An emergent participatory design framework for higher education

Eduardo Bellani

July 23, 2009

Abstract

This paper proposes a model of higher education that uses emergence and constructionism as the guiding design principles and takes the current computational technologies and networks as the technological base to distribute and generate information and knowledge.

It also assumes and tries to make the point that the people of the present and near future will grown up with access to computers and their potential, and will take them for granted.

keywords: education, technology, constructionism, university

1 Introduction

Two fundamental concepts form the basis of the educational system this article is trying to communicate. One is constructionism, a theory developed by Seymour Papert, and it is the epistemological approach that runs throughout the system, and affects how the learning (and consequently the teaching) process is viewed. The second one is emergent design, and that is the organizational and structural view of the system, and affects how the system evolves and relates to its members and environment. Both concepts are intertwined, as will be shown below.

1.1 Constructionism

Constructionism is an epistemological theory that was developed by Seymour Papert, drawing from his experiences as a mathematician, his time studying with Jean Piaget (the developer of the constructivist theory) in France and from his background as an artificial intelligence and media researcher.

Cavallo [2000a] makes a clear distinction between Constructionism and Constructivism:

> Constructionism builds upon principles in constructivism. While constructivism holds that the learner constructs new knowledge based on the existing knowledge he or she has, constructionism builds on this idea by maintaining that this process happens particularly well when the learner is in the process of constructing something.

Constructionism is also a true pedagogy of autonomy, in a very Freirean way:

> ...teaching is not transferring knowledge, but creating opportunities for their own production or its construction. Freire [1996]

We can observe the deep connection of constructionism with computers and technology. But that is far from a technocentrist, where technology is used just for the sake of using technology. That connection comes from the almost endless capacity of the computer to create simulations and concept of microworlds:

> Learners in a physics microworld are able to invent their own personal sets of assumptions about the microworld and its laws and are able to make them come true. They can shape the reality in which they will work for the day, they can modify it and build alternatives. This is an effective way to learn, paralleling the way in which each of us once did some of our most effective learning. Piaget has demonstrated that children learn fundamental mathematical ideas by first building their own, very much different (for example, preconservationist) mathematics. And children learn language by first learning their own ("baby-talk") dialects. So, when we think of microworlds as incubators for powerful ideas, we are trying to draw upon this effective strategy: We allow learners to learn the "official" physics by allowing them the freedom to invent many that will work in as many invented worlds. Papert [1981]

That kind of characteristic is crucial to deeper changes in education and what is meant by knowing.

> The need to distinguish between a first impact on education and a deeper meaning is as real in the case of computation as in the case of feminism. For example, one is looking at a clear case of first impact when "computer literacy" is conceptualized as adding new content material to a traditional curriculum. Computer-aided instruction may seem to refer to method rather than content, but what counts as a change in method depends on what one sees as the essential features of the existing methods. From my perspective, CAI amplifies the rote and authoritarian character that many critics see as manifestations of what is most characteristic of–and most wrong with–traditional school. Computer literacy and CAI, or indeed the use of word-processors, could conceivably set up waves that will change school, but in themselves they constitute very local innovations–fairly described as placing computers in a possibly improved but essentially unchanged school. The presence of computers begins to go beyond first impact when it alters the nature of the learning process; for example, if it shifts the balance between transfer of knowledge to students (whether via book, teacher, or tutorial program is essentially irrelevant) and the production of knowledge by students. It will have really gone beyond it if computers play a part in mediating a change in the criteria that govern what *kinds of knowledge are valued in education.* Papert and Harel [1991]

1.2 Emergent Design

Emergent design is a strategy for building systems that are too complex to be tackled in a top down, plan first manner, as Cavallo [2000b] puts is:

> Popular views about design, about reform, about planning, about control typically lag behind progress. New organizations are pioneering new means of control and change. Emergent design is the recognition that certain systems are too complex, dynamic, interconnected, and chaotic to attempt to manage them by top-down, pre-planned, rigid means of control. Large educational systems are one-such system. The human brain is another. That this project is simultaneously involved with both systems is all the more reason to take an emergent approach.

So the point of the strategy is to build systems that provide a base for systems to be built on it, by the users of the system itself. A global participatory architecture that connects several systems that grew on top of it. That

view has several advantages as Cavallo [2000b] objectives for workshops in his emergent design system in Thailand shows:

> The workshops were intended to:
>
> - provide powerful personal experiences of a different approach to learning,
> - break pessimistic mindsets about people's ability to learn,
> - surface, reflect upon and discuss participants' own prior explicit and implicit assumptions about learning to the surface, and compare them to the new experience,
> - encourage participants to think about the learning process itself,
> - engage in thinking about the design and practice of learning environments in the local context,
> - identify local people whose thinking and acting appear promising so that they can take on greater roles for change,
> - debug our own thinking about the mechanisms of learning and our own pattern of practice in designing learning environments.

1.3 Why

But why propose of a new system for higher education, one that puts the learner in the driver seat, that can growth organically with a community and is deeply connected to what is important for an individual and his community? Because I see that the act of descholling society, in the sense of individuals empowering themselves, is critical for the current and future society that wishes to remain democratic.

Cavallo [2004] quotes John Dewey on exactly this fact:

> For Dewey a just society could only be built not based upon the dictates of clergy, royalty, or an elite, but depended upon the informed collective decisions of all, where every voice should be heard.

But what descholling means, and to who falls the responsibility for deschooling an individual? Illich provides a clear answer to both questions.

> Only liberating oneself from school will dispel such illusions. The discovery that most learning requires no teaching can be neither manipulated nor planned. Each of us is personally responsible for his or her own deschooling, and only we have the power to do it. No one can be excused if he fails to liberate himself from schooling. People could not free themselves from the Crown until at least some of them had freed themselves from the established Church. They cannot free themselves from progressive consumption until they free themselves from obligatory school.

So if we analyze that the current and next generations of children, poor and rich alike, are growing along with computers and their powerful integration capabilities, and the aim of projects like the OLPC is:

> to adequately educate all the children of the emerging world. Simply doing more of the same is no longer enough, if it ever was. If their citizens are to benefit, as they should from the spread of the technology-based, global information economy, these nations must rethink the old top-down classroom paradigm. OLPC

What can we say about the next educational step for those children, higher education, in this context? Certainly a person who grew used to those conditions in their development would find the current state of affairs in university appalling.

Kurzweil [2006], in his book tries to make a point about the importance of the exponential pace of technological development, and how it will affect the individual and the society as a whole on all conceivable aspects on a very close future. A society that does not prepare it's citizens for such future is doomed to become mere spectator and follower of those who do. A small account of his view of the present educational situation perhaps illustrates the point better:

> Most education in the world today, including in the wealthier communities, is not much changed from the model offered by the monastic schools of fourteenth-century Europe. Schools remain highly centralized institutions built upon the scarce resources of buildings and teachers. The quality of education also varies enormously, depending on the wealth of the local community (the American tradition of funding education from property taxes clearly exacerbates this inequality), thus contributing to the have/have not divide.

The impact of delaying, however, is not only social, but profoundly individual as well, as Papert and Caperton [1999] puts it, "So the choice is not whether we will consider deep changes in school but how many children will be lost before we recognize that we have to do so", or in other words on the same work:

> As the slow evolution of school lags further and further behind the rapid evolution of society, increasing numbers of students all over the world see school as irrelevant to life. Many drop out. Many more drop out mentally, emerging from school with poor skills and negative visions of themselves and the society they are entering.

2 Description

The overall system has the objective of graduating individuals in a manner that is at the same time democratic, stimulating, meritocratic and able to prepare those same individuals for a life in a society where computers will play a major role.

In order to do that with a decreased cost, both financial and social, it is wise to use the existing structure where it is possible to do so, so that factor is embedded in the project as well.

2.1 The relationship with knowledge

The first step of the system would be the self preparation of a given student through a process of interaction with the knowledge. But what knowledge? Well, before the system is constructed it will be the job of the competent authorities, both private and public, to digitalize the best available content of the existing superior educational system. That could be done through the video capturing of the federal universities classes, plus the digitalization of all the non copyrighted material.

That content should be placed in a free and open environment in the internet, where it would be available to every citizen that would be interested in it. This system would be described only superficially here, because ideally it would leverage all the modern existing web development techniques in the "web 2.0". Those techniques would serve to guide the students, to promote socialization in the form of forums, tests, iterative games and so on, where the students would play not only with the resources available on the system, but with each other projects and exercises. That, as Papert puts it, places the fun on the learning process:

> Part of the fun is sharing, posting graphics on the walls, modifying and experimenting with each other's work, and bringing the "new" products back to the original inventors. Although the work at the computer is usually private it increases the children's desire for interaction. These children want to get together with others engaged in similar activities because they have a lot to talk about. Papert [1981]

This space would, of course, grow in richness with every user increasing the opportunities and sharing it's own epistemological experiences, not only in some particular subjects, which of course would take place, but of the medium itself, smoothing the learning curve with each generation of users and producing a more fitted social intelligence in the process, like Papert again makes clear:

> As with writing, so with music-making, games of skill, complex graphics, whatever: The computer is not a culture unto itself but it can serve to advance very different cultural and philosophical outlooks. Papert [1981]

Of course, one does not expect the users would be the only responsibles for the system. The hired professors of the competent authorities should be available with enough consistency to increase the quality of the discussions and of the official content of the system.

One important aspect is that the form of the courses could be highly flexible, which means that one could approach some subject from several points of view, according to one's own pace and vocation. That would be a form of Piagetian thinking, because although there would be goals, as the it will be discussed later, the student is completely free to choose how and when to face those goals, and if they would be faced at all.

2.2 The guarantee of quality

A skeptical of the last scenario could, with quite a lot of reason, ask: "But what about the quality of those students, or should we just hand diplomas to everyone who claims to be ready?". Our society clearly must have a way to assure itself of the quality of those who want to perform critical functions, such as engineers, physicians and several other professions who deal with human life in their craft.

The way that was proposed so far concerned itself with the student acquiring and holding the knowledge. But what about testing? To that we

should turn to what society usually turns to find credibility, specialized institutions and the government, and those credible institutions could build a streamlined, on-demand certification scheme. More specifically in the Brazilian case, the very structure of the vestibular system (which is highly effective and encompassing) could be used to certificate students on general or specific points. Those authorities would have control over the tests and what set of tests would encompass a given course.

For instance, to be fully graduated in medicine one should have to complete the certifications of medicine 1 all the way through medicine 10, each sequentially and with a minimum grade. To ask for a given test to be applied some person would only have to provide some documentation and pay some fee to cover the costs of using the system, and in the next round of testing the wanted test would be available on some testing facility that is nearest to the requirer. The testing procedure per se would be audited by payed officers. The system would indeed be the same as a normal vestibular.

2.3 The needed physical step

The model so far would be incomplete on our day and age, mostly because of the limitations of the digital distribution model. That will probably change if we follow Kurzweil ideas:

> Because of current bandwidth limitations and the lack of effective three-dimensional displays, the virtual environment provided today through routine Web access does not yet fully compete with "being there", but that will change. In the early part of the second decade of this century visual-auditory virtual- reality environments will be full immersion, very high resolution, and very convincing. Most colleges will follow MIT's lead, and students will increasingly attend classes virtually. Virtual environments will provide high-quality virtual laboratories where experiments can be conducted in chemistry, nuclear physics, or any other scientific field. Students will be able to interact with a virtual Thomas Jefferson or Thomas Edison or even to *become* a virtual Thomas Jefferson. Classes will be available for all grade levels in many languages. The devices needed to enter these high-quality, high-resolution virtual classrooms will be ubiquitous and affordable even in third world countries. Students at any age, from toddlers to adults, will be able to access the best education in the world at any time and from any place. Kurzweil [2006]

But what could be done today to reproduce the physical training and socialization required for the formation of a fully fledged professional or researcher? That today would still need a physical gathering place.

The steps explained earlier would provide that space, by freeing up the existing classrooms that before were dedicated to teaching repeatedly stuff. Not only the classrooms would be liberated, but the professors would be alleviated of most of the burden of direct teaching the horde of new students that would arrive each semester.

If both professors and classrooms would have more capability, so workshops could be created based on demand, and labs could use students with some qualifications or characteristics for assistants. There would be a very lively interplay between the institutions and those who wanted to partake on those activities, and that process would be guided much by the individual, choosing when and how to approach the institution.

Those labs and workshops could, if certified by the authorities, also certify students who are active on them, so there would be an extra motivation for students to build their own projects, in a very constructionist way.

2.4 Overview

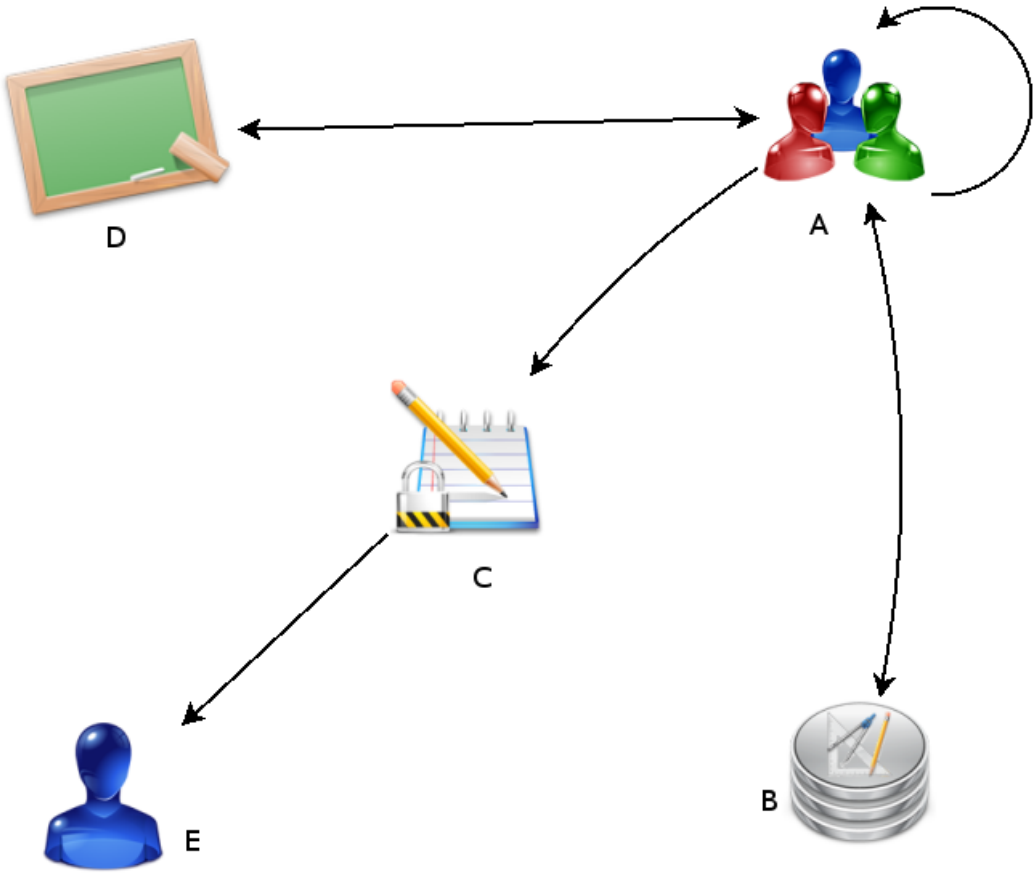

Figure 1: Overview diagram

A The population interested in the system, the candidates.

B The knowledge made available by the institutions.

C The certification procedure.

D The labs with a physical location, operated by faculty, mentors and the certificated students.

E A graduated student.

3 Conclusion

The technical conditions for an education that is modeled in the framework detailed in the course of this article are already available, and some initial implementations for topics such as language acquisition are already available on the market. Eisenberg [2008] Those could be adapted as models to be used in a very large scale for any number of topics.

Some of the benefits of learning in this environment were demonstrated in the introduction, but to make some more emphasis, we can see some "key ingredients for creating rich design environments", that Resnick and Ocko [1991] describe for their LEGO/Logo environment for children learning, and that , correlates with the system described in this article:

- Put people in control.
- Offer Multiple paths to learning
- Encourage a sense of community

But perhaps even more steep will be the social conditions for developing this system, seeing that it is mainly a social machine. Even more if we consider what Negroponte [2006] has to say about it:

> If you look at governments around the world, ministries of education tend to be the most conservative, and also the ones that have huge payrolls, everybody thinks they know about education, a lot of culture is built into it as well, it's really hard.

The solution for those situations are completely out of the scope of this article, but personal effort and conscious struggle for a better education is a sure step on the right direction. Plus, this system provokes the emergence of self-reinforcement, in the sense that the more a person is is exposed and trusted to control his/her own learning, the more engaged and enthusiastic he/she will be about the process. To illustrate this pattern, consider Wilensky [1991] though:

> What kinds of relationships between people would be fostered by a society which stipulated that people be introduced to each other formally and thereafter relate only in prescribed, rule-driven ways? If you shudder at this prospect, consider the analogy between this scenario and the instructionist paradigm for learning (see Harel and Papert [1991]). It is through people's own idiosyncratically personal ways of connecting to other people that meaningful relationships are established. In a similar way, when learners are in an environment in which they construct their own relationships with the objects of knowledge, these relationships can become deeply meaningful and profound.

This article ends with the wise words of Resnick and Ocko [1991] about it:

> Implementing these strategies is not easy. There are many unanswered questions–such as how to help students "break away" from their initial "regions of comfort." And coordinating open-ended design activities is a challenge for any teacher. Indeed, organizing an "Inventor's Workshop" is far more difficult than delivering a lecture on mechanical advantage, or developing a step-by-step hands-on lesson. As Dewey [1997] noted more than a half-century ago (in words that still ring true today): "The road of the new education is not an easier one to follow than the old road but a more strenuous and difficult one." But it is a road well worth taking.

References

D. Cavallo. Models of growth — towards fundamental change in learning environments. *BT Technology Journal*, 22(4):96–112, 2004. ISSN 1358-3948. URL http://dx.doi.org/10.1023/B:BTTJ.0000047588.81509.4c.

D. Cavallo. Emergent design and learning environments: building on indigenous knowledge. *IBM Syst. J.*, 39(3-4):768–781, 2000a. ISSN 0018-8670. URL web.media.mit.edu/~cavallo/cavallo_emergent_design.pdf.

David Paul Cavallo. *Technological fluency and the art of motorcycle maintenance: emergent design of learning environments (thailand)*. PhD thesis, 2000b. Supervisor-Papert, Seymour.

John Dewey. *Experience And Education*. Free Press, July 1997. ISBN 0684838281.

Anne Eisenberg. *Learning From a Native Speaker, Without Leaving Home*. New York Times, feb 17 2008. URL http://www.nytimes.com/2008/02/17/business/17novel.html?_r=2&em&ex=1203483600&en=cde38341fd5cbf9f&ei=5087%0A&oref=slogin&oref=slogin.

Paulo Freire. *Pedagogia da Autonomia; Saberes Necessário A Prática Educativa*. Paz E Terra, 1996.

I. Harel and S. Papert. Software design as a learning environment. In I. Harel and S. Papert, editors, *Constructionism*, pages 41–84. Ablex Accessed oct 9 2008, Norwood, NJ, 1991. URL http://carbon.cudenver.edu/~lsherry/courses/harel_papert.html.

Ivan Illich. *Deschooling Society*. Marion Boyars Publishers, Ltd. ISBN 0714508799. URL http://www.amazon.ca/exec/obidos/redirect?tag=citeulike09-20\&path=ASIN/0714508799.

Ray Kurzweil. *The Singularity Is Near: When Humans Transcend Biology*. Penguin (Non-Classics), 2006. ISBN 0143037889.

Nicholas Negroponte. *Nicholas Negroponte at TED*. TED Accessed oct 9 2008, February 2006. URL http://www.olpctalks.com/nicholas_negroponte/negroponte_ted_speech.html.

OLPC. *educational proposition*. Accessed sep 9 2008. URL http://laptop.org/vision/mission/educational.shtml.

Seymour Papert. *Mindstorms: Children, computers, and powerful ideas*. Basic Books, January 1981. ISBN 0465046274.

Seymour Papert and Gaston Caperton. *Vision for Education: The Caperton-Papert Platform*. Accessed sep 9 2008, aug 1999. URL http://www.papert.org/articles/Vision_for_education.html.

Seymour Papert and Idit Harel. *Situating Constructionism*. Ablex Publishing, 1991. URL http://www.papert.org/articles/SituatingConstructionism.html.

M. Resnick and S. Ocko. Lego/logo: Learning through and about design. In I. Harel and S. Papert, editors, *Constructionism*, pages 141–150. Ablex Accessed oct 9 2008, Norwood, NJ, 1991. URL http://llk.media.mit.edu/papers/archive/ll.html.

U. Wilensky. Abstract meditations on the concrete and concrete implications for mathematics education. In I. Harel and S. Papert, editors, *Constructionism*, pages 193–204. Ablex Accessed oct 9 2008, Norwood, NJ, 1991. URL http://ccl.northwestern.edu/papers/concrete/.