projects and communities of practice

The future of medical education must rely on increased pedagogical flexibility. Faculties of medicine must respond to the diversity of student needs, acknowledging varying learning styles, levels of prior knowledge, and individual motivations. This flexibility must also extend to clinical environments, where health professionals must continually update their competencies to keep pace with advancements in medicine and technology (Majid A *et al., 2025*).

Medical education cannot be limited to theoretical knowledge transmission ; it must also support the development of practical skills such as clinical examination, patient management, and interpersonal communication.In this contexte, the educator's profile directly influences the quality of educational design and the structuring of learning pathways in medical schools (Sukkurwalla *et al.2024*). Their disciplinary and pedagogical expertise determines how medical content is translated and organized to facilitate the acquisition of knowledge and the development of clinical competencies.

Didactics plays a central role in the thoughtful design of learning sequences that integrate theory, clinical practice, and problem-solving to optimize educational effectiveness. This perspective underscores that the performance of an educational system depends not only on teacher qualifications but also on their ability to structure and contextualize medical knowledge for learners (Singh *et al ., 2013*).

5. Didactics in Medical Learning

Didactics, as a discipline that investigates teaching and learning processes, plays a fundamental role in the design, implementation, and evaluation of pedagogical strategies in medical education. It facilitates the analysis of educational practices, the understanding of interactions between instructors, students, and content, and the development of tailored methods aimed at maximizing the effectiveness of medical learning. The primary goal of didactics in medical education is to ensure that students acquire not only theoretical knowledge but also practical and behavioral competencies essential for competent medical practice (Higashi *et al., 2019*).

Within the context of medical learning, didactics assumes a pivotal role by proposing innovative approaches to convey both theoretical and practical knowledge and by supporting the acquisition of clinical and professional skills. It also allows for the adjustment of teaching to students' needs while ensuring high-quality, effective medical education. Didactics is thus considered a critical lever for optimizing teaching practices in medicine.

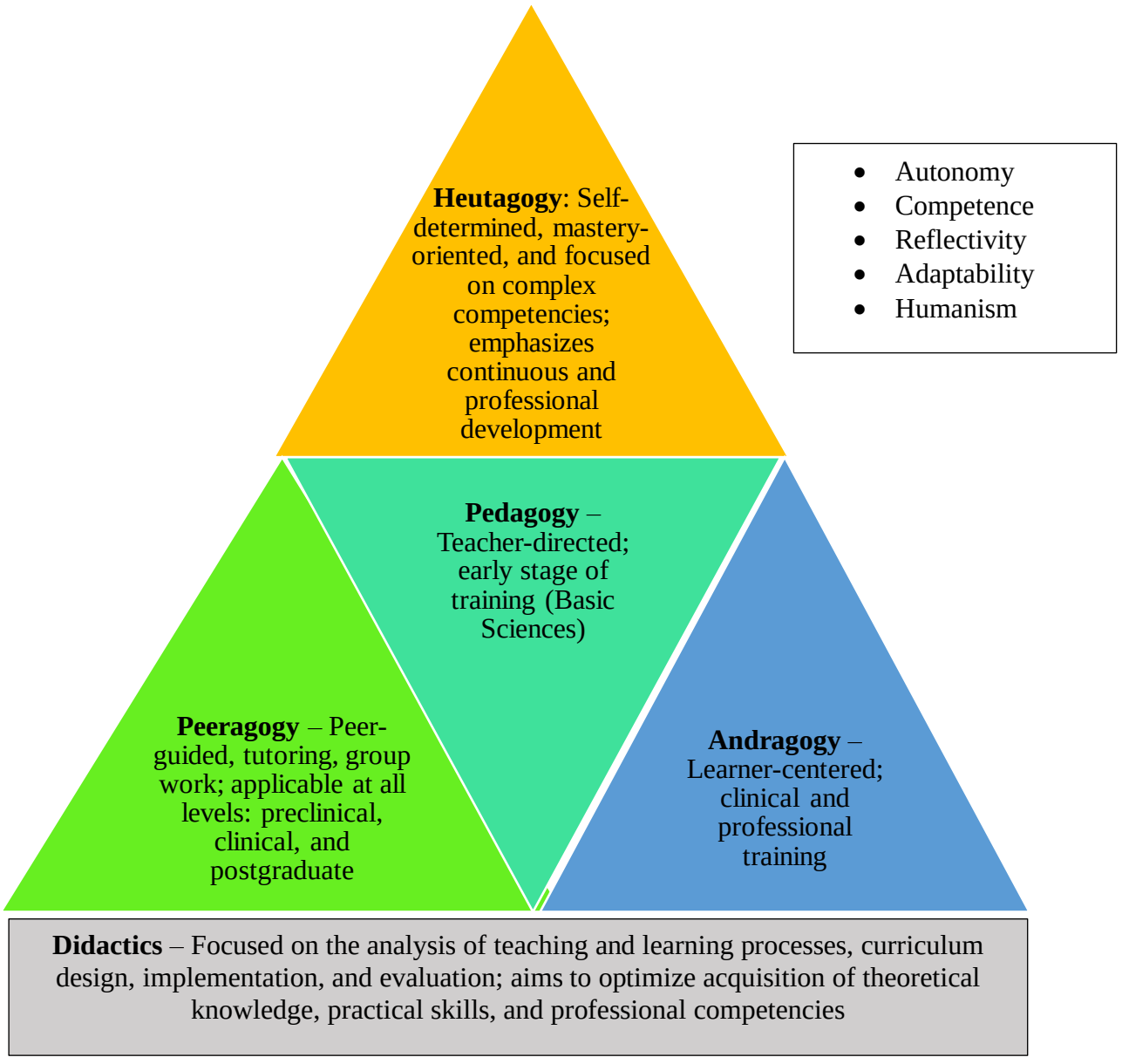
6. Conclusion

Although research in medical education has extensively explored traditional pedagogical approaches and learner-centered models, few studies have proposed a conceptual integration of these approaches within an ecological framework. More advanced strategies, such as heutagogy and peeragogy, which emphasize self-directed and collaborative learning, are often studied in isolation without fully exploring the systemic interplay of pedagogy and andragogy.

This article offers an original contribution by proposing an integrated ecological model of medical learning, founded on the co-evolution of actors (teachers and students), learning contexts, and pedagogical arrangements. While this model builds on socio-ecological approaches in education, its originality lies in applying them specifically to medical training, integrating five theoretical domains: pedagogy, andragogy, heutagogy, peeragogy, and didactics (Figure 1), in a transdisciplinary perspective aimed at overcoming the fragmentation of educational paradigms for the benefit of an adaptive, active, reflective, and sustainable medical learning ecosystem.

This proposed model remains primarily theoretical and should be validated across various medical education contexts. Subsequent empirical studies, particularly qualitative or mixed-methods research, could confirm its relevance and operational applicability. Such investigations would provide a promising avenue to refine and consolidate this integrated ecological framework, enabling immediate practical use by medical educators.

Figure 1. Integrated Ecological Model of Medical Learning



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