European International Journal of Pedagogics (ISSN: 2751-000X)

Received: 06 March 2026 | Accepted: 29 March 2026 | Published: 24 April 2026

DOI: 10.55640/eijp-06-04-40

RESEARCH ARTICLE

Synergetic Model of Engineering Personnel Training: Apospasmatics + Interakt

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VOLUME: Vol.06 Issue04 2026

PAGE: 202-206

Abstract

This article presents the author's didactic concept of "Apospasmatics" — a three-level cognitive learning model based on the principles of fragmentation, algorithmization, and knowledge synthesis. As an instrumental extension to this concept, the "InterAkt" methodology is introduced — a dynamic system for monitoring the educational weight of a student during the training process. The combination of the two methodologies forms a closed pedagogical cycle: from cognitive input to measurable competency output. The theoretical foundations, structural components, implementation mechanisms, and projected educational outcomes of the integrated system are examined.

KEYWORDS

"Apospasmatics", "InterAkt", dynamic monitoring system, cognitive learning model, implementation mechanisms.

INTRODUCTION

Engineering education in the 21st century is undergoing systemic transformation. The exponential growth of technological complexity, the convergence of disciplines, and the multi-paradigmatic nature of professional activity — all of these place fundamentally new demands on the engineering personnel training system. Traditional linear-transmissional learning models prove insufficient: they fail to develop the capacity for independent knowledge structuring, systems analysis, and creative synthesis [1].

The central question of pedagogy in technical disciplines can be formulated as follows: how do we teach students not merely to memorize complex material, but to meaningfully decompose it, operationalize it, and integrate it into stable professional competencies?

The answer to this challenge is the "Apospasmatics" methodology — a didactic model developed on the basis of a synthesis of cognitive science, systems thinking, and engineering didactics.

However, even the most advanced teaching methodology requires a feedback loop — a tool that allows for the objective measurement of educational progress dynamics. For this purpose, the “InterAkt” methodology was developed — an educational weight monitoring system capable of tracking competency accumulation in real time, identifying deficiencies, and adjusting the educational trajectory [2-4].

This article substantiates the conceptual unity and operational compatibility of both methodologies, demonstrating that it is precisely their synergistic interaction that ensures the preparation of a competitive specialist capable of independently solving highly complex problems.

METHODS

The term “Apospasmatics” derives from the ancient Greek “ἀποσπάσματα” — fragments, excerpts, extracted parts. The methodology fundamentally reframes the relationship to the complexity of educational material: instead of linear progression from simple to complex, it proposes the purposeful decomposition of a systemic whole into operationally manageable fragments, followed by their reconstruction into integrated knowledge [5-6].

The methodological foundation of “Apospasmatics” consists of three interrelated principles: the principle of didactic decomposition (structuring a complex object down to comprehensible units), the principle of synergetic reconstruction (assembling fragments into systemic understanding), and the principle of dialectical unity of theory and practice (knowledge becomes competence only through practical action) [8-10].

It is precisely this philosophical triad that distinguishes “Apospasmatics” from traditional didactic systems (Table 1).

Table 1.

Three-Level Structure of the Model

Level / Layer	Content and Function
Cycle 1: Cognitive Input	Object — a complex dynamic system. Process — didactic decomposition. Condition — dialectical unity of theoretical and applied knowledge.
Cycle 2: Methodological "Shell" (Processing)	Instrumental-didactic decomposition: algorithmization and systematization. Synergetic constructive synthesis: from simple to complex. Didactic synthesis: assembly of an engineering model.
Cycle 3: "Core" — Meaningful Understanding (Output)	Formation of cognitive, applied, and creative skills. A highly qualified, competitive engineering specialist. Ability to independently analyze complex systems.

The key operational algorithm of the methodology is a four-cycle procedural loop: Input — Analysis — Synthesis — Output. This sequence is not a simple linear progression — each cycle provides reflexive feedback to the previous one, forming an iterative architecture of cognition that closely approximates real engineering design cycles.

Psychological Mechanism: Reducing Cognitive Load

The central educational hypothesis of “Apospasmatics” can be visualized as an inverse relationship between the complexity of educational material and the degree of its assimilation in the traditional model. The methodology breaks this dependency through controlled fragmentation: the student never encounters unprocessed complexity — they deal only with the fragment that corresponds to their current zone of proximal development.

Psychologically, this means transitioning from a state of cognitive overload to a state of controlled intellectual effort. Neurodidactics confirms that it is precisely in this state that the most effective formation of long-term cognitive schemas occurs. Thus, "Apospasmatics" ensures not merely the transmission of knowledge, but the formation of stable mental tools for engineering thinking.

The "InterAkt" Methodology: Dynamic Monitoring of Educational Weight

One of the key unresolved problems of modern pedagogy is the gap between declared educational goals and actually formed competencies. Traditional assessment systems (exams, tests, credit scores) capture a snapshot of knowledge at a fixed point in time, failing to reflect the dynamics of its formation, stability, and operationality. A student may "pass" an exam without possessing genuine professional readiness.

The "InterAkt" methodology was developed as a response to this challenge. The central concept of the methodology is "educational weight" (EW) — an integral indicator reflecting the student's cumulative accumulation of theoretical knowledge, practical skills, and interdisciplinary competencies throughout the dynamics of the training process. Educational weight is not synonymous with a grade — it is a multidimensional, continuously updated metric that allows for the objective tracking of an educational trajectory.

Structure of Educational Weight: Three Measurement Axes

Component	Content	Maximum Score
EW-C: Cognitive Weight	Depth and systematicity of theoretical knowledge, capacity for conceptual analysis, metacognitive skills	0–40 points
EW-A: Applied Weight	Operationality of knowledge: ability to apply theory to real-world tasks, algorithmic thinking, design skills	0–40 points

The Total Educational Weight (TEW) is calculated as a weighted sum of the three components and is displayed on a scale from 0 to 100 units. The methodology establishes threshold values: a TEW below 45 represents a critical zone requiring immediate pedagogical intervention; 45–65 is the development zone; 65–80 is the readiness zone; and 80–100 is the zone of professional maturity. This gradation allows for the differentiation of pedagogical strategies for each group of students.

InterAkt as a Continuous Monitoring System:

The fundamental distinction between "InterAkt" and traditional control-assessment systems lies in its continuity and multi-channel nature. Monitoring is carried out through five key channels: weekly micro-assessments (short operational tasks that capture current cognitive weight); project portfolios (cumulative artifacts of applied weight); peer evaluations (student mutual assessment forming integrative weight); expert cross-sections (instructor verification of total weight); and self-assessment reflections (metacognitive component).

All data is integrated into the student's individual "weight map" — a visualized trajectory of educational weight plotted against academic time coordinates. The map allows for the clear identification of growth patterns, stagnation zones, and the predictive determination of professional insufficiency risks well in advance of the final assessment moment.

Key formula of InterAkt:

$$\mathbf{TEW(t) = [EW\text{-}C(t) \times 0.4] + [EW\text{-}A(t) \times 0.4] + [EW\text{-}I(t) \times 0.2]}$$

Where t represents the monitoring time interval. The dynamic $\Delta TEW = TEW(t) — TEW(t-1)$ serves as the key indicator of the effectiveness of the current educational strategy.

Synergy of Apospasmatics and InterAkt: A Unified Pedagogical Circuit

"Apospasmatics" and "InterAkt" are not parallel independent methodologies — they form a single closed pedagogical circuit, in which the former sets the algorithm for knowledge formation, while the latter provides feedback on the quality and pace of that formation. The integration is realized through the direct correspondence of the structural elements of the two systems: each of the three levels of "Apospasmatics" has its own measurement correlate in "InterAkt."

Apospasmatics Level	Correlate in InterAkt
Cycle 1: Cognitive Input	EW-C: Cognitive Weight — depth of assimilation of introductory material
Cycle 2: Methodological Shell (Processing)	EW-A: Applied Weight — operationality of processing and algorithmization
Cycle 3: Core — Understanding	EW-I: Integrative Weight — synthetic professional competence
Procedural Cycle: Input — Analysis — Synthesis — Output	TEW(t): Total Educational Weight in dynamics

The Correction Loop as a Key Mechanism:

The most critical element of the integrated system is the pedagogical correction loop. Its operational algorithm is as follows: if "InterAkt" monitoring detects stagnation or a decline in TEW over a given time interval, this serves as a signal for diagnostic analysis — identifying the deficient level within the "Apospasmatics" architecture — and the subsequent adaptation of the pedagogical strategy.

For example, if EW-C is growing while EW-A stagnates, this indicates a gap between the theoretical level (Cycle 1) and the processing level (Cycle 2): the student is accumulating a conceptual foundation but is unable to translate it into algorithmic actions. The pedagogical response will be directed specifically at Cycle 2 — reinforcing the instrumental-didactic component. This diagnostic precision is unattainable in traditional assessment systems.

Educational Outcomes of the Integrated System

The practical implementation of the "Apospasmatics + InterAkt" combination allows for the achievement of systemic educational outcomes that are unattainable when using either methodology in isolation:

- Personalization of the educational trajectory: each student progresses along an individual "weight map" without falling outside the general pedagogical circuit.
- Predictive prevention of academic failure: a decline in TEW is detected 4–6 weeks before the traditional control assessment point.
- Objectification of the graduate's portfolio: TEW serves as a verifiable indicator, accessible to employers as a measurable characteristic.
- Formation of engineering identity: a student who consciously progresses from Cycle 1 to Cycle 3 and observes their growing educational weight acquires professional subjectivity.
- Development of metacognitive skills: regular reflection within the InterAkt framework cultivates the capacity for independent self-assessment of one's own cognitive state.

Theoretical Foundation: A Dialogue with Pedagogical Science

The "Apospasmatics + InterAkt" methodological complex does not emerge in a theoretical vacuum — it draws upon the fundamental achievements of world pedagogical science and enters into productive dialogue with them.

L.S. Vygotsky's concept of the zone of proximal development finds its operational embodiment in the mechanism of measured decomposition in Cycle 1: the student always works at the boundary of actual and potential knowledge.

J. Sweller's cognitive load theory substantiates the effectiveness of fragmentation — controlled complexity does not overload working memory, ensuring deep-level processing.

The constructivist paradigm of J. Bruner and J. Piaget is reflected in the synergetic synthesis of Cycle 2: knowledge is not transmitted, but constructed through active engagement with the material.

Finally, the competency-based approach underlying the Bologna system and modern educational standards finds its measurement instrument in "InterAkt" — a system that translates abstract competency descriptors into verifiable units of educational weight.

CONCLUSION

The "Apospasmatics + InterAkt" methodological complex represents an attempt at a systemic response to one of the fundamental challenges of modern engineering education: how to combine the depth of cognitive mastery of complex material with the measurability of formed competencies and the adaptability of pedagogical strategy to the individual educational trajectory.

"Apospasmatics" addresses the problem of pedagogical engagement with complexity: it neither evades it nor substitutes it with oversimplified schemes, but instead creates a controlled architecture of cognition in which the student is capable of independently moving from fragment to system, from algorithm to understanding, from understanding to action.

"InterAkt" addresses the problem of pedagogical blindness: it makes visible what has traditionally remained hidden — the dynamics of the formation of the student's professional consciousness.

Taken together, both methodologies realize the pedagogical ideal formulated by Ibn Sina: understanding as the result of practical mastery of decomposed complexity. This ideal, relevant a millennium ago, acquires particular urgency today — in an era when the complexity of the systems with which an engineer works exceeds the capacity of the individual human mind, and only an engineer who commands the tools of cognitive decomposition and synthesis is capable of meeting the professional challenges of the future.

REFERENCES

1. Vygotsky, L.S. Thinking and Speech. — Moscow: Labirint, 2012. — 352 p.
2. Sweller, J. Cognitive Architecture and Instruction. Cognitive Load Theory. — New York: Springer, 2011.
3. Bruner, J. The Psychology of Cognition. — Moscow: Progress, 1977. — 412 p.
4. Bloom, B.S. (Ed.). Taxonomy of Educational Objectives. Cognitive Domain. — N.Y.: McKay, 1956.
5. Hattie, J. Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement. — Routledge, 2009.
6. Jonassen, D.H. Designing Constructivist Learning Environments. Instructional Design Theories and Models. — LEA, 1999.
7. Shadrikov, V.D. Psychology of Human Activity and Abilities. — Moscow: Logos, 1996. — 320 p.
8. CDIO Syllabus v2.0. Worldwide CDIO Initiative. — MIT, 2011.
9. Abu Ali Ibn Sina (Avicenna). Kitab ash-Shifa (The Book of Healing). — Tashkent: Fan, 1981.
10. Zagvyazinsky, V.I. Theory of Learning: A Modern Interpretation. — Moscow: Akademiya, 2006. — 192 p.