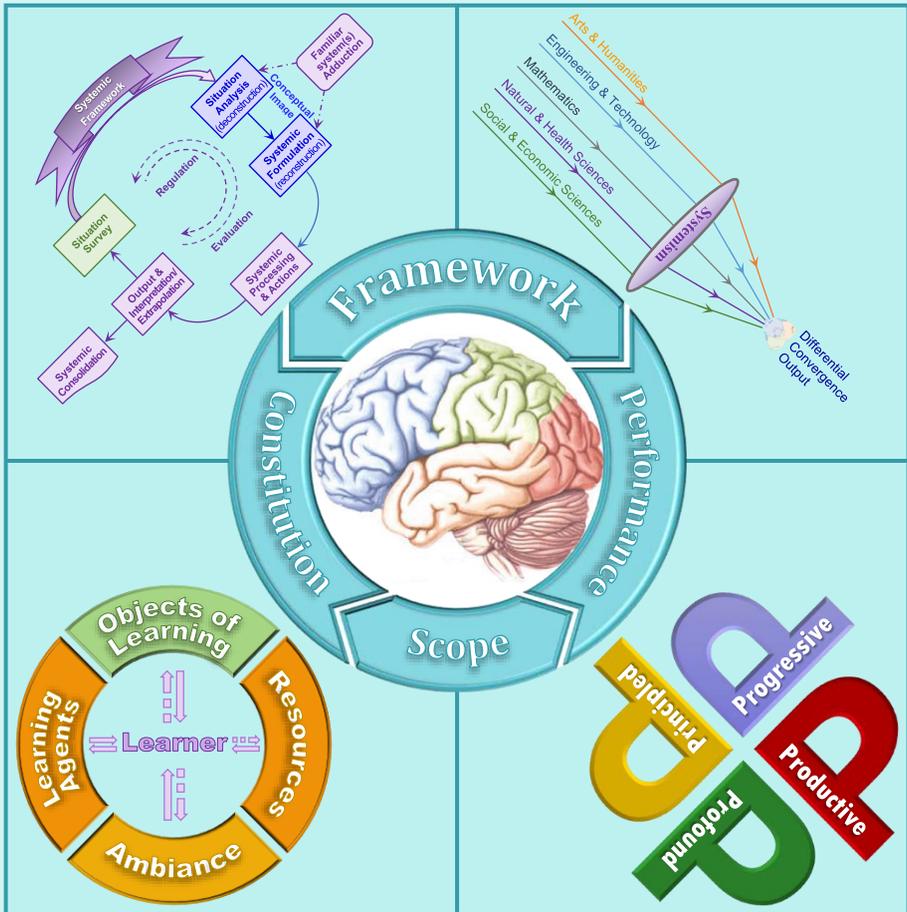


IBRAHIM HALLOUN

SYSTEMIC COGNITION AND EDUCATION



**Empowering Students
for Excellence in Life**

SYSTEMIC COGNITION AND EDUCATION

Empowering Students

for Excellence in Life

IBRAHIM HALLOUN



H Institute
Jounieh, Lebanon

May 2022

To

All teachers who seek not to teach to the test but
to empower their students to excel in life

CONTENTS

Preface	xi
Chapter 1: Systemism	1
1.1 Systemic worldview	5
1.1.1 Systems and systemic schema	6
1.1.2 Systems taxonomy	11
1.2 Systemic mindset	13
1.3 Systemic advantages	18
1.3.1 Order	19
1.3.2 Patterns	20
1.3.3 Stability and efficacy	22
1.3.4 Synergy	24
1.3.5 Ontological-epistemological consonance	25
1.3.6 Pedagogical efficiency	27
Chapter 2: Systemic Profiles	39
2.1 Knowledge dynamics	40
2.2 Systemic habits and competencies	43
2.3 Normative profiles	48
2.4 Systemic 4P profiles	50
2.4.1 Progressive mind	52
2.4.2 Productive habits	55
2.4.3 Profound episteme	58
2.4.4 Principled conduct	61
Chapter 3: Systemic Cognition	65
3.1 Transaction with the real world	67
3.2 Brain plasticity, flexibility, and discrete functionality	71
3.3 Memory	75
3.3.1 Engrams	77
3.3.2 Taxonomy	80

3.4	Memory encoding	83
3.4.1	Brain readiness	84
3.4.2	Selective adaptive encoding	85
3.4.3	Reiterative ontogenetic encoding	89
3.4.4	Long active encoding	92
3.4.5	Lifestyle dependent encoding	95
3.5	Memory consolidation	96
3.5.1	Distributed collective consolidation	97
3.5.2	Rehearsal dependent consolidation	100
3.5.3	Pattern embedded consolidation	102
3.5.4	Insightful challenging consolidation	104
3.5.5	Differential dynamic consolidation	107
3.6	Memory retrieval	109
3.6.1	Differential memory processes	110
3.6.2	Mutually dependent memory processes	112
3.6.3	Mnemonics dependent retrieval	114
3.7	Memory modulation	117
3.7.1	Attention	118
3.7.2	Motivation	120
3.7.3	Emotions	122
3.7.4	Control	125
3.8	Metacognition	126
Chapter 4: Systemic Pedagogy		133
4.1	Pedagogy for meaningful learning	134
4.2	Systemic knowledge	138
4.2.1	Taxonomy of learning outcomes	139
4.2.2	Middle-out knowledge structure and development	146
4.2.3	Knowledge evolution	149
4.3	Experiential learning	155
4.3.1	Experiential ecology	156
4.3.2	Systemic learning	159
4.4	Learning cycles	163
4.5	Insightful dialectics	167

4.6	Learning mediation	173
4.7	Assessment and learning	179
4.7.1	Item maps	183
4.7.2	Assessment rubrics	186
4.7.3	Maps and rubrics for authentic assessment	189
Chapter 5:	Systemic Education	199
5.1	Transcending traditional curricula	200
5.2	Systemic curricula	205
5.3	Differential convergence	207
5.4	Scope and sequence	216
5.5	Praxis	221
5.6	Technology	228
5.7	Educational systems	232
5.7.1	Paradigm shift	234
5.7.2	Middle-out systemic governance	236
5.7.3	Partnerships	238
5.7.4	Teaching profession	239
5.7.5	Exchange platforms	240
5.7.6	Student certification	241
5.7.7	Culture of excellence	242
	Glossary	245
	References	257
	Index	267
	About the Author	273

PREFACE

Making sense of our own selves and of the world around us has always been the prime concern of human beings, for the sake of survival, progress, and prosperity at the individual and collective levels, for curiosity sake, and for various other purposes. All along, and at least since the dawn of civilizations and humans' invention of image drawing and carving on stone, hieroglyphs, and then alphabets, came the concern to systematize our quest for meaningful knowledge and its sustainability in memory, as well as its documentation and exchange with others in readily accessible forms and its deployment in efficient and creative ways. That systematization became crucial with the emergence of formal education, at first for ancient philosophers and astronomers to form disciples who could sustain and carry forward their vision of the world, and for craftsmen and other professionals to form apprentices who could make their crafts, trades, and services thrive in society. It became most crucial when enlightened rulers and decision makers wanted formal education to become an institutionalized, widespread endeavor to transfer knowledge accrued throughout generations to youngsters at large so that they may take advantage of it for their own welfare and the welfare of their communities and humankind.

Human knowledge about the physical world, including humankind and all organisms we are part of, and products, processes, and services we have invented, and about the abstract realm of our own imagination, like in the case of music and mathematics, have so much proliferated and diversified in constituents, structural modes, and procedural modalities, and continue to do so at a fast and unprecedented pace that no individual or community can keep up with. Systematization of learning how to learn in general, and of learning about professional knowledge in any community of practice, academia included, becomes then far more crucial than ever before in formal and informal education. Systemism, as introduced in Chapter 1 and elaborated throughout this book, is a worldview and a mindset that can serve us best in this respect in cognition and various aspects of formal education.

With a systemic worldview, we conceive everything within us and around us as consisting of interacting physical or conceptual systems or parts of systems (or of subsystems). Simply put, a system is an ordered unit or totality consisting of interconnected and interdependent physical or conceptual entities that come together or that are brought together in order to serve specific purposes under specific conditions. With a systemic mindset, we learn about, interact with, and modify both the physical world and the abstract realm through appropriate conceptual systems that we construct to represent and investigate patterns of interest in either world or realm, and/or to make changes in these patterns or bring about new patterns altogether.

Systemism is of great value to both experts working in a given discipline and students learning about that discipline. Looking at any discipline in any field with systemic conceptual lenses (e.g., the disciplines of physics and biology in the field of natural sciences, algebra and geometry in mathematics, music and painting in arts, philosophy and literature in humanities) brings for experts and students alike coherence and consistency to content and procedural knowledge in that discipline, and efficiently systematizes knowledge construction and deployment. More importantly, systemism efficiently systematizes disciplinary convergence, i.e., bringing and connecting together different disciplines in the same and different fields in order to tackle issues that neither discipline helps tackling well enough independently of other disciplines. Such convergence is behind major inventions and disciplinary advances we have witnessed in the last few decades, and it is, and will continue to be, at the very foundations of most new careers and all other developments affecting our lives that have emerged and that will keep emerging in the 21st century. These developments have necessitated major paradigmatic changes in numerous professions, changes that have been quite revolutionary in some instances like in the case of digital technology. Meanwhile, paradigms that go back to the nineteenth century, and that the developments in question have turned obsolete in many respects, continue to prevail in all aspects of formal education at all educational levels, and in many parts of the world, from pedagogy and curricula to structure and governance of educational institutions and of entire educational systems. Alternative paradigms of systemic nature help education resonate well with both human cognition and the changing realities of the century in the workplace and elsewhere in daily life.

Each community of practice (CoP) or professional community is characterized with a particular paradigm that governs how the community goes about developing its content and procedural knowledge and deploying it in tackling issues of concern to that community. In academia, a CoP is usually concerned with one distinctive discipline, and disciplines in the same field may share one or more common paradigms. For example, in natural sciences, two paradigms prevail across the board, the so-called classical and modern paradigms that are adapted in specific respects to the particular needs of every discipline. Those paradigms are systemic par excellence, though implicitly for most scientists, because science is primarily concerned with the description, explanation, and extrapolation of patterns in the structure and behavior of physical systems. CoPs concerned with non-scientific fields can similarly conceive and deploy their disciplinary knowledge in the framework of systemic paradigms for better systematization within and across disciplines and fields, particularly for convergence purposes, and most importantly for pedagogical purposes.

The prime function or mission of formal education is about helping students develop appropriate profiles for self-fulfillment, success in life, and significant contributions to the welfare of others and the ecosystem. That mission is best fulfilled when students are empowered with systemic profiles as discussed in Chapter 2. At the core of a systemic profile are habits of looking at the world and dealing with it with systemic worldview and mindset. These habits evolve from gradual development of systemic competencies needed to tackle certain tasks that may fall within the scope of a particular discipline or that cut across different disciplines. A systemic competency consists of an appropriate mix of conceptions (concepts and relations among concepts), reasoning skills, sensorimotor skills, and axio-affective controls (in particular, a good value system and constructive attitudes and dispositions) that are necessary to successfully achieve similar tasks with a systemic mindset. Systemic profiles are further distinguished with particular traits that turn them into what we call 4P profiles. A person with a systemic 4P profile is characterized with a *progressive* mind that seeks to develop and constantly enhance *productive* habits for systematizing and optimizing the person quest for, and deployment of, *profound* knowledge that concentrates on substantial and generic conceptions and processes in any domain, all with a commitment to *principled* conduct in all aspects of life.

Learning involves cognition and is most meaningful and productive when experiential, i.e., when it takes place through transaction with real world situations and other people, teacher and peers included. Cognition, as discussed in Chapter 3, is about memory development that takes place to adapt to new demands through conscious and unconscious mind and brain processes induced or not by external signals detected by our senses. Cognitive outcomes affect how we think, perceive people and things, feel, and act in the future, and thus determine the course and outcomes of prospective learning experiences. Memory development begins with encoding new knowledge in working and short-term memory, and then follows with gradual reinforcement of the new knowledge for integration with existing memory patterns and consolidation or permanent sustainability in long-term memory. Newly encoded memory is consolidated only after successive retrieval for rehearsal in a variety of situations that continuously impose new but reasonable cognitive demands and that engage a mix of brain regions of distinct function regarding knowledge construction and deployment. All memory processes from encoding to consolidation are modulated by particular brain regions concerned with attention, motivation, emotions, and other metacognitive factors that control how learning proceeds and determine the quality of outcomes it brings about.

Pedagogy is about systematizing how students learn and about optimizing learning conditions and outcomes. As discussed in Chapter 4, pedagogy is most effective when systemic, i.e., when it conforms to human cognition and when it helps students develop systemic 4P profiles in systemic learning ecologies. In the first respect, systemic pedagogy helps students explicitly learn how to learn through conscious and systematic encoding, deployment (retrieval and rehearsal in novel contexts), and consolidation of generic content and procedural knowledge. Special attention is then given to systemic knowledge organization and pattern-focused systemic processes for knowledge construction and deployment. In the second respect, systemic pedagogy engages students individually and collectively in experiential, hands-on, minds-on, learning activities pertaining to real life situations and carried out insightfully in structured but flexible learning cycles with proper teacher mediation. Insightful experiential learning involves continuous evaluation and regulation of student knowledge throughout every learning exercise, and particularly through assessment that is not an end by itself, but

means for a worthy end: meaningful learning of course materials and development of systemic 4P profiles for success, even excellence in life.

The latter end is the ultimate goal of systemic education that transcends traditional education in practically every respect as discussed in Chapter 5, from curriculum design and implementation to governance of educational institutions and entire educational systems. In systemic formal education, teachers teach not to the test and not to inform students about specific disciplinary knowledge as passed along from one generation to another in traditional textbooks. Curricula are designed and implemented instead under systemic pedagogical frameworks in ways to meet the changing realities of the 21st century. Any discipline is organized in any curriculum at any level around a limited set of powerful conceptual systems and systemic processes that meet students' cognitive potentials at a given age and preserve and reveal, to the extent that is possible, the paradigmatic rigor of the discipline. As such, systemic curricula allow systematization of learning in the context of individual disciplines and across different disciplines to the extent of realizing what we call differential convergence education, which is about bringing together knowledge from different disciplines, while preserving the integrity and sovereignty of each discipline, in order to tackle real life issues.

Differential convergence education may take place, for a start, in the context of traditional disciplinary curricula, and is optimized through experiential learning that culminates in suitable educational modalities of praxis. Students would then be immersed into praxis, beginning at least at the secondary school level, in order to learn how to bring theory and practice systemically and systematically together like professionals do in given CoPs, and how to tackle issues students are themselves interested in, using actual CoP conceptual and physical tools, modern technology included. Under propitious conditions, traditional disciplinary education would then be transcended into systemic, praxis immersive, convergence education (SPICE) that ultimately brings about graduates who know how to think outside the box and excel in practical real-life situations in the most innovative ways possible.

SPICE or any other form of education that meets the realities of the century require across the board transcendence of traditional education, including the way educational institutions and entire educational systems are structured and operated. In particular, rigid top-down authoritative

governance should be given away in favor of truly systemic governance that allows all organisms and stakeholders in an educational system to readily and autonomously adapt to any change within and outside the system and constantly operate with a hive-mind spirit and shared responsibility. Systemic governance should also provide for educational institutions and all other organisms in the system to work in close partnership with each other and with all sectors of society, particularly for SPICE sake. For, these sectors are most concerned with the specification and realization of student profiles that are necessary to succeed and excel in respective careers and operations. For optimal systemic education, and for students' excellence in various aspects of life to become an ultimate part of the mission of formal education, educational systems and various sectors of society need to work systemically and systematically together on engraining a culture of excellence throughout society.

Systemic Cognition and Education (SCE) is about what it takes for education to resonate well with the way the world within us and around us is and works in order to bring about graduates who are empowered for excellence in life and not conditioned to pass school and high-stakes exams. We belong to a world that can be systematically and efficiently conceived and dealt with – perhaps to the best that we can and that is possible – when we look at ourselves as biological and cognitive systems that constantly affect and are affected by local and global environments made of different sorts of systems. SCE thus calls for transcendence of all traditional paradigms and settings, and for systemism for excellence to prevail throughout educational systems, from pedagogy to governance, and from curricula to organization in partnership with various sectors of society, ultimately in the direction of systemic, praxis-immersive, convergence education (SPICE).

ABOUT THE AUTHOR

Ibrahim Halloun is Founding President of H Institute, a nonprofit research and development organization based in Lebanon and dedicated to engraining the Culture of Excellence in society, especially in the educational and cultural sectors.



In 1984, he earned a PhD in Physics/Education from Arizona State University (ASU). He then joined Lebanese University and remained there until 2019 as tenured Professor of Physics and Education. Meanwhile, he held joint appointments at many institutions in Lebanon and abroad, including ASU, American University of Beirut, and UNESCO-Paris.

Prof. Halloun has dedicated his career to the improvement of education in all fields and at all grade levels, but especially in secondary school and university science, and he contributed to curriculum reform in many countries around the world. Through classroom-based research, he developed:

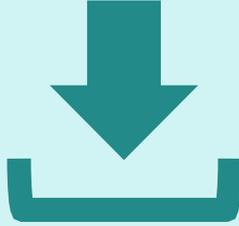
- *Systemic Cognition and Education*, for student and teacher self-fulfillment and empowerment for excellence in the 21st century and beyond.
- *Modeling Theory in Science Education*, for student-centered, model-based, meaningful learning of science.
- Viable means for characterizing student intuitive worldviews and mindsets and regulating them in commensurability with scientific paradigms.

His R&D work and interests also include:

- Educational policy and systemic reform, particularly under systemic frameworks and in relation to the United Nations *2030 Agenda for Sustainable Development*.
- Convergence education and curriculum design, with focus on systemic cross- and trans-disciplinarity.
- Authentic assessment and evaluation in education.
- Professional development of pre-service and in-service teachers.
- Cognitive science and neuroscience.
- Philosophy, history, and sociology of science.

Details at: www.halloun.net and www.hinstitute.org.

**For a complimentary
pdf preprint copy of this book**



Please click here

**Thank You
for your interest**

**Your valuable feedback
would be greatly appreciated
at**

halloun@hinstitute.org