

# POLIS V12: The Complete Education Series – 12 Giants

Jorge Batista Alves Pereira

Independent Researcher, Sabugal, Guarda, Portugal

[ORCID: 0009-0000-6385-7245](https://orcid.org/0009-0000-6385-7245)

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*This document combines two companion papers:  
“Tensional Reinterpretation of Six Founders of Modern Pedagogy”  
and “Tensional Reinterpretation of Six More Educational Pioneers”.*

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## Abstract

Within the POLIS V12 tensional ontology, every educational system is a polis constituted by three meshes (solid, liquid, gaseous) and governed by the closure condition  $\epsilon = \sum K_m(2 + K_m) = 0$ , with  $T = K_{\min}$  as the tensional origin. This paper applies the framework to six foundational figures of pedagogy: John Amos Comenius (pansophism), Jean-Jacques Rousseau (natural education), Johann Heinrich Pestalozzi (holistic education), Friedrich Fröbel (kindergarten), Maria Montessori (scientific pedagogy), and John Dewey (progressive education). Each classical contribution is reinterpreted as a tensional configuration: Comenius's universal knowledge as  $K$  unity; Rousseau's child-centred learning as following natural  $K$  development; Pestalozzi's head-heart-hand as three meshes; Fröbel's play as Phase 5 activity; Montessori's prepared environment as structured  $K$  space; and Dewey's learning by doing as experiential  $K$  accumulation. The universal equations remain unchanged; no free parameters are introduced.

## 1 Introduction

POLIS V12 is a closed, parameter-free tensional conservation theory built on four axioms (Tensional Ontology, Harmonic Ground  $H = 1$ , Tensional Conservation, Data Origin  $T = K_{\min}$ ). The governing equation, after normalisation, is

$$\epsilon = \sum_{m=1}^n K_m(2 + K_m) = 0,$$

with  $K_m = (v_m - T)/(v_{\max} - T) \in [0, 1]$ . The disequilibrium index is  $\text{IDT}^* = \epsilon/(1 + \epsilon)$ . All real educational systems reside in Phase 4 ( $\text{IDT}^* \geq 0.70$ ) unless artificially uniform. The Rolling Law  $2\pi r_p = V_{\text{orb}}T_{\text{rot}}$  applies fractally at all scales.

This paper reinterprets six key educational contributions within this tensional ontology. No classical primacy is assumed; tension is the primitive.

## 2 John Amos Comenius – Pansophism and Universal Education

Comenius advocated teaching all things to all men (pansophism). In POLIS V12, the pansophic polis aims for  $\epsilon = 0$  across all knowledge domains. His *Orbis Pictus* (visible world) used pictures to convey  $K$  directly, bypassing language barriers. Comenius's "great didactic" proposed a structured progression from simple to complex (increasing  $K$ ). He introduced the idea of "school as workshop of humanity" – a polis where human potential ( $K_{\text{potential}}$ ) is actualised through systematic instruction. The concept of "pampaedia" (universal education) is a tensional project to bring all people to a baseline  $K$ .

Comenius's three phases of instruction (sensory, mental, spiritual) correspond to the three meshes. His influence on curriculum design (graded textbooks) standardised  $K$  progression.

### 3 Jean-Jacques Rousseau – Natural Education and *Émile*

Rousseau's *Émile* advocates education that follows nature, avoiding adult corruption. In POLIS V12, the natural child has an innate  $K_{\text{development}}$  that unfolds in stages. The tutor's role is to provide a tensional environment (negative education) that allows the child's  $K$  to emerge without forcing. Rousseau's three educations (nature, men, things) are three meshes: nature = internal  $K$  (solid), men = social  $K$  (liquid), things = material  $K$  (gaseous). The "negative education" (no direct moral teaching before adolescence) delays external  $K$  imposition.

*Emile* is a tensional novel where the protagonist's  $K$  is carefully calibrated by the tutor. Rousseau's concept of "natural punishment" (let consequences, not adults, teach) is a tensional feedback.

### 4 Johann Heinrich Pestalozzi – Holistic Education (Head, Heart, Hand)

Pestalozzi emphasised the harmonious development of head (intellect), heart (emotion), and hand (practical skills). In POLIS V12, these correspond to the three meshes: head = solid mesh (knowledge, facts), heart = liquid mesh (affect, values), hand = gaseous mesh (action, skill). Pestalozzi's "Anschauung" (intuition) is the immediate perception of  $K$  through concrete objects. His method of "object lesson" uses physical items to convey abstract  $K$ . The school at Yverdon demonstrated tensional balance: all three meshes must be cultivated together.

Pestalozzi's mantra "learning by head, heart, and hand" aims for  $\epsilon = x_{\text{head}} + x_{\text{heart}} + x_{\text{hand}} \approx 0$ . His influence on later educators (Fröbel, Montessori) is direct.

### 5 Friedrich Fröbel – Kindergarten and Play

Fröbel invented kindergarten (children's garden) and emphasised play as the highest form of learning. In POLIS V12, play is Phase 5 activity: the child reorganises  $K$  freely without external pressure. Fröbel's "gifts" (wooden blocks, balls) are solid meshes for exploring geometry and physics. His "occupations" (clay, weaving) are liquid meshes for creative transformation. The circle time (morning circle) is a gaseous mesh of song and movement. The concept of "self-activity" (Selbsttätigkeit) is the child's intrinsic drive to increase  $K$  through engagement.

Fröbel's "mother songs" (Mutterlieder) integrate poetry, music, and gesture – a triple  $K$  experience. The kindergarten was the first formal early childhood polis.

## 6 Maria Montessori – Scientific Pedagogy and Prepared Environment

Montessori developed a scientific approach based on observation of children. In POLIS V12, the prepared environment is a carefully organised  $K$  space: materials arranged on low shelves (accessible), each activity has a specific  $K$  purpose (practical life, sensorial, language, math). The "absorbent mind" (0–6 years) has high  $K_{\text{absorption}}$ ; the child constructs  $K$  from the environment. "Sensitive periods" are windows of high  $K$  susceptibility to specific stimuli (order, language, movement). The Montessori teacher is a facilitator (low  $K$  direct intervention) who removes obstacles to learning.

The "three-period lesson" (naming, recognition, recall) is a tensional sequence for building  $K$  vocabulary. Montessori's "cosmic education" aimed to show the child the interconnected  $K$  of the universe.

## 7 John Dewey – Progressive Education and Learning by Doing

Dewey argued that education must be grounded in experience and inquiry. In POLIS V12, learning by doing (experiential learning) is direct manipulation of  $K$ : the student acts on materials, observes outcomes, and adjusts future actions. Dewey's "reflective thinking" (problem  $\rightarrow$  hypothesis  $\rightarrow$  testing  $\rightarrow$  conclusion) is a tensional cycle (Phases 2–5). The school as a "miniature community" (democratic polis) allows students to practice social  $K$  (cooperation, conflict resolution). Dewey's "instrumentalism" held that ideas are tools for action, not passive representations – a tensional pragmatism.

His laboratory school (University of Chicago) implemented project-based learning (long-term  $K$  investigations). Dewey's "experience and education" warned against rigid traditional methods (high  $\epsilon$ ) and aimless progressive extremism (also high  $\epsilon$ ).

## 8 Conclusion

The six foundational contributions to pedagogy are coherently reinterpreted within the POLIS V12 tensional ontology. Pansophism, natural education, holistic pedagogy, kindergarten, scientific pedagogy, and progressive education all become natural consequences of the closure condition  $\epsilon = \sum K_m(2 + K_m) = 0$  and the fractal hierarchy of educational polises. No free parameters are added.

## Zenodo references

- Main treatise: [10.5281/zenodo.19618276](https://zenodo.org/record/19618276)
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### Abstract

This paper extends the POLIS V12 tensional reinterpretation to six additional educational giants: Lev Vygotsky (ZPD and scaffolding), Jean Piaget (cognitive stages), Paulo Freire (critical pedagogy), B. F. Skinner (programmed instruction), Carl Rogers (student-centred learning), and Loris Malaguzzi (Reggio Emilia approach). Each is re-read as a tensional configuration: Vygotsky's ZPD as  $K$  gap; Piaget's stages as phase transitions; Freire's banking model as low- $K$  oppression; Skinner's teaching machine as  $K$  reinforcement; Rogers's unconditional positive regard as  $K$  acceptance; and Malaguzzi's hundred languages as multiple  $K$  expressions. The universal equations remain unchanged; no free parameters are introduced.

## 9 Introduction

As in the companion paper, POLIS V12 rests on four axioms. After normalisation the mother equation is

$$\epsilon = \sum_{m=1}^n K_m(2 + K_m) = 0,$$

with  $\text{IDT}^* = \epsilon/(1 + \epsilon)$ . All real educational systems are in Phase 4 ( $\text{IDT}^* \geq 0.70$ ) unless artificially uniform. The Rolling Law  $2\pi r_p = V_{\text{orb}}T_{\text{rot}}$  applies fractally.

This paper reinterprets six more foundational contributions to education.

## 10 Lev Vygotsky – Zone of Proximal Development and Scaffolding

Vygotsky's ZPD (already introduced in cognitive science) is reinterpreted here in educational context. In POLIS V12, the ZPD is the tensional interval between solo  $K$  and assisted  $K$ . Scaffolding is the temporary external  $K$  provided by a tutor or peer. When the learner internalises the support, their solo  $K$  increases, shifting the ZPD upward. Vygotsky's concept of "scientific concepts" (systematic  $K$ ) versus "everyday concepts" (spontaneous  $K$ ) shows how formal education reorganises informal knowledge (Phase 5). The role of language (inner and social) in mediating thought is a tensional bridge between external and internal meshes.

Vygotsky's influence on cooperative learning (student interaction) is a tensional design: peers provide mutual  $K$  scaffolding. Dynamic assessment (measuring ZPD) is a tensional test of learning potential.

## 11 Jean Piaget – Cognitive Stages Revisited

Piaget's stages were introduced in cognitive science; here, the educational implications are highlighted. In POLIS V12, instruction must match the child's current  $K$  stage (readiness). Presenting material beyond the child's  $K$  causes  $\epsilon$  (frustration); below it causes boredom. The concrete stage (7–11 yrs) requires hands-on materials (solid  $K$ ); the formal stage (12+) can handle abstract  $K$  (logic, algebra). Piaget's concept of "active learning" (child constructs own  $K$ ) aligns with tensional constructionism.

Classroom practices derived from Piaget: discovery learning, peer discussion, error analysis (accommodation). The "Piagetian classroom" is a polis where the teacher facilitates, not lectures.

## 12 Paulo Freire – Critical Pedagogy and Banking Model

Freire criticised "banking education" (teacher deposits  $K$  into passive students). In POLIS V12, banking education is a low- $K$  transfer that does not increase student  $K$ . Critical pedagogy (problem-posing) treats students as co-creators of  $K$  (Phase 5 dialogue). Freire's "conscientização" (critical consciousness) is awareness of oppressive  $K$  structures and the ability to change them (Phase 4 action). The teacher-student dialectic dissolves hierarchy, making both learners and teachers.

Freire's "pedagogy of the oppressed" is a tensional liberation: the oppressed increase  $K$  (empowerment) to overcome structural  $\epsilon$ . His method of codification (representing reality in images) uses visual  $K$  for discussion. The circle of culture (group dialogue) is a liquid mesh of shared  $K$ .

## 13 B. F. Skinner – Programmed Instruction and Teaching Machines

Skinner applied operant conditioning to education. In POLIS V12, programmed instruction breaks material into small steps (frames), each frame requiring a response and providing immediate feedback ( $K$  reinforcement). Correct responses increase  $K$  (reinforcement); errors decrease  $K$  (correction). The teaching machine (physical or software) delivers frames sequentially, adapting the  $K$  difficulty. Skinner's linear programming (cram school) has high  $K$  efficiency but low  $K$  creativity. He advocated for mastery learning (students must reach 90–100%  $K$  before proceeding).

Criticisms of Skinner: reduces learning to rote  $K$ ; ignores internal  $K$  (understanding). Nonetheless, computer-aided instruction (CAI) uses tensional reinforcement.

## 14 Carl Rogers – Student-Centred Learning (and Unconditional Positive Regard)

Rogers (humanistic psychology) applied his therapy principles to education. In POLIS V12, a student-centred classroom reduces the teacher's  $K$  authority, replacing it with facilitative conditions: realness (genuine  $K$ ), prizing (unconditional positive regard = accepting  $K$ ), and empathic understanding (listening to student's  $K$ ). The "freedom to learn" encourages self-initiated projects (autonomous  $K$  building). Rogers opposed grading and competition (sources of  $\epsilon$  anxiety). The "facilitator" sets a climate where students can explore  $K$  without fear.

Rogers's "learning to be free" is a tensional Phase 5 release from external control. His influence on open classrooms, experiential learning, and democratic schools persists.

## 15 Loris Malaguzzi – Reggio Emilia Approach

Malaguzzi founded the Reggio Emilia early childhood approach. In POLIS V12, the environment is the "third teacher" (after parent, teacher). The hundred languages of children (drawing, clay, dance, words) are multiple  $K$  modes for expressing understanding. Project-based learning (long-term investigations) is a tensional journey (Phases 2–5). Documentation (photos, transcripts) makes learning visible (externalising  $K$ ). The "atelier" (art studio) is a gaseous mesh space for exploratory  $K$ . Parent and teacher collaboration forms a wide  $K$  support network: the "community polis".

Reggio's concept of "progettazione" (flexible planning) adapts  $K$  activities to children's emerging interests. The "pedagogy of listening" values children's  $K$  (voice) as a guide for curriculum. Malaguzzi's approach is rich in tensional creativity.

## 16 Conclusion

Six additional educational pioneers are reinterpreted within the POLIS V12 tensional ontology. ZPD, cognitive stages, critical pedagogy, programmed instruction, student-centred learning, and the Reggio Emilia approach all become natural consequences of the closure condition  $\epsilon = \sum K_m(2 + K_m) = 0$  and the fractal hierarchy of educational polises. No free parameters are added; the same equations that describe a physical system or a social system also describe the art and science of teaching.

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- POLIS Bible: [10.5281/zenodo.19836226](https://zenodo.org/record/19836226)

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