Reflections on the Role of *Tutoria* in the Future of Learning

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In late-October/early-November I helped to organize a workshop for *tutoria* practitioners in Guanajuato, Mexico. The purpose of the workshop was to engage adult *tutoria* practitioners in the initial stages of developing a more explicit set of norms and practices around the role of adults and young people in the work of *tutoria*. The development and spread of *tutoria* has, to this point, been accomplished exclusively by word-of-mouth, face-to-face modeling of practices, and occasional professional development events, without an explicit codification of the practice. The Guanajuato workshop was a deliberately experimental attempt to address the question of whether development of a more explicit language for communicating the practice would be helpful in building the culture of the practice and promoting its spread.

It is far from clear that developing clearer norms of practice will actually enhance the development and spread of *tutoria.* The absence of explicit, codified practice seems not to have hindered the development and spread of *tutoria* thus far, for reasons I will explore later. There is an additional risk that too much codification of the practice will lead to a culture in which people who are new to the practice will substitute certain routines and behaviors as evidence of mastery of the practice, losing the essential underlying ideas and the embedded culture and theory of learning that is the essence of *tutoria*. Nonetheless there are some reasons why experimenting with clearer norms and processes of practice might help. The main reason is that interest in *tutoria* is spreading beyond the core network of participants in Mexico, into other parts of Latin America and, at least potentially, into parts of the U.S. As I have observed interactions between expert *tutoria* practitioners and people new to the practice in Chile and the U.S., I note that people are deeply moved and impressed with what they see, and highly motivated to

become skilled at the practices of *tutoria* but they are also in need of clearer guidance on the essential norms and ideas behind the practice. It is possible that a more explicit set of norms would help support the spread of the practice to other settings, where the more traditional face-to-face model of spread is less practical, especially if the scale of potential practitioners begins to exceed the limits of the core group of practitioners from Mexico. It is also possible, however, that the face-to-face model of developing the practice is so integral to the culture of *tutoria* that it is impossible to use the practice without a deep apprenticeship that can only be conducted by skilled practitioners. These are all open questions.

The Guanajuato workshop was, I would say, a qualified success in its relatively modest goal of creating initial statements of norms of practice for *tutoria*. The participants, who spanned a considerable range of experience and expertise in the practice, were good natured about the tasks they were asked to do, whatever doubts they may have had about the end goal. The facilitators were, predictably, magical in their ability to coax and draw out ideas from the participants without providing answers, true to the norms of *tutoria*. And, with some skillful prodding and editing at the end of the process, the group produced a good initial set of descriptions of practice, covering a range of expertise from novice to expert. (See the Rubrics in Appendices A and B) Central to the workshop was the idea that learning any practice is a developmental process. One does not "adopt" a complex practice simply by adhering to a set of rules and executing them. One has to grow into the practice through successive levels of mastery and understanding, usually in tandem with coaching by someone with a greater mastery of practice than you. The model of the workshop, in other words, was, at least in principle, designed to be consistent with the learning theory behind *tutoria*.

In addition to participating in the workshop, I had the opportunity to visit a *tutoria* site in a rural area of Guanajuato, to be tutored again, and to speak with state officials, school leaders and support staff about the practice. This was a useful experience because it gave me an opportunity to, yet again, experience the variety of settings in which *tutoria* has taken root. My experience, while still far from comprehensive, is becoming broader, with previous visits to *tutoria* sites in Zacatecas, Tijuana, Mexicali, and now Guanajuato. Hopefully, there will be more opportunities in the future. I have also observed a very promising professional development session between practitioners from Mexico and sponsors of a foundation-supported network in Chile, designed to provide a basis for future spread of the practice.

<u>From Practice to Theory: The Joy of Learning</u>

As part of my present consulting and on-line teaching practice, I have been undertaking a deep personal learning adventure into two complex bodies of research: (1) the neuroscience of learning, or, literally, how the brain works when it

is assimilating and developing new knowledge and complex understandings; and (2) the relationship between the design of physical spaces, the processes by which people experience those spaces, and the learning that occurs in those spaces. These two bodies of knowledge are, in my view, critical to the future of learning in society. In tandem with this personal learning project, I am also working as a consultant in several settings on the design of new learning environments, as well as creating documentation of these environments for use by future leaders of learning in society at large

In my view, *tutoria* occupies a *very special* niche among the exemplars that will guide the future of learning. *Tutoria* is special in a number of powerful and informative ways. It is a practice that is designed to lead to the development of a progressively more complex and deep theory of learning, driven by the practice itself. The practice is relatively simple; the theory leads to increasingly powerful and complex understandings of how young people and adults learn. In this sense, it reverses the traditional social science relationship between theory and practice, and it creates a culture that is organized around what I would characterize as "deliberate surprises." The practice emphasizes questions rather than answers. The essence of the tutorial relationship is to give as much control as possible to the learner over the choice of what to learn and to structure the tutorial relationship around the learner's *discovery,* through a dialectical process with the tutor, of how a body of knowledge works—not just what knowledge is, but how and why it takes the form it does. It stresses reasoning and discovery over fluency and speed in finding right answers. In my experience of being tutored, and in closely observing the tutorial process, it strikes me that, when *tutoria* works well, there is a constant sense of tension and an expectation of the possibility of surprise. The learner is guided in a discovery process, unsure of where it will end. The tutor, no matter how many times they have conducted the tutorial in the same subject matter, expects to discover something unexpected about how this particular learner will respond to the challenge of understanding. The tutorial questions are devised not to produce "right" answers but to deepen the learners' and tutors' understanding of the content. In this context, the unexpected is highly valued, not an anomaly that requires fixing. I will say later why this deliberate cultivation of surprise embodies a powerful neurobiological insight. For the moment, it is important to observe that this is a practice that sheds light on an important theory of learning emerging from the science of neurology.

Another powerful way that *tutoria* is different from other exemplary learning practices is that the practice is completely independent of the physical environment in which it occurs. I spend a good deal of my time these days puzzling through how physical environments influence learning. There is a demand for this kind of expertise (a) because schools are, with few exceptions, dreadfully toxic places for children and adolescents to learn, much less to spend 16,000 hours of their lives inhabiting; and (b) schooling is an incredibly capital-intensive industry that

consumes massive amounts of public money replicating deeply dysfunctional habits and patterns of practice in deeply dysfunctional work environments. It turns out that there is a massive body of research on the neuroscience of physical environments, and on the more specialized subject of the relationship between environmental factors and learning—virtually all of it completely ignored by educators and bureaucrats who make major decisions about capital investments in education. The exemplars I am studying, in which there is an intimate relationship between physical design and learning, all have one thing in common: they start from a clear, and usually highly controversial, theory of learning, and they mold the physical environment deliberately around that theory, often in highly experimental (and not always successful) ways, but always with an eye to the desired experience of the learner.

What I find fascinating about *tutoria* is its complete indifference to physical environment. I have seen *tutoria* work in the most deprived physical settings, consisting of only the bare minimum shelter, with minimal light, and bare dirt in the outdoor learning spaces. I have seen it work in schools that have obviously had the benefit of recent physical renovation, although usually simply a cleaner, newer version of the old model. I have seen *tutoria* work in settings where learners have access to wifi and computers; I have seen it work in settings where there is not a computer in sight. I have seen tutoria work in settings where we have been advised to leave the community before a certain time because of the risk of physical danger; I have seen tutoria work in seemingly sleepy and congenial villages where danger seemed far away. Do I have ideas of how to design a physical environment to enhance the experience and practice of *tutoria*? Of course. But the important thing is that the power of the practice does not come from the *accoutrement* of the physical environment; it comes from the deeply personal and powerful learning practice and the theory of learning it embodies.

By contrast, another exemplar I have experienced is HiTech High in San Diego, now a collection of schools built around a very divergent theory of learning focused on integrated content coupled with project-based learning practice. The physical design mirrors and reinforces the learning theory in powerful ways, although it is also clear that the learning theory and the practices it entails are beginning to outgrow the physical plant. Another exemplar is NuVu, in Cambridge, Massachusetts, which is deliberately designed around the architectural studio learning model of brainstorming, creating prototypes, regular critiques, redesigns, and commitment to producing a final physical or virtual product in response to a real-world problem. The adults in NuVu are architects and designers with a passion for learning. NuVu is a candy store of every possible device that can be used to design and make things, and an environment that vibrates with energy every hour of the day.

As I think about the relationship between physical setting and learning, I think that *tutoria* provides an important lesson. We may know powerful things about the relationship between physical environment and learning, but all that knowledge is practically useless without a powerful theory of learning around which to design (or, in the case of *tutoria,* ignore) physical setting. What *tutoria* has taught me is that our most powerful theories of learning don't necessarily require huge investments in physical capital, and "improvements" that rely on such investments are likely to fail if they are not connected to powerful theories of learning. The two most monumental new high schools in the greater Boston area each cost in the hundreds of millions of dollars to build and they both replicate a theory of learning (if it can be dignified with that label) that emerged in the 1870s and still holds American secondary education in its death grip.

Finally, as I have said repeatedly on many occasions, *tutoria* represents a powerful alternative way of imagining and enacting transformations of learning in society. In my first reflection, after visiting Zacatecas, I said that *tutoria* was important because it showed us how to organize transformations of learning using the organizational model of social movements, rather than hierarchical bureaucracies. Since then I have been rethinking my own experience over the last fifteen years of attempting to engage educators in what might be called "practices of improvement"—namely, close observation and analysis of instructional practice and diagnostic reflection on organizational practice. My stark conclusion from my own experience is that practices of improvement have minimal, to no, impact in highly institutionalized policy environments. Another way of saying this is that policy is a failed strategy for long term, large-scale improvement, not to mention transformation, of learning. Policy and hierarchy are primarily useful for generating and allocating social and political credit and authority among existing political interests and institutions, not for engaging in divergent or disruptive transformations. Gabriel Camara said it best during our visit to San Diego and the border towns of Mexico. Commenting on a session in which the discussion veered, as it always does, in the direction of how difficult it is to fit new practices into the existing institutional constraints of public education, he said, "It seems to me that we are spending an inordinate amount of time and energy trying to make that which is crooked straight. Why don't we do it straight in the first place?"

I have no doubt that the existing hyper-institutionalized environment of public education will continue to exist for a long time, regardless of its capability to engage in improvement and without reference to improvements and transformations of learning that are occurring in the broader society. This established institutional structure is too big and too deeply connected to powerful political interests to acknowledge, much less respond to, its deeply-rooted pathologies and dysfunctions. It is also the case that learning, as a human activity and a social function, is far too important, and far too deeply embedded in the human genetic code, to be captured and domesticated indefinitely by the existing institutional structure of education.

Learning will soon break loose from its institutionalized monopoly, and when it does, society will have to learn collectively how to organize itself in new ways, how to develop and grow knowledge and practice outside of established structures, how to attract a new generation of human talent to the learning enterprise, and how to reach the broadest possible segments of society.

With this as a point of departure, I think *tutoria* is much more than a broad-scale social movement in the service of a transformational theory of learning; it is also a design experiment on the future of learning in a global environment in which established institutions are progressively losing their authority and control over learning and being replaced by forms of organization that we are just beginning to learn how to design. Its major strengths are that it serves populations of children and adults who are least likely to be well-served by established institutions and who are at risk of being ill-served by new, more global, more flexible forms of learning, and that it provides a "transitional form" of social organization for learning, modeling how a radical departure from traditional forms can coexist with and, on-and-off, live in a symbiotic relationship with old forms. It is also possible that one reason *tutoria* has been able to extend its reach into thousands of schools is that the established education sector in Mexico shows many of the symptoms of a failed state enterprise, pre-occupied with servings its constituent interests and only episodically aware of its primary mission. There is a deep need in society at large to confront these issues, and there is an even deeper capacity for denial of this urgency embedded in the existing institutional structure.

What I see in *tutoria* is a potentially powerful way of connecting the micro with the macro in the transformation of learning in society. The culture of deliberate surprises embedded in tutorial practice is also a powerful model for the future of organizational design. Saeed Areda, the Chief Excitement Officer of NuVu, observes that most young people live a substantial part of their lives in educational environments in which adults ask questions to which they, they adults, know the answer (or at least think they do), and they expect learners to discover what the adults know. He proposes an alternative design for a learning environment in which adults and young learners engage in projects that pose questions to which neither the adults nor the young people know the answer, and engage in a process of mutual discovery through a disciplined process of design. Why? Because as a number of NuVu learners have said to me, "guessing what adults want you to say is totally boring and unproductive." Cultivating the capacity for deliberate surprises, both as a learning model, and as a model for the design of future learning environments seems critical to me. Society is very good at reproducing what it already knows how to do; it is much less good at imagining how to do something it doesn't yet know how to do and deliberately learning how to do it. The learners in *tutoria*, NuVu, and HiTech High, and others we don't yet know about, will teach us how to invent the future. The future requires of us the cultivation of the capability of deliberate surprise.

This leads me back to the earlier question of how *tutoria* might help us learn a deeper practice for developing and spreading its practice. The answer, I think, lies in fidelity to the underlying theory of learning that drives *tutoria*: disciplined engagement through questions, and the practice of cultivating deliberate surprise. The answer is *not* development of a code of practices that can be "implemented" in diverse settings. It lies in providing wider and wider circles and networks of learning devotees to the direct experience questioning and the cultivation of deliberate surprise. This necessarily involves developing more and more sophisticated forms of face-to-face learning, using the capabilities of adults and young people who are deeply knowledgeable about the practice.

Tutoria as Neuroscience

In observing *tutoria* practice lately along the Mexican-U.S. border, Guanajuato, and in the learning sessions in Chile, I became more intensely aware of something I call "THE LOOK." Take a normal 14 or 15 year-old adolescent and observe their behavior in casual social situations. Their behavior looks a lot like any other young person at that age: joking, flirting, a little bit of emotional drama, hanging out, spacing out, etc. This kind of behavior doesn't look so very different across different cultures, especially between the U.S. and Mexico. Take this "normal" Mexican adolescent and put them in a learning environment that requires them to master a relatively simple but demanding tutorial practice, to engage in learning that requires sustained attention for long periods of time (typically at least an hour for a single problem or text, often much longer), create the expectation that not only will they learn what they are studying, but they will prepare an exhibition of their learning, and take the role of a tutor for another learner, and the "normal" adolescent is transformed into someone with THE LOOK. THE LOOK is hard to characterize, but difficult to miss: calm, self-possessed, patient, observant, deliberate, capable of flashes of humor, purposeful almost to the point of relentlessness. I've seen THE LOOK now dozens of times in dramatically different settings. I have seen it at different stages of development, from the cautious and halting to the mature and practiced. I have seen it in adults, and, more importantly, I have seen it routinely in young people. I have, in other words, seen a disposition toward learning in adolescents that defies all the usual adult stereotypes of adolescent behavior. Personally, the frequency and regularity of THE LOOK among extremely poor rural Mexican adolescents has caused me to reflect deeply on the powerful, deeply-rooted way American society and American schools infantilize adolescents, projecting onto them made-up developmental theories that characterize adolescents as incapable of self-management, lazy, disorganized, flaky and obsessed with themselves. Whatever the realities of prevailing theories of adolescent development (of which I am becoming highly skeptical), young people engaged in *tutoria* practice are highly competent, highly focused, enormously thoughtful, empathetic, mature and charismatic people. Experienced practitioners

of *tutoria* routinely say that Mexican adolescents, before they are introduced to the practice, are unusually withdrawn and shy in their interaction with adults. Learning the practices of *tutoria* uniformly transforms them into highly verbal, confident individuals with strong social skills and high levels of empathy. How does this happen?

Organically, the developmental struggle that is going on inside the adolescent brain is one between feeling, sensing, and reacting, on the one hand, which tends to be located more toward middle and lower part of the brain, and regulating, managing, and anticipating, which tends to be located toward the upper, more frontal part of the brain. Popularized notions of adolescent development tend view this process as a dramatic mess of impulsive, often irrational acts that, if the adolescent survives, result in a reasonably controlled human being—always with the sage guidance, direction and control of a mature adult. In other words, if it weren't for adult control, adolescents would perish. The typical adolescent in this process is made to seem like a wild animal that is periodically required to receive special training, and school is the primary environment in which this training occurs. Rarely, if ever, do we think of the *intrinsic human drive to learn*, as a potentially powerful factor in the development of self-regulation, insight, and control in adolescents. The common theme in the exemplars I have described above—*tutoria*, HiTech High, and NuVu—is adults' confidence that, given access to the intrinsic rewards of learning and social connection to other learners, adolescents are fully capable of managing their own development toward self regulation, self reflection, and self control. An interesting side-light of these exemplars is the seemingly total absence of external disciplinary control over behavior, engagement, and language. Another way of saying this is that the activity of learning, if it requires high agency and engagement on the part of the learner, is a powerful driver of neurological development. Hence, THE LOOK. Adolescents in these exemplary settings give up little or nothing in terms of their normal playful, often zany and disorganized social interactions with their peers. When they are learning, they project purposefulness, creativity and self control beyond what most adults are capable of.

Real-time pictures of the brain in the process of learning are dramatic to watch: the brain "learns" in powerful, physical ways by growing increasingly dense networks among neurons, and by quite literally pruning and reorganizing existing networks into more efficient forms of cognitive and affective processing. Adolescence is the period when this process is at its maximum. Brain mass reaches its maximum in early adolescence and declines significantly through consolidation and reorganization into early adulthood. How does this process happen, and what influences the way it happens? There are many possible answers to these questions, and many hypothetical answers that remain to be explored. But there is one answer for which there is fairly clear evidence: the brain "learns" in this process of growth and consolidation through the use of language as means of making sense of the

world. Language and meaning-making quite literally create and solidify structures for future use in thinking and creating.

In my work observing classrooms over 12 or so years, one thing I did routinely was simply to code for the proportion of student and adult talk in classrooms. In the U.S. classrooms I observed, there was a fairly stable pattern of something like 85-90 percent adult talk, to 10-15 percent student talk. Adults typically spoke in large rambling chunks of text, often without complete sentences or paragraphs. Students typically spoke in short bursts of less than a dozen words, also in incomplete sentences, often in two or three word responses to adult cues. If your theory of brain development includes language production as a causal factor for learning, these patterns suggest minimal opportunities for developmental growth. In this circumstance, where does the innate human drive for language production and developmental growth go? My prediction would be that it language production moves into peer interaction and, possibly, into interaction with adults in non-school settings, which is to say that we are asking young people to spend a large chunk of their lives in environments that are contributing little, if anything, to the developmental course of their neuro-cognitive function.

What strikes me about *tutoria*, is the overwhelming amount of language production by learners, and the depth of language used by tutors, whether youth or adults. The patterns are so outlandish and strange, relative to conventional classroom observations, that my accustomed practices of observation are practically useless. The most astonishing pattern is the simple *amount* of actual talk in fully formed questions, responses, and references to texts and problems that tutorials elicit. The second most astonishing pattern is the *depth* of the talk. What might occur as a simple question and answer pattern in a conventional classroom turns into a series of increasingly complex and challenging questions, over and over again, around a path of reasoning though a math problem or a single sentence, stanza, or paragraph of text. I can say that I personally have never felt so uncomfortable and activated cognitively as when I was tutored in geometry and historical poetry by two fourteen-year-old girls; I emerged feeling like my brain had been to the gym for a two-hour workout.

One can see similar patterns of language production in HiTech High and NuVu. At HighTech High, adults seldom, if ever, give straightforward answers to student questions; they ask students the source of their questions and respond by asking probing questions designed to clarify the learner's thinking and intentions. At NuVu, the discourse would seem initially quite scary to people who are used to the faux-politeness of traditional school culture. Each stage of the design process culminates with a whole group critique session in which every member of the design cohort (typically about 40-50 learners and four or five adults) poses questions, challenges design decisions, and proposes alternative avenues of approach for each prototype or final design. Fully-developed design ideas are often

routinely, and unceremoniously, dumped after critique sessions, as the design team returns and starts over again with a new idea. Saeed Areeda, one of the founders of NuVU, says that students come to the studio from school, expecting to provide quick solutions to the design problems that are posed, and they respond with resistance and anger to the initial critiques. Saeed says that they are conditioned by school to equate quickness and fluency with smartness, and it is a shock when they are pushed through critique to deepen their thinking and decisions. As they learn the discipline of the design studio, they become active participants in the critique process and fluent in the language of design that informs the process.

There are many paths to adolescent development, but language production is surely one of the most essential. Language reverberates in many different developmental directions. Learners in *tutoria*, for example, have extensive vocabularies for expressing empathy and support to each other. The simple proximity of one young person to another, or one adult to another, for extended periods of time creates the necessity for highly complex and variegated language. Time and time again I have observed young tutors trying out various formulations of questions designed to uncover where a particular learner is stuck on particular math problem of piece of text. I have watched with amazement as two fourteen-year-old girls engaged in deep conversation for an hour and a half, working line by line through a very complex original source document on Mexican history. The tutor in the pair modeled powerful practices of eliciting vocabulary and meaning from context and moved back and forth between the larger historical narrative and the fine points of the text. At the end of the session, we asked the tutor and the learner what they would do next, and the tutor responded that the learner would be her tutor in math.

Finally, *tutoria* has much to teach us about the neurobiology of stress and learning. It would be difficult to imagine a more neurobiologically dysfunctional learning environment than the typical American school. Learners with widely varying backgrounds, dispositions and aptitudes are judged repeatedly in terms of attributes and performances based on arbitrary age-grade expectations. Time is chopped up into small segments and tasks are allocated to those segments without regard to the developmental demands of the task. Learners have few choices about what learning to engage in, and are systematically and regularly told that their interests are subordinate to the demands of some external authoritative source. Adults in this environment are more or less systemically programmed to ignore, or exacerbate, the stresses the environment creates for learners. More importantly, high stress levels are often interpreted as evidence that "good" or "rigorous" learning is occurring, especially for adolescents. "Hard" school is "real" school. Learning to cope with unreasonable levels of stress is considered to be good preparation for adulthood.

The brain and body deal with stress through the management of neurotransmitters—basically, various forms of natural chemicals and hormones

that activate certain areas of the brain. The key area of the brain in stress responses is the amygdala, in the lower-middle of the brain, which regulates the so-called fight or flight response. Actually, stress responses, like most important brain functions, are more broadly distributed in the brain; we are learning more about how stress works with continued research. The important thing about stress responses is that they are triggered, in part, by threats and they literally reprogram the individual's responses to a given environment or situation by attaching affect to memory. In highly stressful situations, the higher order functions of the brain shut down, and the brain focuses on survival. Repeated exposure to stressful situations triggers withdrawal and instinctually defensive behaviors. Stressful situations produce memories that are reactivated by similar situations in the future—the room, the lighting, the smell, the language can trigger stress responses without necessarily being accompanied by stress-inducing behaviors. Subjecting learners to repeatedly stressful situations in a fixed learning environment virtually guarantees that they will, over time, associate that environment with stress reactions and find ways to withdraw from that environment and avoid engagement in the activities that created the stress in the first place.

One surprising finding from neuroscience—actually shocking and counter-intuitive to me when I first read about it—is that the brain responds neurochemically to *boredom* almost identically to the way it responds to threat. That is, putting a person in a situation of chronically low stimulation and affective and cognitive disengagement creates the same withdrawal and avoidance response as an external threat. So much for the idea that boredom is a condition in which the brain "shuts down" its normal biological functions. In fact, boredom activates and stimulates the amygdala, releasing the same stress hormones that create the fight or flight response.

In my classroom observations in American schools I routinely recorded the body language, eye contact, and verbal cues associated with learners' engagement. My colleagues and I also routinely asked random students to explain what they thought they were learning during a particular moment in class. Out of these observations a pattern emerged that I have come to call the "rule of thirds." Under the best of circumstances, *not* the most common ones, one third of the class appeared to be completely disengaged (no eye contact, no physical cues), one third nominally engaged (paying attention but unresponsive to teachers' cues), and one third fully engaged (actively providing eye contact and visual cues to the teacher). The patterns of engagement of specific students tended to vary from moment to moment, while the proportions remained relatively stable. Coupled with this pattern was another much more dismal one. When we asked students what they were learning, whether they were actively engaged or not, their responses took two forms: they would either simply repeat what the teacher said the task was (*not* what they were learning) or they would say candidly that they did not know what they were learning. As with all such patterns, there was considerable variability at the

extremes in many schools—some classrooms would be pandemoniums of engagement with dense language and high levels of engagement, some would be completely dead environments with little language on either end of the teaching/learning transaction. In schools serving adolescents, we frequently found ourselves coding for the (significant) number of students who were asleep at any given time.

So-called "no-excuses" schools in the U.S. have a particular set of responses to this pattern, using scripted behavioral rules for student attention, eye contact, and responses to teachers' questions to create a compliant environment of engagement. Whether these routines would produce similar patterns of responses to the "what are you learning?" question would be interesting to know. These routines could be characterized as the systematic use of stress-inducing practices to stimulate and maintain an adult-centered learning environment. In these classrooms, non-compliant students are frequently stigmatized by, for example, being asked to leave the classroom under supervision or to sit with their backs to the class. However unlikely this might be, it would be interesting to see students' brain scans of stress reactions in these situations, compared with patterns in other types of learning environments. Put that idea on the list of interesting neuroscience experiments that will never happen. Similar types of experiments in highly controlled environments, however, do show substantial impacts on working memory and cognitive processing in settings where participants are subjected to repeated behavioral directions and cues.

What's remarkable about *tutoria* is the almost total lack of stress-inducing practices. Individual students choose the learning tasks they engage in, sometimes with adult guidance, sometimes with peer guidance, but always with a focus on the learner's interest in the task. The tutorial practice itself uses empathy, focus, and the development of persistence as the main sources of motivation, coupled with the belief that human beings, presented with the opportunity and a congenial setting, will activate their intrinsic desire to learn. Even more powerfully, during the tutorial the learner is asked repeatedly to articulate what they think they have learned and to use that understanding to approach the next level of work. The exhibitions that qualify a learner to become a tutor in a particular content area are bound to be stress-inducing because they are public performances. But they are preceded by extensive practice and apprenticeship that builds confidence.

Similar patterns can be observed at HiTech High and Nuvu. Students internalize self-management through regular participation in group processes that focus on critique and their responses to critique. Students coming from "regular" school environments that value passivity and compliance over active discussion and critique experience initial stress, but over time adapt to an environment where critique is central to learning. Most importantly, they are coached to acquire a language that communicates not just critique, but empathy and respect for the

individuals. The central mantra of NuVu, for example, is "critique the idea or the prototype, not the person." The central norm is that the person, or the team, should emerge from the critique challenged to produce a better design, not disabled by the anticipation of yet another failure at the next critique.

This extended detour into neuroscience and learning can be summarized under the heading of how we learn to build and propagate powerful learning environments. The more I observe learning environments that are based on powerful, explicit, and divergent theories of learning, the more respect I have for the complex human vessel into which we pour our ideas and expectations about what is "good" for people. It strikes me that the most promising theories for the design of new learning environments are the ones that have the greatest respect for human beings as organisms that are biologically and genetically engineered to learn, theories that honor the principle of deliberate surprises, and theories that challenge the grip of established institutions on the discourse, beliefs, and rules around learning as an individual and social activity. My recent experience leaves me highly skeptical about the future of schooling, and enormously optimistic about the future of learning. Thanks to those amazing adolescents, especially Maricruz and Scarlet, who have taught me math and poetry so well and so deeply, and who have transformed my understanding of myself as a learner.

Apéndice A. Rúbricas Tutor – 6 Dominios

1 y 2. Elección de un tema

Novato	En desarrollo	Competente	Experto
El tutor entrega al estudiante una lista de textos y/o problemas para que éste elija cuál estudiar	El tutor presenta una colección de textos y/o problemas al estudiante y ofrece una breve introducción sobre su contenido y las preguntas esenciales a las que cada problema o texto intenta responder. Tras esta introducción, el tutor permite al estudiante elegir su tema o texto.	El tutor descubre los intereses del aprendiz a través del dialogo, identifica temas que responden a esos intereses, y busca una serie de textos o problemas para abordar el tema. Luego los presenta al aprendiz para que éste elija qué estudiar y en qué orden.	El tutor orienta al aprendiz a identificar y articular qué le interesa, y lo apoya para que el propio aprendiz determine el tema que va a abordar e identifique los materiales (textos, problemas, etcétera) que lo ayudarán a abordar el tema.

3. Dominio del Texto o Problema.

Novato	En desarrollo	Competente	Experto
El tutor ha adquirido dominio básico del texto o problema, encontrando una interpretación o solución. Su tutoría se enfoca en orientar al estudiante a obtener una interpretación o solución similar a la del tutor.	El tutor conoce varias soluciones o interpretaciones del texto o problema. Puede guiar al estudiante para obtener soluciones o interpretaciones similares a las que él obtuvo.	El tutor conoce varias soluciones o interpretaciones del texto o problema. Está abierto a las soluciones e interpretaciones del estudiante, y puede guiarlo incluso cuando estas son distintas a las que el tutor conoce.	El tutor conoce varias soluciones o interpretaciones del texto o problema y ha adquirido suficiencia en la disciplina o disciplinas académicas a las que éstos pertenecen. Puede orientar eficazmente al estudiante en la exploración de nuevos textos y temas en estas disciplinas aun cuando no los ha estudiado previamente.

4. Introducción del Texto o Problema

Novato	En desarrollo	Competente	Experto
El tutor presenta dos o más textos o problemas al estudiante y le pide que elija cuál abordar, con base en los títulos de los textos o problemas. con dos o más temas. Permite que el aprendiz elija entre la oferta existente.	El tutor presenta dos o más textos o problemas al estudiante y le ofrece una breve explicación de lo que trata cada uno. Con base en esta explicación, pide al estudiante que elija qué texto o problema abordar.	El tutor presenta una serie de textos o problemas y una explicación breve de lo que trata cada uno. Pide al estudiante que los revise para darse una idea general de estos materiales. El tutor explora las dudas, dificultades o intereses que muestra el estudiante tras esta revisión, y articula de qué modo cada tema de estudio podría ayudarle a abordar éstos. Con base en toda esta información, el tutor invita al estudiante a elegir su tema o material de trabajo.	El tutor apoya al estudiante a articular sus intereses profundos (por ejemplo, ¿cómo vuelan los aviones? ¿qué es la vida? ¿cómo producir energía eléctrica con luz solar?), identifica materiales que pueden ayudarle a explorar estas preguntas, y se dispone a explorarlos a la par que el aprendiz.

5. Diálogo tutor

Novato	En desarrollo	Competente	Experto
Realiza preguntas cuya respuesta puede ser simplemente correcta o incorrecta. La intervención del tutor consiste principalmente en dar instrucciones al estudiante sobre qué hacer a cada paso del proceso de estudio. Cuando hay un error o concepción errónea, el tutor la señala al estudiante y la corrige. Se dirige al estudiante con respeto y empatía.	Solicita al tutorado que exprese sus conocimientos previos. La intervención del tutor consiste principalmente en asegurar que el estudiante ha adquirido dominio de los conceptos y procedimientos fundamentales que se requieren para comprender el tema o resolver el problema elegido. Cuando hay un error o concepción errónea, el tutor la señala al estudiante para que éste la corrija. Establece una relación de confianza y colaboración mutua	Realiza preguntas que invitan la reflexión del estudiante y que permiten múltiples soluciones o interpretaciones. Solicita al estudiante que exprese en sus propias palabras de qué trata y cómo ha interpretado o resuelto el texto o problema en cuestión. Utiliza lo que el estudiante expresa como material para hacer nuevas preguntas. Cuando hay un error o concepción errónea, el tutor orienta al estudiante a identificarlos y corregirlos por sí mismo.	Realiza preguntas que simultáneamente invitan la reflexión del estudiante, permiten múltiples soluciones o interpretaciones, y le permiten al tutor identificar cómo está pensando el estudiante en el texto o problema en cuestión. El tutor utiliza esta información para crear preguntas o hacer señalamientos que permiten al estudiante profundizar, refinar, o corregir sus interpretaciones y soluciones. El tutor mismo se hace preguntas relacionadas con el tema en cuestión para las que no tiene respuesta en el momento, y las explora a la par que el estudiante.

6. Determinar el nivel de dominio

Novato	En desarrollo	Competente	Experto
Formula preguntas para verificar que el estudiante ha completado cada una de las etapas del proceso de estudio y que sabe de qué trata el texto o problema que ha abordado.	Formula preguntas para verificar que el estudiante ha adquirido dominio de los conceptos y procedimientos esenciales involucrados en el texto o problema en cuestión. Confirma que el estudiante puede explicar qué ha aprendido y cómo lo aprendió.	Pide al estudiante que articule en sus propias palabras de qué trata el texto o problema que ha estudiado, qué ha aprendido y cómo lo ha aprendido. Asegura que el estudiante puede dar cuenta en todo momento de qué está haciendo y por qué. Junto con el estudiante, compara esta información con evidencia de lo que el estudiante sabía y era capaz de hacer antes de abordar el tema o problema en cuestión.	Formula preguntas dirigidas a entender cómo está pensando el estudiante en el texto o problema en cuestión. A partir de esta información, identifica qué ha aprendido, cómo ha aprendido, y cómo piensa el estudiante. Asegura que el estudiante puede dar cuenta en todo momento de qué está haciendo y por qué. Orienta al aprendiz para cotejar lo que ahora conoce y sabe hacer en relación con lo que sabía y podía hacer antes.

Apéndice B. Rúbricas Estudiante – 6 Dominios

1 y 2 – Elección de un tema

NOVATO	EN DESARROLLO	COMPETENTE	EXPERTO
El tutorado elige un texto o problema particular del catálogo de temas que le presenta el tutor. Cuando se le pregunta qué tema está estudiando su respuesta se limita a repetir el título del texto o problema. El estudiante elige el texto o problema porque sabe que eso es lo que se espera que haga, más que porque el tema mismo le parezca especialmente interesante.	El tutorado elige un texto o problema particular del catálogo de temas que le presenta el tutor. Puede expresar con elocuencia las razones por las que le interesa trabajar con este texto o problema en particular. Puede articular claramente por qué ha elegido el material de estudio que ha elegido y lo que espera aprender y ser capaz de hacer al finalizar el proceso de aprendizaje.	El tutorado elige un tema de estudio personal en función de preguntas que le han surgido a partir del estudio previo de otros temas. Puede articular claramente qué es lo que ha aprendido hasta el momento y con qué profundidad, así como la manera en que el estudio del tema elegido le ayudará a profundizar lo que ha aprendido.	El tutorado elige un tema que responde a preguntas e intereses personales. En función de estos intereses y preguntas, busca y selecciona los materiales que le ayudarán a explorar el tema. Puede articular claramente qué lo que ha aprendido hasta el momento, la profundidad con que lo ha aprendido, y el grado en que ha desarrollado competencias de estudio autónomo. Asimismo puede explicar con elocuencia de qué manera el estudio del tema en cuestión lo ayudará a profundizar su conocimiento y sus habilidades para aprender por cuenta propia.

3. Práctica del aprendizaje independiente

NOVATO	EN DESARROLLO	COMPETENTE	EXPERTO
La mayoría de las actividades que el estudiante realiza para interpretar el texto o resolver el problema que ha elegido provienen de sugerencias y preguntas que le hace el tutor.	Las actividades que realiza el estudiante durante el estudio del tema que ha elegido provienen en ocasiones de sugerencias y preguntas del tutor, y en otras ocasiones surgen de preguntas e ideas que formula el propio estudiante.	El estudiante elabora y sigue su propio plan de aprendizaje independiente y lo discute con el tutor para solicitar recomendaciones o sugerencias para mejorar el plan. El aprendiz sabe cuándo investigar y consultar diferentes materiales de manera independiente, y solicita apoyo al tutor sólo cuando ha agotado sus propios intentos y estrategias sin encontrar respuesta a sus dudas. El aprendiz toma registro de qué está aprendiendo y cómo está aprendiendo a lo largo de todo el proceso de aprendizaje.	El estudiante elabora y sigue su propio plan de aprendizaje independiente y es capaz de articular con elocuencia en qué consiste el plan, qué espera aprender y ser capaz de hacer al concluir su estudio, y de qué manera las actividades en su plan de estudio le ayudarán a lograr sus objetivos. Ha internalizado el tipo de preguntas que le haría el tutor, y la mayoría de las veces no requiere de la intervención del tutor para identificar y corregir sus errores o concepciones erróneas o para resolver sus propias dudas. En todo momento el aprendiz es capaz de identificar y explicar qué sabe y ha aprendido a hacer y qué le falta. Lleva un registro sistemático de lo que ha aprendido y cómo lo ha aprendido.

4.- **Demostración del dominio del tema**

NOVATO	EN DESARROLLO	COMPETENTE	EXPERTO
El aprendiz puede explicar con sus propias palabras, tanto por escrito como oralmente de qué trata el tema que está estudiando, lo que ha aprendido, y el proceso que ha seguido para aprenderlo. Requiere apoyo del tutor para articular lo que ha aprendido y cómo lo ha aprendido, así como para recordar lo que ha aprendido previamente.	El aprendiz puede explicar claramente y con sus propias palabras qué está aprendiendo y cómo lo está aprendiendo. Registra detalladamente su proceso de aprendizaje. Cuando se enfrenta con información o problemas similares a los que ha utilizado o resuelto anteriormente, puede recordarlos y utilizarlos sin intervención del tutor. Requiere poco apoyo para demostrar públicamente su dominio del tema de estudio.	El aprendiz puede explicar con sus propias palabras, en forma verbal y escrita, de qué trata el tema que está aprendiendo, qué estrategias está utilizando para para aprenderlo, el modo en que estas estrategias le están ayudando a aprender, las dificultades que ha enfrentado, los modos en que ha sorteado estas dificultades, y lo que le falta por aprender o mejorar. Puede relacionar lo que ha aprendido en el pasado con lo que está aprendiendo en el presente.	Logra articular claramente, tanto por escrito como oralmente, su proceso de aprendizaje. Con sus propias palabras y con claridad explica no sólo qué está aprendiendo y las estrategias que está utilizando, sino también cómo está pensando en el texto o problema que está abordando. Intencionalmente busca, acepta y desarrolla diferentes formas de solución o interpretación del problema o tema que está abordando. Es capaz de comparar entre sí estas múltiples soluciones o interpretaciones, de elegir la que más le convence y argumentar por qué. Aplica lo aprendido en la solución de otros problemas o la interpretación de otros textos en nuevos contextos.

5. Reflexión sobre el Aprendizaje

NOVATO	EN DESARROLLO	COMPETENTE	EXPERTO
El estudiante realiza un registro que responde a preguntas que le hace el tutor sobre el tema de estudio y los pasos que siguió para aprenderlo.	El aprendiz puede explicar con sus propias palabras lo que ha aprendido y las estrategias que ha utilizado para aprenderlo, en ocasiones con apoyo del tutor, en otras por su propia cuenta.	El aprendiz profundiza, refina y corrige sus propias interpretaciones o soluciones. Puede explicar los múltiples métodos que resultaron útiles para su aprendizaje, así como comparar entre sí diversas interpretaciones o soluciones al texto o problema que ha abordado. .	El estudiante puede explicar claramente y en todo momento cómo está pensando en el tema o problema que enfrenta. Crea estrategias para confirmar, refinar o descartar su modo de pensar sobre el tema de estudio. Articula con elocuencia cómo va cambiando su conocimiento, sus habilidades para aprender, y su modo de pensar a lo largo del tiempo. Asimismo identifica qué ha logrado y qué le falta en cada una de estas áreas.

6. Convertirse en Tutor

NOVATO	EN DESARROLLO	COMPETENTE	EXPERTO
El estudiante conoce y domina un tema y lo tutora de un modo muy similar a como lo recibió. El aprendiz maneja los conceptos básicos involucrados en el tema, así como estrategias básicas para ofrecer tutoría.	El estudiante conoce y domina varios temas y los tutora como los recibió, pero está abierto a explorar junto con el estudiante nuevas interpretaciones o soluciones que éste expresa. Su atención se centra en asegurar que el estudiante domina ideas y conceptos clave del tema.	El estudiante conoce y domina varios temas. Adapta su tutoría a las preguntas, ideas y estrategias de su tutorado, y está abierto a explorar junto con él nuevas interpretaciones o soluciones. Su atención se centra en entender y utilizar las ideas e interpretaciones del tutorado.	Ha adquirido dominio de los modos de pensar y resolver problemas de la(s) disciplina(s) académicas de una variedad de temas, así como de la habilidad para aprender por cuenta propia. Puede orientar eficazmente a otros en el estudio de temas que no ha estudiado previamente.