



EDITORIAL V.4 N.2–2026 Learning should be like breathing

Carlos Fernando Collares^{a,b,c,d,e}

ORCID: 0000-0003-0914-3430

a. Medical Education Unit, Faculty of Medicine and Biomedical Sciences, University of Algarve, Faro, Portugal

b. European Board of Medical Assessors, Cardiff, United Kingdom

c. Inspirali Educação, São Paulo, Brazil

d. Faculdades Pequeno Príncipe, Curitiba, Brazil

e. Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Largo do Paço, Braga, Portugal

Learning should be like breathing. The simplicity is the point. The most robust findings of the science of learning have not failed to replicate; they have failed to become ordinary.¹ A teacher knows that testing beats rereading and still lectures for ninety minutes; a student knows that highlighting barely works and keeps highlighting. The gap is no longer one of evidence but of form: science not compressed into a transferable image remains advice; infrastructure is used without thinking. Nowhere does that gap cost more than in health professions education, where the daily temptation is to mistake coverage for learning.

The objection comes at once: breathing is the symbol of what costs no effort, and the metaphor would seem to preach ease, when the science of durable learning is, almost without exception, a science of productive difficulty.² The image survives, however, on two facts. Breathing is the only major bodily function at once autonomic and voluntary: it runs below awareness, yet can be seized and trained. And resting breath is thrifty: quiet exhalation is mere elastic recoil, the lungs are never emptied, and the reserve volume is reached only by forced expiration, active precisely where rest spends nothing. That asymmetry is not a flaw in the analogy; it is its engine.

Three correspondences carry the weight of the image, with reproducible findings. To inhale is to encode: the intake of new information, dosed not to flood working memory before schemas form.³ To exhale with force is to retrieve with effort: reconstructing from memory produces more durable learning than restudying;⁴ retrieval is not the measurement of learning, it is a learning event.⁵ The obligatory alternation between phases is spacing and desirable difficulty: forgetting between sessions is not failure but function, for it makes the next retrieval effortful and, therefore, potent.⁶ Two conditions sustain the cycle: psychological safety is the air itself,⁷ for to exhale is to expose oneself, and no one empties the lungs into air they do not trust; meaning makes the effort bearable.

One sentence holds it all: for knowledge to come in, it must also go out. Read in haste, it sounds like a paradox; read with the body, it is physiology. No one breathes in deeply on full lungs: the deepest inhalation begins with a complete exhalation. So with knowledge: only what goes out

repeatedly, said, written, drawn, done, truly comes in, becomes durable and available. The way out is not the proof of the way in; it is its mechanism.

The image names two familiar pathologies. The fluency illusion is the held breath: rereading, replaying recordings, following a fluent lecture produce a façade of competence, because processing fluency is not durability.⁸ To accumulate without retrieving is not to learn slowly; it is to suffocate with the sensation of breathing. Mimicked comprehension is the chest that rises without gas exchange: the “do you understand?” answered with nods, the slide recognised when it reappears, the question solved by elimination. The criterion is the cognitive operation, not the closing of books: to generate, not to recognise. A clinician with the guideline open is exhaling, and hard, if she must reason the case rather than merely look it up.

From this follows one atomic instructional move: before the next unit, each student produces the previous one from closed notebooks, saying, writing, drawing what remains. Cadence is the dial the teacher tunes: breaths rarer and deeper for complex material, quicker as mastery grows.⁹ Nor does the rhythm demand solitude: explaining to a peer, being questioned, teaching what one is still learning are exhalations in company;¹⁰ to prescribe breathing is, often, to prescribe a choir. Nor is it utopia: case-based collaborative learning, born at Harvard with no thought of respiration, already embodies the cycle at scale; proof of feasibility, though not of the active ingredient.¹¹

And what if the alternation is more than one pair? We venture a conjecture, still without literature to support it as a whole: the same beat governs pairs we habitually separate. Theoretical input and activation; encoding and retrieval; action and reflection; intensity and recovery. Language keeps the clue in one verb: to recover a memory and to recover one's strength are gestures of one rhythm. In each pair, the second term is not the interval of the first; it is the half that completes it. Dewey heard something of this between doing and reflecting on what was done;¹² the complete family is our wager. The body countersigns: the heart rests at every beat, and half its work is called diastole; sleep consolidates what waking gathers; muscle grows in the interval. To design teaching on these alternations, not against them, is to respect human nature and its cognitive and physiological architecture.

Here the metaphor meets the student's mental health. A course that only inhales, content without pause, intensity without rest, action without reflection, produces not merely forgetting; it produces apnoea. There is the difficulty intrinsic to reconstruction, and there is the difficulty layered on by surveillance, ranking, and the punishment of error; the same task makes one grow as challenge and fall ill as threat.¹³ The load must be titrated to the person, and the adjustment is instruction's task, not the sufferer's; and breathable air depends on class sizes, time, and structures, a condition that institutions, not exhortations, must guarantee. With the air cleared of threat, the necessary effort can

be welcome under autonomy, competence, and relatedness,¹⁴ offered, never demanded. Much of what we diagnose as disengagement or fragility is the rational response of an organism denied its rhythm.

The metaphor is only worth keeping if it bows to the evidence. The testing effect is robust on average but moderated by format, interval, feedback, and complexity; whether it shrinks as element interactivity rises, precisely where the stakes are highest, remains in dispute.^{15,16} At the scale where it is least proven, the image risks a falsifiable prediction: the optimal cadence is an interior optimum, lengthening with complexity, shortening with prior knowledge and safety; a curriculum tuned to this interaction should outperform monotonic intake and a fixed schedule on delayed transfer. If the interaction does not appear, the curricular thesis falls. At the lesson, the claims are strong; at the curriculum, and in the extended family, a design commitment and a conjecture awaiting test.

Knowledge repeatedly reconstructed in safe air, invested with meaning, ceases to be content one possesses and becomes part of who one is: the Aristotelian *hexis*, the stable disposition that practice builds until the doing is who we are.¹⁷ An excellence merely performed breaks at a single visible failure, itself a held breath; an excellence embodied absorbs error and grows with it. A child knows, without being taught, that holding the breath is effort and that, held long enough, it fails. The correction is simple and old: make the air safe, give the effort meaning, compel the honest exhalation, and let the rhythm, sustained and shared, form what it may. For knowledge to come in, it must also go out. Let learning breathe.

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