



Preserving Kairos: a research agenda for productive struggle

Preservar o Kairos: uma agenda de pesquisa para a luta produtiva

Carlos Fernando Collares¹

Inspirali Educação; Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho;

Largo do Paço - Braga, Portugal. Orcid: <https://orcid.org/0000-0003-0914-3430>

Autor Correspondente: Carlos Fernando Collares

Address: Avenida Angélica, 2565, CEP: 01227-200. São Paulo - São Paulo, Brazil.

E-mail: carlos.collares@inspirali.com

ABSTRACT

In this short commentary the author explores the concept of productive struggle in medical education, proposing a shift from narrow discussions of task difficulty calibration toward a broader understanding of meaningful engagement with challenges. The author contrasts two temporal frameworks—Kronos (rigid, standardized timing) and Kairos (opportune moments for meaningful learning)—arguing that current educational systems overprivilege the former at the expense of the latter. Drawing from experiences with computerized adaptive testing and authentic learning activities, the author raises concerns about how artificial intelligence might further diminish opportunities for productive cognitive effort. A research agenda is proposed focusing on three areas: the role of professional authenticity in challenge perception, balancing adaptive support with cognitive effort, and examining how technology influences metacognitive regulation. The commentary calls for collaborative research to ensure medical education cultivates resilient professionals through experiences where effort, challenge, and professional identity converge meaningfully, rather than merely optimizing for efficiency.

RESUMO

Neste breve comentário, o autor explora o conceito de luta produtiva na educação médica, propondo uma mudança de discussões estreitas sobre calibração de dificuldade de tarefas para uma compreensão mais ampla do envolvimento significativo com desafios. O autor contrasta duas estruturas temporais — Kronos (tempo rígido e padronizado) e Kairos (momentos oportunos para aprendizagem significativa) — argumentando que os sistemas educacionais atuais privilegiam excessivamente o primeiro em detrimento do último. Com base em experiências com testes adaptativos computadorizados e atividades de aprendizagem autênticas, o autor levanta preocupações sobre como a inteligência artificial pode diminuir ainda mais as oportunidades de esforço cognitivo produtivo. Uma agenda de pesquisa é proposta com foco em três áreas: o papel da autenticidade profissional na percepção de desafios, equilibrando o suporte adaptativo com o esforço cognitivo e examinando como a tecnologia influencia a regulação metacognitiva. O comentário pede pesquisa colaborativa para garantir que a educação médica cultive profissionais resilientes por meio de experiências em que esforço, desafio e identidade profissional convergem significativamente, em vez de apenas otimizar para eficiência.

HISTÓRIA DO ARTIGO

Received 13 February 2025

Accepted 24 February 2024

KEYWORDS

Productive struggle; Medical education; Self-determination theory; Artificial intelligence; Adaptive testing; Metacognition.

PALAVRAS CHAVE

Luta produtiva; Educação médica; Teoria da autodeterminação; Inteligência artificial; Testes adaptativos; Metacognição.

The upcoming MedEd on the Edge event will explore the role of discomfort in education, a theme that resonates deeply with current debates on productive struggle. My concern is that the conversation may focus too narrowly on calibrating task difficulty while overlooking the broader

implications of how learners engage with meaningful challenges, particularly in an era where artificial intelligence (AI) is reshaping assessment and learning.

After two decades working with computerized adaptive testing (CAT), I have observed the growing sophistication of these systems, from optimizing test difficulty to their integration into intelligent tutoring systems [1]. The gamification elements of CATs, often perceived positively, raise important questions: does the adaptive nature of testing enhance engagement, or could it foster complacency by making learning too seamless? The assumption that a 50% success probability is ideal for maximizing measurement precision has been challenged by evidence suggesting that a higher probability of success (around 80%) may better support motivation and self-efficacy [2]. The rise of generative AI further complicates this landscape, as learners increasingly rely on external cognitive aids, potentially diminishing metacognitive effort and fostering a form of learned dependence [3].

There is a tendency in discussions on productive struggle to focus on desirable difficulties—structuring learning experiences to enhance retention and transfer [4, 5].

While this is important, a broader perspective is still needed. The performance-learning paradox, the inverse relationship between short-term performance and long-term learning, suggests that ease of success does not necessarily equate to effective learning [6]. Research on productive failure has shown that initial struggle, when framed appropriately, can result in deeper conceptual understanding [7]. However, how this principle translates into medical education, where clinical errors carry real consequences, remains underexplored.

To understand what is at stake, I posit we must consider two contrasting conceptions of time: Kronos and Kairos. Our education systems overwhelmingly privilege Kronos, rigidly controlling pace and difficulty through predetermined schedules and standardized assessments.

In contrast, Kairos moments—where meaningful learning emerges through engagement with complex, authentic challenges—seems to have been largely forgotten. I will give a practical example. More than a decade ago, when I was still working as a pharmacology teacher, I tried to move away from traditional lectures and experimented to "activate" my old lectures by doing what I called a "surprise test" in which I simulated a shift on a Poison Control Center using real cases from my night shifts. In a computer lab, small groups of students could freely collaborate in what appeared to be an open-book examination, but it was a carefully designed learning experience. Students had to apply pharmacokinetic principles such as half-life and volume of distribution to estimate the length of hospitalizations and decide the appropriateness of indicating hemodialysis. I witnessed the power of professionally authentic challenges. The struggle felt meaningful because it connected directly to their future professional responsibilities. More importantly, students were highly engaged, motivated, and had fun—as if the activity was not a test at all.

When learning environments foster autonomy, competence, and relatedness [8], these moments become possible. AI-driven personalization risks reinforcing Kronos by optimizing for efficiency rather than engagement, potentially reducing opportunities for meaningful struggle.

To advance our understanding of productive struggle and its role in medical education, I propose a collaborative research agenda that investigates:

1. The Role of Professional Authenticity in Challenge Perception: How do contextually relevant, professionally meaningful tasks impact motivation, persistence, and competence development?

2. Balancing Adaptive Support and Cognitive Effort: What conditions optimize deep learning without fostering disengagement or excessive frustration? How do self-determination theory constructs (autonomy, competence, relatedness) mediate this process?
3. Technology, AI, and the Future of Effortful Learning: How does increasing reliance on AI in medical education influence metacognitive regulation and problem-solving approaches? Does AI-enhanced learning reduce productive struggle in ways that ultimately weaken clinical reasoning?

As automation accelerates, the need to cultivate resilient, adaptive professionals has never been greater. If medical education is to rise to this challenge, it must move beyond simplistic notions of optimizing difficulty and instead foster environments where effort, challenge, and professional identity converge in meaningful ways. The outlined research agenda offers a thoughtful direction for ensuring that medical education evolves not only to enhance learning efficiency but also to retain the essential challenges that foster true expertise. I invite the international academic community to collaborate in expanding this agenda, fostering a deeper understanding of how productive struggle shapes learning and expertise in medical education.

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