SPICE

Systemic, Praxis-Immersive, Convergence Education
A Paradigm Shift in Education for
Excellence in the 21st Century

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Abstract

The world within and around us is a world of systems. Major innovations of our time are the upshots of praxis-based disciplinary convergence, i.e., of bringing together, into generative consonance, theory and practice from different disciplines, especially disciplines from different fields like arts and science that have long been erroneously considered to be remotely related. Prevailing paradigms in education often go back to the early days of the 20th century and sometimes long before and have become gravely superannuated. These paradigms drive for compartmentalized knowledge and segregation among disciplines, even within the same field. Latest developments in neuroscience show that their cognitive and pedagogical foundations are seriously flawed, thus leading to detrimental classroom practices that prevent students from developing learning and occupational competencies fit for the 21st century. Formal education has the major mission to empower students for self-fulfillment and for coping with the realities of our time so that they may have decent and productive lives and make significant contributions to sustainable development of their communities and ultimately of the globe at large. Formal education has thus to dispose of archaic paradigms and opt instead for paradigms that are in harmony with the systemic nature of the world, particularly of our minds and brains, and that meet the realities of the 21st century, particularly in the job market. Systemic, praxis-immersive, convergence education (SPICE) is proposed in this paper to this end.

Keywords

Cognition, competency, convergence, crossdisciplinarity, experiential learning, model, paradigm, praxis, schema, system, transdisciplinarity.

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Formal education is still governed in many parts of the world by archaic paradigms that go back to the days of the assembly line a century ago, and often long before. These paradigms may have suited industrial societies then when workers were required to merely accomplish narrow tasks mandated by their firms in prescriptive ways with no necessary insight or innovative thinking required, and often with no anticipated feedback outside reporting possible failure in the handled machinery or service line. Paradigms in question may somehow continue to suit many regimes around the globe that do not sufficiently value formal education and/or that require citizens to be obedient servants of the interests of the ruling oligarchy, including in many so-called democratic countries. However, these paradigms are superannuated and suit by no means the rapidly changing realities of the 21st century, especially not communities and nations that seek sustainable development with self-fulfillment and decent lives for their people. New paradigms are needed in education to these ends along the lines proposed in this paper.

The 21st century has been marked, and continues to be, by many swift and radical changes in virtually every aspect of our daily lives, particularly in the job market. Our rapidly changing world keeps: (a) forcing some long-established industries (firms of all sorts) out of the market and eliminating some traditional professions, (b) pushing many existing industries and professions into new and unprecedented directions, and (c) requiring, at high rate and to high proportions of market share, new industries with functions never heard of before and new professions with unprecedented roles and competencies. Archaic education paradigms prevailing in the overwhelming majority of education systems and educational institutions around the globe cannot form graduates who can readily adapt to such changes and succeed in life. Enterprises everywhere in the world have long been complaining that fresh graduates of conventional tertiary education are ill prepared for induction in the job market and lack necessary competencies for coping with market demands and challenges[1].

These paradigms are superannuated to the point that they cannot be revised and adapted to the realities of the century. They need to be transcended into different paradigms that bring about graduates who are competent enough to engage in meaningful lifelong learning and to succeed and readily adapt to any change in their life and prospective careers, even to change career – and perhaps life habits – altogether if necessary. New paradigms should especially break up with: (a) compartmentalized disciplinary education that sustains traditional boundaries between disciplines in the same and different fields and that even fails to help students connect coherently different parts of the same discipline, (b) segregation between general education and technical and vocational education (or career and technical education), (c) the disconnect of formal education with various sectors of society, and (d) traditional instruction of lecture and demonstration delivered to a passive and quiet audience of students who end up assimilating course materials by rote for the sole purpose of passing tests and exams. Systemic, praxis-immersive, convergence education (SPICE) is advocated in this paper for such transcendence.

SPICE is grounded in philosophy, cognition, neuroscience, and reliable educational theory and research, and accounts explicitly for what is required of individuals and communities for success and sustainable development in the 21st century (Halloun, 2023). It relies on systemism to provide a seamless perspective on education from pedagogy to governance. According to systemism, and as discussed in Section 1 of this paper, we can best conceive and deal with the world within and around us 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. SPICE then calls for systemic curricula that help students conceive any discipline in any field around a limited set of powerful systems and develop generic systemic competencies that

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[1] See, for example:

National Academies of Sciences, Engineering, and Medicine. (2018). *Graduate STEM Education for the 21st Century*. Washington, DC: The National Academies Press. doi: https://doi.org/10.17226/25038.

they can readily deploy for tackling everyday life issues efficiently. Students may best develop such competencies under mind-and-brain-based pedagogy that promotes experiential learning ecologies whereby students engage systematically in systemic hands-on, minds-on transaction with real world situations that involve explicitly insightful praxis modalities as discussed in Section 2. With such modalities, students learn not only how professionals bring theory and practice together into consonance, but more importantly they learn in practice to appreciate the importance of relying systematically in our thoughts and actions on corroborated theories and paradigms of professional communities in order to deal with the world in the most reliable, efficient, and innovative ways possible. To the latter end, students do not learn individual disciplines independently of each other. Instead, as discussed in Section 3 and as increasingly required in the job market and other aspects of life, systemic curricula help students transfer what they learn about a particular discipline to other disciplines and, most importantly, move toward disciplinary convergence. Convergence is about bringing knowledge from different disciplines coherently together under systemic frameworks to tackle issues that cannot, or better not, be tackled in any discipline independently of other disciplines. Systemism, praxis, and convergence education discussed in the previous three sections are then brought together under SPICE to transcend conventional education as discussed in Section 4 in all pedagogy and governance respects and empower students for excellence in life in the 21st century.

1. Systemism

We can make sense of the world within us (our individual minds, brains, and bodies) and around us (our immediate environment and the rest of Earth and the universe) meaningfully when we look at realities the world over, whether independently or in relation to each other, consistently with a coherent and comprehensive *worldview*. Similarly, we can carry our lives in this world efficiently when we deal with everything systematically with a dynamic and generic *mindset*. *Systemism* allows us to achieve this mission most meaningfully and most efficiently in all aspects of life, particularly in education.

Systemism[2] is a two-side philosophical and cognitive coin that applies to all realities, from the atomic scale to the galactic scale and spanning all living and inert entities and related phenomena, as well as to all human-contrived concrete and abstract artifacts (Halloun, 2019/2022, 2023). On one side of the coin is the most coherent and comprehensive worldview whereby we conceive every reality in the universe, whether living or inert and whether natural or artificial, as a *physical system* or subsystem, or as part of such systems or subsystems. Similarly, we envisage conceptions (concepts, laws, principles, and all other constructs relating different concepts) and all sorts of abstractions in human minds not isolated from each other but as coherent building blocks of *conceptual systems* (e.g., scientific models and music, literature, or text genres), or subsystems (Halloun, 2001, 2004/06, 2018a, 2019/2022). On the other side of the coin is the most dynamic and generic mindset that brings us systematically[3] to develop (construct, evaluate, and refine or change) all sorts of knowledge around powerful conceptual systems following well-defined rules and procedures, and to deploy such systems

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[2] Modern day foundations of systemism are found in the seminal works of Mario Bunge and Jay Forrester:

   Bunge, M. (1979). *A World of Systems*. Dordrecht, NL: Reidel.

   Forrester, J.W. (1968/1971). *Principles of Systems*. 2nd Ed. Cambridge, MA: Wright-Allen Press.

[3] "Systemic" and "systematic", and thus "systemically" and "systematically", "systemize" and "systematize", are not synonyms for us. Systemic refers to systemism or systems, whereas systematic refers to a consistent and often orderly way of doing certain things like exploring certain entities and territories or developing knowledge about them. With a systemic mindset, we do everything systematically through, say, system exploration or construction, system extrapolation or deployment.

methodically for designing and constructing all sorts of conceptual and physical artifacts and making – hopefully – constructive changes in the world.

1.1 Systems and systemic schema

In simple terms, and unless made of a single constituent (e.g., monoatomic chemical elements and unicellular organisms), a system is an orderly whole or unit of interdependent real (concrete or physical) or conceptual (abstract or theoretical) elements that come together or that are brought together within specific theoretical and practical contexts in order to serve certain purposes that no one element can serve independently of other elements in the system, at least not as adequately or as efficiently.

Figure 1. Systemic schema.
The schema serves to define all sorts of systems, as well as any physical or conceptual system constituent.

We systematically identify and delimit any system (or subsystem) of any real or conceptual nature, as well as any system constituent, and we "define" systems and system constituents explicitly using a generic four-dimensional template that we call *systemic schema* (Fig. 1). The four schema dimensions pertain to the system's scope, constitution, and performance, all specified in the context of an appropriate theoretical framework. Each *dimension* may be broken down into two or more *facets*, and all facets are constantly evaluated and regulated based primarily on the system performance (Halloun, 2023).

1. The *framework* of a system consists of theoretical premises that are necessary to specify the other three dimensions of a system or system constituent, and to deploy the system for specific purposes. These premises are typically taken or derived from a particular paradigm (or from two or more coherent paradigms) that may best come from concerned professional communities (Box 1).

2. The *scope* of the system specifies the system *domain* and *function*, i.e., where it exists or applies and what purposes it serves.

Box 1. Professional paradigms (Halloun, 2004/2006, 2023).

Every professional community or community of practice (CoP), and especially every academic community, is characterized by one particular paradigm (or a couple of complementary paradigms, like the classical and modern paradigms of natural sciences). The paradigm consists then primarily of:

- ontological, epistemological, methodological, and axiological (ethics and value system included) tenets of axiomatic nature, corroborated principles, and other foundational propositions commonly accepted by all members of the concerned community and hereby collectively referred to as *paradigmatic premises*;
- an *episteme*, or conceptual or content knowledge, that consists of a repertoire of *conceptions*, i.e., concepts, laws, theorems, and other relationships among concepts, along with related semantics, and syntax;
- a *methodology*, or repertoire of procedural knowledge that includes cognitive and sensorimotor *skills* and *procedures* of specific rules and guidelines, along with necessary tools and resources chosen or developed in accordance with specific norms and standards.

Paradigmatic premises govern the inception of conceptual and procedural knowledge for serving specific purposes, as well as the corroboration, deployment, and continuous evaluation and regulation of such knowledge, and thus of the paradigm altogether. Because of their generic nature, some if not most of these premises often cut across different disciplines in the same field or different fields. Disciplines in the same field (e.g., dance and music in arts, biology and physics in natural sciences, and geography and sociology in social sciences) would then be distinguished more by their episteme and some of their procedures than by their paradigmatic premises. That is why the word "paradigm" is often reserved in the literature to refer exclusively to paradigmatic premises within the same discipline or the same field, without including episteme and methodology.

3. The *constitution* of the system specifies the system *composition* and *endo-structure*, i.e., what it consists of and how these constituents are connected or related to each other, as well as the system *environment* and its *exo-structure*, i.e., what entities outside the system significantly affect how it serves its function, and how these entities relate to the system in part and as a whole.

4. The *performance* of the system specifies the system *processes* and *output*, i.e., all sorts of conceptual or physical operations the system undergoes and what it brings about as a consequence to serve its designated function.

Ample details are given elsewhere about the systemic schema and its use in defining systems or system constituents of any nature and in any field or discipline (Halloun, 2019/2022, 2023). A quick note is though worth putting forth at this point. With a systemic worldview, we focus on systems, like we do with their constituents, not independently of each other but in relation to each other, and particularly on patterns in their constitution and performance. *Patterns* are primary or pertinent aspects (as opposed to secondary or irrelevant aspects) that we find repeatedly and regularly in space and time in the structure and behavior of physical realities (e.g., similar anatomical and behavioral aspects of all beings in a given species at all places and times, day and night and season cycles) or in abstract or conceptual entities and processes that people construct individually or collectively.

1.2 Systemic engagement

Systemism is not about a static worldview, not about developing passively a fixed, positivist perspective of the world. It is about an all-encompassing insightful and propitious worldview coupled with a dynamic and generic mindset. It is about being systematically engaged actively and critically in the world so as to reveal primary or pertinent aspects of any reality (real entity, event, or phenomenon) or abstraction (conceptual entity, product, or process) in order to make sense of it meaningfully and productively, unveil morphological and phenomenological patterns in relation to other realities or abstractions, extrapolate reality/abstraction and pattern constructively, and, if necessary, control them or change them in certain respects for continuously enhancing personal, collective, and ecological welfare. Systemism is ultimately about thinking outside the box and coming up with innovative ideas and products. Conceptual and physical systems are built to these ends in accordance with the systemic schema of Fig. 1, and they are continuously evaluated and regulated to significantly enhance – and perhaps change – their facets based primarily on their performance as indicated in Fig. 2 (Halloun, 2023).
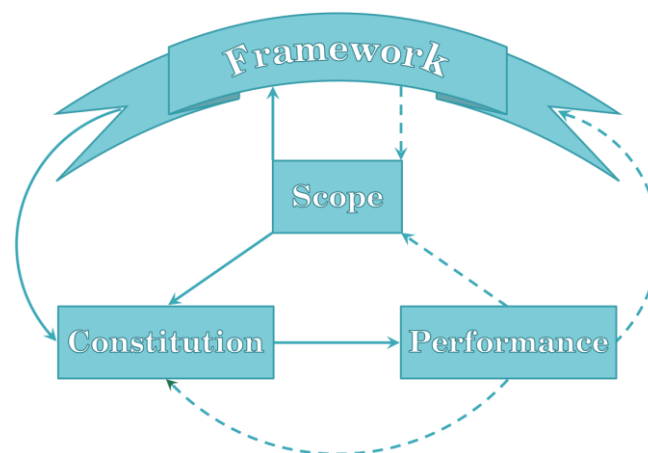

Figure 2. Insightful definition, operation, and continuous regulation of a system.
All facets of the system are constantly evaluated and regulated based primarily on the system performance as indicated by the feedback dashed arrows.
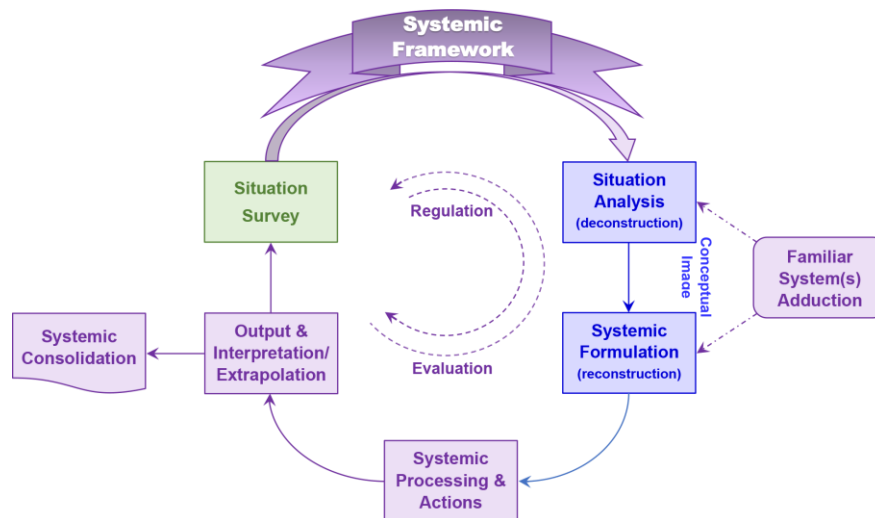
Figure 3. Systemic engagement in physical or conceptual situations.

Fig. 3 shows how systemic engagement[4] can typically take place in concrete and abstract situations. That engagement could be about exploring or investigating a given situation for the purpose of describing it, explaining it, coming up with certain inferences or judgment about it, and/or for coming up with innovative ideas, products, and/or processes to address certain issues in that and other situations. Tackling the situation goes then in six stages (Halloun, 2023):

1. *Exploration*. The situation is quickly surveyed or examined to figure out which systemic framework is most appropriate to deal with that situation and achieve what we want to do with it.

2. *Analysis*. The situation is "deconstructed" into various entities and processes, and primary aspects that are pertinent to what we want to achieve are teased out based on well-defined criteria, and in accordance with rigorous norms.

3. *Synthesis* or *systemic formulation*. The situation is "reconstructed" in the form of a conceptual system or set of interrelated systems making up what we call a viable "conceptual image" of the situation and consisting of interrelated chosen primary aspects. If necessary, conceptual system(s) may then be reified into appropriate physical system(s).

   Analysis and synthesis always involve *adduction* of familiar conceptual and, perhaps, physical systems, i.e., bringing in systems or parts of systems and related systemic processes that we are familiar with from outside the situation.

4. *Processing*. The formulated system(s) is (are) processed conceptually, and perhaps physically, in order to achieve the investigative and/or innovative purposes set for the situation at hand.

5. *Interpretation/Extrapolation*. Outcomes thus obtained (output) are interpreted in terms of what we have set to achieve and proper decisions are made regarding their validity, and thus whether prior stages need to be reconsidered in any respect. Once satisfied, the output is extrapolated beyond the situation at hand and proper lessons are drawn

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[4] We speak of "systemic engagement" in a way that encompasses so-called "systems thinking" in the literature and goes beyond it to involve all thoughts, emotions, perceptions, and actions – some of which we may group, along with necessary knowledge, under the label "competencies" – that we enact to deal with all sorts of existing abstract and physical entities and processes and produce new ones, and to construct and regulate personal and collective knowledge in the context of appropriate paradigms.

from what we have gone through and achieved so far regarding that and other related situations.

6. *Consolidation*. Insights gained regarding the situations in question, and especially regarding constructed and adduced system(s) and all physical and conceptual tools deployed in the process, are explicitly formulated so as to integrate newly developed knowledge with prior knowledge and consolidate the latter (reinforce it and elaborated it), particularly adduced systems, in the context of the designated systemic framework.

The six-stage systemic engagement of Fig. 3 is a cyclic, sequential and reiterative, endeavor. It follows a *sequential* order in the sense that we can proceed to a given stage only after going through, at least in part, a preceding stage. However, it is *reiterative* in the sense that, following continuous evaluation of every step in the way, we may revert at any point to prior steps and prior stages for regulation purposes (dashed arrows in Fig. 3), and for gaining further insight into the situation at hand and into all conceptual and physical tools (systems included) deployed in the situation. The entire engagement process is *cyclic* in the sense that following the consolidation process, or concurrently with it, we may proceed to further elaborate certain aspects we have gone through by revisiting that same situation or by tackling new related situations. Either way, we proceed then through the same six stages of Fig. 3.

Systemism can consciously help us through every thought and action we undertake in both the conceptual realm and the real world regarding ourselves, other people, and any entity, event, or process we are interested in. Engaging with the world within and around us has many unique advantages when undertaken systematically following explicit rules of engagement in the context of systemic frameworks or paradigms. Among others, with systemic engagement we may (Halloun, 2023):

1. Infuse *order* in our thoughts and actions, and readily reveal *patterns* and thus order in the universe.

2. Bring *synergy* to our interaction with others, optimize the governance of our institutions, and subsequently achieve any collective endeavor with outcomes of unsurpassed value.

3. Readily bring about disciplinary *convergence*, i.e., bring together coherently and cohesively knowledge from different disciplines within the same and different fields, especially those traditionally considered to be remotely related to each other, like arts and sciences, in order to tackle complex issues that cannot be tackled in the context of any particular discipline or field independently of others.

4. Efficiently *cope* with our rapidly changing world, particularly in the job market where existing careers keep imposing constantly new demands and new careers keep emerging suddenly with unprecedented demands.

5. *Empower students* for all the above and, particularly, for bringing coherence and consistency to their thoughts and actions, transferring systematically systemic content and process knowledge within and across courses and disciplines, and realizing the big systemic picture within and across different disciplines.

1.3 Systemic Cognition and Education

Our minds and brains are naturally structured systemically and disposed for systemic engagement with the world within and around us, particularly for knowledge development in formal educational settings, whence our call and work for Systemic Cognition and Education

(SCE). SCE draws on philosophy, cognition, and latest developments in neuroscience, as well as on reliable research, theory, and practices in education in order to empower students to think outside the box and excel in various aspects of life rather than to pass school and high-stakes exams. To this end, SCE lays the foundations and provides guidelines to *systematize* under systemic paradigms the entire educational enterprise, from pedagogy, curricula, and teacher preparation to governance of educational institutions and entire education systems (Halloun, 2023).

SCE calls on formal education to adopt mind-and-brain-based systemic pedagogy that allows students (including pre-service teachers) to consciously develop and sustain systemic "*4P profiles*". *Systemic pedagogy* is experiential pedagogy that provides for and governs hands-on, minds-on learning ecologies whereby students are engaged, interactively with peers and teachers, in

Figure 4. 4P profiles.

The four P's are *not* absolute traits of a "one-size fits all" profile. They are instead universal "attributes" of distinct individual profiles that are necessary for success – and excellence – in any aspect of life, in any place and time.

systemic transaction with everyday life situations of student interest and concern. Such pedagogy keeps away from traditional one-size-fits-all lecture and demonstration. It accounts instead for student cognitive differences, and allows in well-structured but flexible settings for insightful regulation and development of student 4P profiles under teacher mediation. These profiles (Fig. 4) are characterized with:

Progressive mind, i.e., an overall systemic and dynamic mindset with clear vision and critical and insightful commitment to empower oneself and others for self-determination and continuous progress in various aspects of life.

Productive habits, i.e., sustained systemic efficient skills and dispositions for wise resourcing and systematic, orderly, and innovative engagement in any individual or collective endeavor and for overall sound conduct in everyday life.

Profound episteme, i.e., rich cohesive corpus of content knowledge focused in any field on generic epistemic essentials that readily lend themselves to practical aspects in the field and to coherence and consistency within and among different fields.

Principled conduct, i.e., constant value-laden drive for beneficiary outcomes that come about in accordance with righteous and constructive individual and collective stance and aspirations and in aesthetic harmony with local and global natural and social orders.

Under SCE, students develop 4P profiles in the form of systemic habits emerging from systemic competencies (Fig. 5) that students develop and sustain in mind and body following sufficient successful deployment in real life situations along the lines of Fig. 3. A *competency* consists of cognitive and behavioral knowledge necessary to successfully achieve a particular type of tasks like riding a bicycle, writing an announcement about particular events, writing a report about an event or about a particular
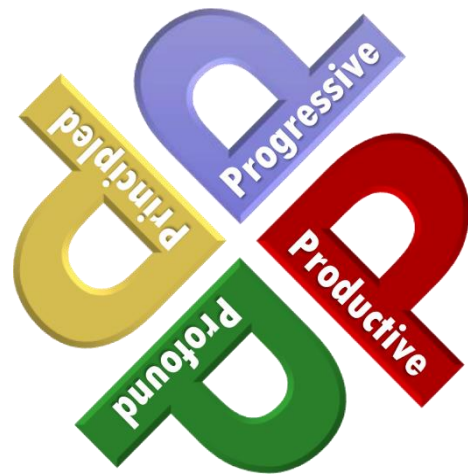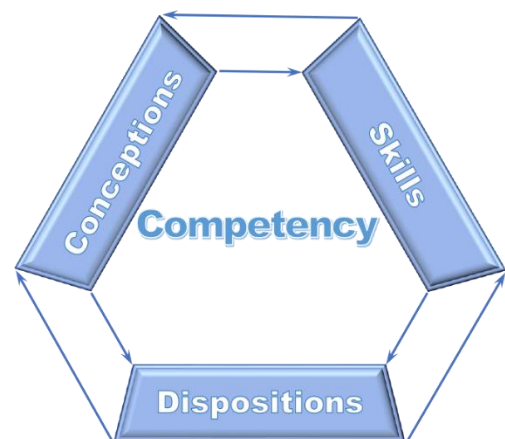

Figure 5. Competency.

Pairs of arrows indicate that various constituents affect each other, and that any change in one constituent might induce changes in other constituents.

type of experiments, solving a particular type of problems, assembling a particular piece of furniture or a particular type of electric circuits. In other words, a competency consists of epistemic knowledge (conceptions in Fig. 5), procedural knowledge (reasoning and/or sensorimotor skills), and dispositions necessary to achieve certain similar tasks.

In formal education, a competency may be specific or generic. A *specific competency* is what it takes to achieve similar tasks that fall within the limited scope of a particular branch of a given discipline. A *generic competency* is what it takes to achieve a variety of tasks that cut across different branches and, possibly, different disciplines in the same or different fields. Students who master a specific competency can successfully: (a) carry out specific tasks in familiar real or conceptual contexts, and (b) transfer what they have learned in the process to new tasks involving similar objects and/or events in similar contexts. In contrast, students who master a generic competency can successfully: (a) carry out a variety of tasks, in familiar and novel real or conceptual contexts, and (b) transfer what they have learned to new tasks involving similar and different objects and/or events, in a variety of familiar, similar, and novel contexts.

Systemic competencies are predominantly generic. They are originally developed for the construction and deployment of particular systems and enable us to approach any task with a systemic mindset. They are generic in the sense that they allow us to: (a) conceive or even reconstruct all entities that a task is about as systems or parts of systems delineated in accordance with the systemic schema of Fig. 1, (b) carry out all endeavors as systemic endeavors following systematically schemes like the one of Fig. 3, and (c) readily transfer systems and/or related knowledge from one branch to another in a given discipline or from one discipline to another in the same and different fields.

To efficiently serve its ends, SCE calls to complement systemic pedagogy with *systemic governance* of educational institutions and entire education systems. As such, various stakeholders are systemically engaged in propitious decision making and implementation, with the spirit of shared responsibility within the educational sector and of true partnership with other sectors, so as to meet realistically and efficiently the needs and aspirations of individual people and communities for self-fulfillment and continuous and sustainable development. We will come back to the issue of governance later in this paper.

2. Praxis

Praxis is the ultimate form of experiential learning that may empower students under systemic pedagogy to think outside the box and excel in practical real-life situations in the most innovative ways possible. The idea of praxis originated in professional communities or communities of practice (CoPs) where it is about comparing theory and practice in order to evaluate and regulate professional paradigms (Box 1), and particularly to bring episteme and methodology in consonance with each other. Praxis is then meant to ensure that various elements of the epistemic corpus (i.e., theory or theories) are duly corroborated by demonstrating their merits in serving the functions they are supposed to serve in their respective domains, and that related processes and output (i.e., practice) viably correspond to what the theory is about in the real world and fulfill the overall function set for the theory.

Praxis in education is meant to help students appreciate CoP professional paradigms and take advantage of these paradigms in both theoretical and practical respects: (a) to reflect on their own paradigms that are often of intuitive nature[5], regulate them, and bring them into harmony with CoP paradigms, and (b) to rely explicitly and systematically on corroborated theory in all thoughts and actions in order to tackle any issue in the most reliable and innovative

ways possible. To these ends, experiential learning should come, whenever possible, as close as possible to CoP praxis and turn into what we call "education praxis".

Education praxis has two complementary modalities: praxis education and praxis for education. *Praxis education* is about learning how professionals engage in praxis within their own CoPs, like indicated in Fig. 2, to bring their theory and practice into consonance with each other and continuously enhance them in the framework of their professional paradigms.

Figure 6. Insightful dialectics for meaningful knowledge/competency development, particularly for helping students regulate their intuitive paradigms, or transcend them if necessary.

Praxis for education serves to help students evaluate their own profiles, their own paradigms[5], and regulate them insightfully to make them inherently coherent, consistent, and viable in theoretical and practical respects, and, especially, to bring them into consonance with – or transcend them altogether in favor of – professional paradigms. In both modalities, education praxis needs to take place in authentic CoP settings or related real world settings, including the job market, community service, or any other real life setting that students can directly relate to and that provides them with the opportunity to put what they learn about professional paradigms into practice within each paradigm natural scope, appreciate what these paradigms can offer at the personal and collective levels, and subsequently take full advantage of them whenever and wherever they fit in their daily lives.

In education praxis, and particularly in praxis for education, students are constantly engaged in *insightful dialectics* whereby they approach a situation critically and reflectively from different perspectives. They undertake negotiations: (a) intrinsically within their own knowledge and (b) externally with other people's knowledge, CoP paradigms included, and with empirical data from the real world. As a consequence, they evaluate and regulate their own knowledge and develop it in specific respects. Insightful dialectics thus come in three modalities as illustrated in Fig. 6:

1. *Coherence* dialectics that are intrinsic, *rational* dialectics involving the comparison of a particular piece of cognitive or behavioral knowledge to one's own related knowledge, and the resolution of any possible incongruence or discrepancy that might emerge as a consequence.

2. *Correspondence* dialectics that are external, *realist* dialectics held between empirical data gathered through direct transaction with real world entities and phenomena of interest or obtained from a reliable source, on the one hand, and one's own related knowledge on the other

3. *Commensurability* dialectics that are also external, but *rational* dialectics held to establish compatibility in measurable ways between one's own knowledge and professional knowledge of concerned CoPs, particularly their professional paradigms.
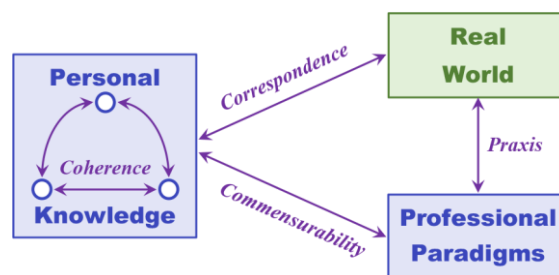
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[5] Students, like ordinary people, hold *intuitive paradigms* that are at odds in many respects with professional or CoP paradigms due primarily to intuitive tenets maintaining, say, that the reality of things appear directly to our senses (e.g., the sun turns around Earth) and that we can always rely on our instincts for good judgement. Intuitive paradigms are discussed elsewhere in details by comparison to professional or CoP paradigms (Halloun, 2004/2006, 2023). For further, and objective, discussion of the philosophical and pedagogical merits of the professional-intuitive dichotomy in the nature of paradigms, see for example:

Clark, T., & Hicks, M.G. (2020). Models of necessity. *Beilstein Journal of Organic Chemistry*, **16**, 1649-1661.

Wendel, P.J. (2008). Models and Paradigms in Kuhn and Halloun. *Science & Education*, **17** (1), 131–141.

In all three dialectics modalities, students take advantage of what they learn about CoPs praxis (praxis education) whereby professionals engage systematically in external, *realist and rational* dialectics between their CoP paradigms and the real world along the lines of Fig. 2 in order to regulate and elaborate theory and practice and continuously improve coherence of theory, consistency of practice, and correspondence between theory and practice. Praxis education should also provide students the opportunity to realize and appreciate how theory in any discipline and field, once duly corroborated, governs practice in all respects.

Take for example scientific theory. Once corroborated, i.e., once all its laws and other premises have constantly proven to be valid for constructing scientific models (conceptual systems) that reliably describe, explain, and predict real world systems and phenomena that fall in the theory's domain, theory and models would then be systematically relied upon in practice, whether for investigating, changing, and controlling existing systems and phenomena or for creating new ones. In any such activity, like in the case of Fig. 1, Fig. 2, and Fig. 3, the theory, along with the paradigm it belongs to, would then safely provide the necessary systemic framework to assume any task that falls within the scope of the theory (Halloun, 2004/2006, 2018a). Once a theory in any field is corroborated enough to reach a status similar to that of a scientific theory (e.g., Newtonian theory of classical mechanics), virtually every time praxis leads to a discrepancy between theory and practice, practice, not theory, would then have to be evaluated and insightfully regulated along the lines of Fig. 2. This is particularly important for students to appreciate the significance of commensurability dialectics and the necessity to fall back on CoP paradigms to regulate any misconception they might hold about the real world.

Education praxis (praxis for short hereafter) should always bring about physical and/or conceptual products that carry added value to experiential learning and that students can directly benefit of, and benefit others from, in theoretical and practical respects. Products, along with processes that bring products about, should well reflect what the corresponding paradigm(s) is (are) about, and, at an advanced tertiary education level, they may even imply necessary changes in any paradigmatic aspect outlined in Box 1 and/or the emergence of new epistemic and methodological components.

Praxis may take place during regular class hours and after school, on-campus and/or off-campus, and it may involve students from the same or, better, different schools and educational levels, along with members from concerned CoPs. On-campus praxis may take place in dedicated makerspaces or in traditional facilities, like laboratories and computer, arts, or technology workshops, provided that these facilities be run with the spirit of makerspaces. A *makerspace* (hereby used in the large sense to include all sorts of facilities where praxis takes place) simulates an authentic CoP field of work, whether it pertains to a single CoP or a number of CoPs working together on issues of mutual interest. It provides students with actual CoP tools and with the opportunity of working collectively, hands-on, minds-on, to design and realize CoP conceptual and physical products following systemic rules and processes that characterize the community(ies) in question.

Makerspaces are run by teachers and/or qualified technicians or mentors who treat students as apprentices in need to master the "rules and tools of the trade", but especially to *think outside the box*, try out their own ideas, and produce things to the highest, and most reasonable, professional standards possible. As such, makerspaces are dedicated not only to praxis in the limited sense of bringing theory and practice into consonance, but to all sorts of productive and innovative experiential learning. When a school cannot afford it alone, a number of schools may share common makerspace(s) located within or outside their campuses. In addition to developing individual students' competencies and bringing them self-satisfaction, what students produce in a makerspace should be of value and benefit to them in practical daily life, to their school(s), and/or to their own community.
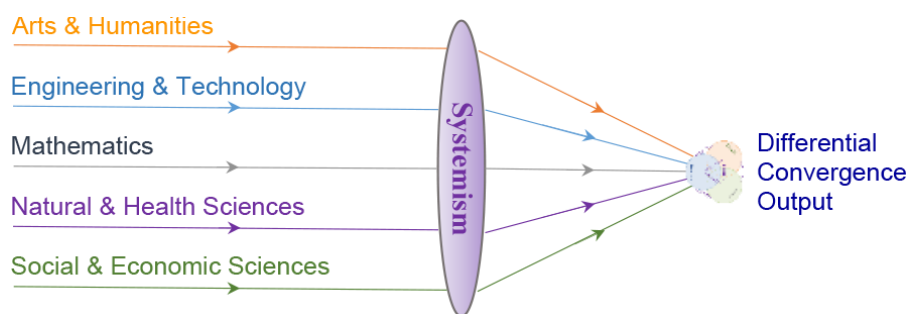
Figure 7. Convergence of disciplines, especially from different fields, optimized in education through systemic differential lenses.

Whatever modality is adopted for on-campus or off-campus praxis, crucial issues need to be attended to that distinguish praxis, and particularly systemic praxis, from other forms of experiential learning. Some of these issues are briefly discussed in Section 4. These and other issues are discussed at length elsewhere (Halloun, 2023). It is though crucial to note here that for any praxis modality to succeed and bring about significant added value to education, traditional curricula need to be transcended in all foundational and practical respects, and so should traditional educational governance. Among other things, the demarcation lines need to be blurred, even removed altogether, among traditionally distinct academic disciplines and between general education and technical and vocational education (or career and technical education), and educational governance should take an explicitly systemic direction that involves not only educators and educationists, but also various other stakeholders concerned with CoP praxis and community and nation development.

3. Convergence education

Praxis is most meaningful and most effective in meeting the realities of the time, whether in the job market or in any other practical aspect of life, when carried out as an integral part of systemic curricula under convergence education[6]. Such curricula transcend traditional disciplinary boundaries and focus on paradigmatic patterns that help converging, i.e., bringing together, disciplines from the same and different fields in order to tackle issues of interest and value to students in their daily lives. They focus, in particular, on systemic, epistemic and methodological patterns across disciplines that have been traditionally separated by impenetrable boundaries or unbridgeable chasms like arts and humanities, on the one hand, and science and technology on the other (Fig. 7).

For all practical purposes, we hereby call for convergence education that brings together two or more disciplines from the same and/or different fields without blending them and fusing them in a single body that annihilates or supervenes individual disciplines in any respect. We call this *differential convergence education* (DCE). DCE honors and spares the integrity and sovereignty of each discipline in all foundational (paradigmatic premises) and practical (episteme and methodology) respects, while recognizing the interdependence of certain disciplines in specific respects and the possibility of any discipline to benefit from other disciplines at any time and in any place. Even when transcendence of existing disciplines is required, i.e., when convergence needs to go beyond disciplinary boundaries into novel paradigmatic territories not ventured before, DCE is achieved not to the detriment of any

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[6] Disiciplinary convergence has been, and will continue to be, the main driving force behind major advances and inventions of our time to the extent that leading international organizations are merging following the lead of the *International Council for Science* and the *International Social Science Council* that merged in 2017 into the *International Science Council* to promote across the board disciplinary convergence and convergence education.

discipline, but by widening horizons and opening new doors in ways which existing disciplines may benefit of. As such, DCE can be feasibly afforded even in the context of traditional disciplinary education, along with or part of, but not instead of, disciplinary courses, though this would require and/or lead to some affordable changes in the curricula in place (Halloun, 2018b, 2020a, 2020b, 2023).

Different convergence modalities are distinguished in the literature based on different criteria, whether among CoPs or in educational settings. In the CoP realm, we distinguish five DCE modalities of increasing cohesiveness and productivity that education systems and curricula can take advantage of the most. These are: pluridisciplinarity, multidisciplinarity, interdisciplinarity, crossdisciplinarity, and transdisciplinarity. These modalities are distinguished as outlined in Table 1 based on ten criteria and discussed elsewhere in ample details (*ibid*). We focus here on an outline of crossdisciplinarity and transdisciplinarity that are the two most important convergence modalities for secondary and tertiary education.

Crossdisciplinarity is a cross-breeding, cross-fertilizing, or cross-pollinating convergence modality (whence the cross- prefix in the name of this modality) that requires continuous crossing of boundaries among disciplines, mutual and reiterative critical evaluation and insightful regulation of various disciplinary aspects, and bridging of disciplinary divides. This modality brings real significance to convergence, whether differential or not, through creative collaboration that goes beyond infusing relative harmony into disciplines in conservative ways. It leaves it to participants' creativity to bring about significant changes in all foundational and practical respects. Those changes are often *emergent* in the sense that they stem from existing paradigmatic premises and epistemic and methodological components and come out with new aspects that cannot be attributed to anything they emerge from but that can always relate and conform to implicated disciplines.

Table 1
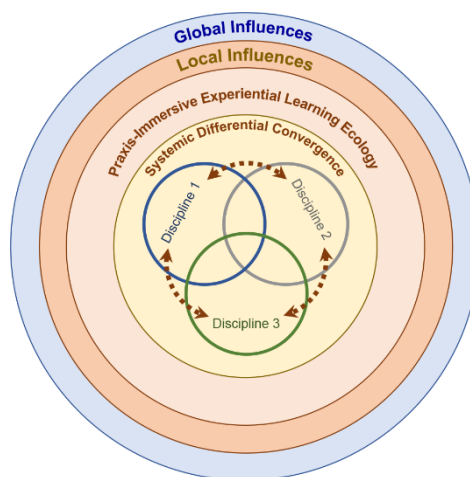Major convergence modalities and their characteristics

Characteristics / Modality	1 Scope of work	2 Disciplines from different fields	3 Collective work*	4 Disciplinary bridges	5 Framework(s) and grounds in Disciplinary paradigms	6 Epistemic changes in each discipline	7 Methodological changes in each discipline	8 Output originality	9 Extrapolation	10 Ultimately new discipline(s)
Pluridisciplinarity	Issue only	May be	Cnsrv ST Coop	No	Separate conformist frameworks	None	None	None	No	No
Multidisciplinarity	Disci-pline	May be	Cnsrv ST Coop	No	Separate conformist frameworks	Refined semantics	Refined rules	Insig-nificant	No	No
Interdisciplinarity	Open	Yes	Cnsrv ST Colb	Yes	Common hybrid framework	Refined semantics & syntax	Refined rules	Slightly	Yes	No
Crossdisciplinarity	Open*	Yes*	Crtv LT Colb	Yes	Common emergent framework	New concep-tions	New proce-dures	Signif-icant/ Crtv	Yes*	No
Transdisciplinarity	Open*	Yes*	Invtv LT Colb	Yes	Common transcendent framework	Novel concep-tions	Novel proce-dures	Signif-icant/ Invtv	Yes*	Yes

* Long-term projects related to everyday life and involving non-academic fields that are not traditionally the object of general K-12 education.

✦ Cnsrv = Conservative; Crtv = Creative; Invtv = Inventive;
ST = Short Term; LT = Long Term; Coop = Cooperative; Colb = Collaborative.
Details elsewhere (Halloun, 2018b, 2020a, 2023).

Figure 8. Crossdisciplinary curriculum in systemic DCE.

Differential convergence is established among many disciplines with target knowledge in each discipline organized around a limited number of powerful systems and systemic competencies. Convergence benefits from common paradigmatic disciplinary aspects, and builds bridges (dashed arrows) among disciplines for mutual adaptation of their distinctive features. Teachers mediate students' development of crossdisciplinary knowledge in praxis-immersive experiential learning ecology under local and global influences that set the objectives of DCE particularly in relation to sustainable development of community and nation.

Transdisciplinarity is the ultimate convergence modality that surpasses by far all other modalities and that transcends existing disciplines (whence the trans- prefix in its name) in all foundational and practical respects in order to bring about novel and unprecedented outcomes that could not be conceived or even foreseen in the confinements of existing disciplines, whether separated or integrated. Like crossdisciplinarity, transdisciplinarity fosters non-conservative, long-term collaboration among CoPs and brings about original outcomes in disciplinary and daily life respects. However, it goes a leap ahead of the latter modality by not simply linking existing disciplines in different realms, but by going outside and beyond disciplinary boundaries altogether to transcend existing disciplines without giving them away altogether.

Praxis is particularly important in crossdisciplinarity and transdisciplinarity. These two convergence modalities require convergence of theory from different disciplines as well as convergence of practice from these disciplines, with the emergence of new theoretical and practical aspects under well-defined paradigmatic frameworks that we urge to be systemic frameworks to facilitate convergence. Consonance needs then to be established between converged theoretical aspects and converged practical aspects, emergent aspects included, in accordance with the paradigmatic premises of the chosen framework in order to establish the validity of undertaken disciplinary convergence. Praxis thus becomes an imperative aspect of convergence, and it gains more significance from both disciplinary and pedagogic perspectives.

A systemic perspective on individual disciplines allows convergence to readily take place in education like it does in CoPs. It can especially help students realize and appreciate common conceptual and procedural patterns in different disciplines, transfer knowledge systematically within and across disciplines, and infuse order in their memories, efficiency in knowledge retrieval, and innovation (creativity and invention) in handling any situation (Halloun, 2017, 2019). Most importantly, such a systemic perspective allows for differential convergence education (DCE) to take place feasibly with the modality that suits best any school and education system (Table 1), and with the ultimate aim to design, implement, and constantly evaluate and regulate, under systemic pedagogical frameworks, crossdisciplinary curricula at the secondary and early tertiary education (Fig. 8), and transdisciplinary curricula at higher levels.

The digital revolution of our era, the breakthroughs in neuroscience, especially cognitive neuroscience, which education may benefit of the most, and the many new careers that keep popping up in the job market and that could not have been foreseen or even imagined just a decade ago, are all compelling testimonies in favor of crossdisciplinarity and, especially, transdisciplinarity. Many universities and enterprises are already there or heading this way. Others, especially in education, have no choice but to shoot for transdisciplinarity, or at least
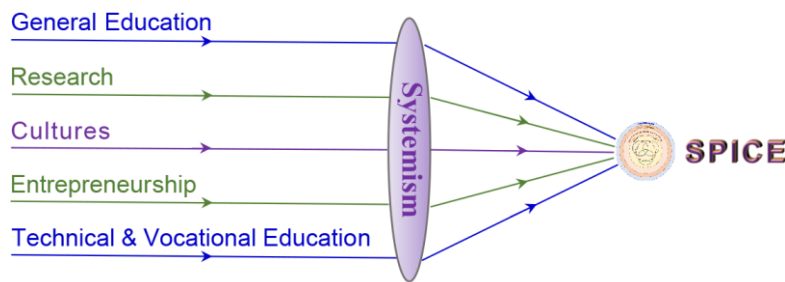
Figure 9. Extra-disciplinary convergence for systemic, praxis-immersive, convergence education (SPICE).

crossdisciplinarity, and work urgently to get there progressively, beginning with the modality that suits them best.

4. SPICE

Formal education should be carried out with curricula that are designed, implemented, and continuously evaluated and regulated to meet the realities of the time and to help students and communities realize self-fulfillment and sustainable development respectively. This may best be achieved under systemic pedagogical frameworks that promote meaningful experiential learning of systemic programs of study that readily lend themselves to differential convergence among disciplines in the same and different fields. Ultimately under such frameworks, experiential learning would turn into insightful praxis, and formal education into systemic, praxis-immersive, convergence education (SPICE).

Praxis that we call for in education goes beyond bringing disciplinary or CoP theory and practice into consonance to helping students learn how to *translate* theory into practice in the *most insightful* and *actionable* ways possible in pertinent daily life situations. Translation, and thus praxis, is most insightful when students are guided to bring: (a) coherence into their own thoughts and actions, (b) explicit correspondence between their own knowledge and the world, and (c) commensurability between their individual paradigms and disciplinary or CoP paradigms (Fig. 6). Translation, and thus praxis, is most actionable when students are led to think outside the box in defining problems or identifying new issues they are concerned about in the world within and around them and solving problems or tackling issues in the most innovative ways possible. This may, and should, be optimized when problems and issues are judiciously chosen to require extra-disciplinary convergence, i.e., convergence in theory and practice not only among traditional disciplines but also between these disciplines and various non-academic sectors of society, along with local and global influences they are under, including cultural and organizational differences. This is what SPICE is about (Halloun, 2023).

As indicated in Fig. 9, SPICE is about systemic praxis and convergence, particularly differential convergence education (DCE), whereby:

1. Convergence takes place with systemic lenses not only among general education (GE) disciplines and fields, or independently among technical and vocational education (or career and technical education, CTE) disciplines, but most importantly among a mix of traditional GE and CTE disciplines so as to blur, even remove altogether, the boundaries between GE and CTE.

2. Systemic convergence also takes place in theory and practice between academic disciplines that make the object of GE and CTE and research and entrepreneurship that prevail outside academia in various sectors of society (humanitarian, artistic, social, economic, industrial, etc.); professionals from all sectors are then invited on board of

education systems as true stakeholders within and beyond the scope of praxis and makerspaces they are directly involved in as mentors or praxis facilitators.

3. In all above respects, particular attention needs to be given to praxis in order to establish the validity of the undertaken convergence modality, particularly when of crossdisciplinary or transdisciplinary nature.

4. Students are engaged in SPICE with peers not only in their own and neighboring educational institutions but also in other communities of different cultures and different nationalities, even if only remotely via internet, so that all engaged students may benefit from each other customs and daily life experiences and open up wider horizons for thinking outside the box.

A number of executive measures need to be taken for SPICE to fulfill its purposes (*ibid*). Among these measures:

1. Proper praxis provisions need to be explicitly spelled out in a given curriculum, including time allocation in school schedules, and proper arrangements need to be institutionalized, perhaps in the form of formal consortia, among different schools (universities included) in a given community and between schools and CoPs in their vicinities in order to share human and material resources and jointly set up and manage on-campus and off-campus makerspaces (in the large sense of the word to include all sorts of facilities where praxis may take place).

2. Different on-campus and off-campus makerspaces can significantly boost their productivity when all involved constantly exchange ideas and coordinate their efforts on joint ventures, particularly when it comes to long-term entrepreneurial modalities in tertiary education which all stakeholders, students and their schools included, can benefit of in financial and various other respects.

3. Common disconnect and disparities among different education systems and among educational institutions and other bodies or subsystems within the same system, particularly between secondary and tertiary education in GE and CTE and between public and private institutions, should make way for across-the-board connectivity, consonance, and relative stability that allow smooth mobility within and across systems, and especially smooth transition of students across grades and educational levels.

4. Decision makers in both education and CoPs in various sectors of society need to regularly come together in order to evaluate education praxis and regulate respective curricula and related CoP aspects so that student profiles better match the actual needs of the job market and the community at large, and college graduates be afforded smooth induction in the workplace and appropriate continuous professional development afterwards.

5. For SPICE to be most effective, disciplinary knowledge must be trimmed in accordance with the "less is more" dictum and concentrate more on what helps bridging disciplinary divides than on what sets disciplines apart (and do the same with sectorial, cultural, and other divides), and on how students can figure out common conceptual and procedural patterns and develop systematic ways for transfer of knowledge within and across disciplines (and across sectors, cultures, etc.) and for thinking outside the box in the most practical and innovative ways possible.

6. SPICE requires transcendence not only of traditional disciplinary curricula and related structural and practical matters. It requires above all transcendence of traditional top-

down, command and control governance and practices of education systems and institutions therein that go back to the rise of superannuated assembly lines in industry about a century ago. Systemic governance should reign instead that:

a. fosters synergy and power sharing with distributed responsibility that rises above simple accountability among all organs in the system (i.e., individuals and subsystems) and within organ constituency;

b. affords individual schools, even individual teachers, a high margin of freedom in making certain decisions regarding their curricula and daily operations, and hold them accountable toward local not national educational authorities;

c. ensures effective pre-service and continuous in-service training, along with proper working conditions and support systems, for teachers and all other people working in various subsystems to give their best at work and sustain continuously evolving system in all aspects and respects.

Shifting from conventional education to SPICE constitutes a major reform that may be radical in certain respects, especially when a given educational system is as outlined in the second column of Table 2. Above all, the reform that would take place along the lines of this table requires a paradigm shift in pedagogy and governance, and totally new concepts of student, teacher, curriculum, school, and of virtually every other aspect of the concerned conventional education system (Halloun, 2023).

Table 2

SPICE vs Conventional Education

Aspect	SPICE	Conventional Education
Vision	Serving long-term national aspirations for individuals' lifelong learning, self-fulfillment, and strong national identity and pride, and for sustainable development of local community and nation, with a deep appreciation of education as public good with significant returns at the individual and collective levels.	Unclear vision, if any, implicitly tied to the hegemony of ruling oligarchy that often sees education as an unworthy marketable commodity, or as an investment with no significant returns, and never as a public good that needs to be equitably afforded by all people with the highest quality possible.
Mission	Formation of systemic citizens with 4P profiles who can think outside the box to meet the rapidly changing realities of the 21st century and come up with the most innovative products and processes possible for personal and collective welfare.	Turning the majority of people into blind and submissive consumers by restricting formal education to the transmission of cognitively and epistemologically unsubstantiated loose bundles of disciplinary information that are often not suited for our time, and that do not attract student interests and do not serve the actual needs of individuals and communities.
Pedagogy paradigm	Systemic student-centered paradigm with mind-and-brain-based premises for the design and implementation of systemic curricula that help students develop systemic, daily life competencies bringing traditionally distinct disciplines into differential convergence in experiential learning ecologies culminating in praxis.	Mostly implicit paradigms, and often dominated by myths and false cognitive tenets, that are discipline-focused and that promote teacher lecture and demonstration designed to inform students about often superannuated disciplinary conceptions and processes rather than to form individuals of particular traits or profiles.
Governance paradigm	Systemic premises, resources, and mechanisms for middle-out structure of education system and subsystems and flow of operations therein, and for affording competent individual actors and subsystems enough power and trust with shared responsibility for SPICE to be implemented in the most dynamic, feasible, and efficient ways possible.	Top-down rules and regulations, often dictated by special interest people and improvised following rules of thumb, about curricula and routine operations that do not necessarily suit the actual aspirations and needs of individuals and communities.

Table 2 continued

Aspect	SPICE	Conventional Education
Stakeholders	Entire communities and nations, particularly students, teachers, parents, CoPs, and decision makers in various sectors of society, all working together in true partnership to set appropriate policy and regulations, and ensure proper school environment, conducive working conditions, and continuous professional development for teachers and other school actors (learning agents treated like and acting as true leaders).	Ruling oligarchy and education authorities practically treating teachers and other learning agents as servants of their interests and delivery agents of canned and outdated rigid programs of study, and refusing to engage these agents and concerned bodies outside the educational sector in setting educational policies and decision making regarding any aspect of the educational enterprise.
Scope	Disciplines of general education and career and technical education converging in theory and practice with each other and with various sectors of society, and benefiting of a diversity of customs and cultures prevailing in different communities around the globe.	Disciplinary knowledge mostly of epistemic nature put together as hodge-podge of informative materials rather than formative theory and practice of value to students and everyday life.
Curricula	Dynamic and flexible, competency-based, with interrelated systemic programs of study that facilitate differential convergence education (DCE) and that are explicitly coupled with adequate systemic means and methods for teaching and learning, assessment and evaluation, in order to optimally serve the adopted vision and mission.	One-size-fits-all programs of study with no clear learning and instruction strategies and mandating an unsubstantiated choice of conceptions and prescriptive, step-by-step routines for solving problems, carrying out experiments, executing projects, etc., that students may memorize by rote for the sole sake of passing specific tests and exams.
Disciplinary content	Coherent, systems-based to facilitate DCE, with "less is more" in epistemic aspects and more focus on generic skills and competencies, all of which students can easily transfer from one discipline to another to deal with real life situations.	Loose bundles of conceptions and prescriptive routines for answering test questions and solving exam problems that do not necessarily relate to everyday life and that students are often unable to realize their utility and to relate them to each other in coherent and effective ways.
Learning ecology	Teacher-mediated experiential learning ecology that ultimately takes the form of praxis, and that takes students collectively in well-structured but flexible learning cycles for engaging them systemically, interactively, and insightfully in significant transaction with real world situations of their interest that help them explicitly evaluate and regulate their own knowledge and develop competencies they need for excellence in life.	Lecture and demonstration that students listen to and watch passively mainly to figure out what is needed to memorize for passing exams.
Technology	Critical choice of automation, artificial intelligence, and other technology developed and corrobrorated under SPICE related pedagogy paradigms and integrated in SPICE curricula in ways to significantly enhance individual students' development of their systemic competencies and 4P profiles.	Adoption of marketed technology developed under unclear pedagogy paradigms, if any, and not necessarily piloted in education to prove its merits, and used as add-ons following rules of thumb, thus bringing about no added value to student understanding of course materials.

In pedagogical respects, systemic mind-and-brain-based paradigmatic premises need to be explicitly formulated and enforced with clear guidelines that allow stakeholders, particularly teachers, curriculum designers, textbook authors, and developers of various other curricular materials to feasibly adopt these premises and adapt them in curriculum design and implementation to the actual state of their own students, schools, and communities. Particular attention needs then to be paid in premises and guidelines to formulating programs of study around limited sets of powerful systems in accordance with the systemic schema of Fig. 1, and to setting and managing proper experiential learning ecologies.

Some of the systems in question will come from particular traditional disciplines. They have then to be carefully chosen and designed to allow students to meaningfully and insightfully: (a) understand what a given discipline is about and good for, (b) transfer to other

disciplines what they learn about these systems and systemic competencies they develop in their context (Fig. 5) and around systemic engagement skills (Fig. 3), and (c) achieve differential convergence among different disciplines with focus on crossdisciplinarity in secondary education through early stage of tertiary education, and ultimately on transdisciplinarity in tertiary education. Experiential learning ecologies need to facilitate student systemic engagement in real life situations where they can tackle situations of their own interest and eventually engage into praxis and learn how to think outside the box and bring about product and processes of value to them and their community in the most innovative ways possible.

For SPICE to be well-implemented and to meet its ambitious ends, systemic pedagogy paradigms need to be complemented – rather overarched – with systemic governance paradigms. A systemic governance paradigm does not mandate top-down administration of an education system, or of any of its subsystems and schools, universities and other educational institutions included. The highest authority in the system, e.g., a ministry of education in centralized education systems or a district authority in decentralized systems, should not then comprehensively dictate curricula on various educational institutions along with various policies and routine operations on these and other subsystems. For an education system to fulfill its function properly in the 21st century, its organs (subsystems and individual members) should constantly interact and work together under a middle-out systemic governance (Fig. 10) that fosters power sharing with distributed responsibility rising above simple accountability among all organs in the system. Under systemic governance, every subsystem and every person in any subsystem are afforded enough power, authority, and leeway to assume their respective responsibility to the fullest, based on their actual competence and what they can actually contribute to the system vision and mission. Proper systemic monitoring and feedback mechanisms are instituted at all levels and in all respects to allow all actors make timely, informed, and effective decisions regarding any aspect of the educational enterprise along the lines of Fig. 2.

Local authorities afford then enough power to constantly interact with schools falling under their mandates and with national authority(ies) so that each organ assumes its duties in harmony with other organs and within the limits of its own mandate. In this respect, local authorities do not operate as intermediaries or as interface between schools and national authority, but as agencies that translate national vision and mission into local policies and curricula that are adapted to the realities of the communities they serve. They do so in concert with their schools which they actively engage in all decisions, and with all other authorities and organs in the system so as to bring coherence and consistency to the operation of the system at large without supervening any school or any other system organ. Local authorities also work in partnership with various sectors of society to support schools and ensure that SPICE is tailored to the actual needs of the community. Middle-out, systemic governance proceeds then in all directions through a sort of differential collective engagement (whence another referent to DCE in addition to differential convergence education!).

Figure 10. Middle-out systemic governance in education.

The SPICE-implied reform can and should take place progressively and realistically in all respects in order not to cause unnecessary turmoil within and outside education systems and not to defeat the very purpose of the reform. Many ambitious and worthy reform attempts have already been made in various parts of the world in the past few decades, but reformists could not achieve what they were meant to achieve because of major impediments they could not overcome in structural and practical

respects. Among others, these attempts failed because reformists: (a) did not explicitly formulate and propagate needed pedagogy and governance paradigms, and (b) did not set and execute affordable plans to lay the grounds for the target reform and allow smooth transcendence of conventional education in the manner outlined in part in Table 2. In the latter respect, reformists particularly did not pay due or sufficient attention to: (a) training teachers, school administrators, and other actors to understand, appreciate, and bring about the outcomes called for in the advocated reform movements, and (b) ensuring that proper legislation and conducive working conditions and appropriate support systems were in place to help those actors succeed in their mission.

To avoid such pitfalls, the shift to SPICE needs to be carefully planned to make realistic and affordable changes in reasonable intervals of time during which teachers and all other actors can be sufficiently trained and supported to handle required changes. Meanwhile, a wise and well-targeted campaign is needed to prepare students, parents, and other stakeholders in various sectors of society for the reform called for, and to have them all actively and constructively engaged in the process to the extent that they can and should afford. Special care needs to be given in the process to circumvent special interest and narrow-minded individuals and groups who profit from conventional education and/or refuse to divert off their inertia tracks and step out of their comfort zones. The future and welfare of our students is at stake, and so is the development of our communities and nations, all of which are inhibited by conventional education. SPICE stems from well-substantiated theory and practice to empower our youth for self-fulfillment, success in life, and significant contribution to the development of the world around them, all to high excellence standards.

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