

Entrepreneurial learning in the networked age

How new learning environments
foster entrepreneurship and innovation

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Computers and the Internet started in the later half of the 20th century as instruments of research – and thereby of learning. Today, they have become an omnipresent part of our daily routines by becoming much easier for us to use. During this evolution they have also become consumer products and, at least partially, lost their original educational potential. It is the social peer production aspects of the online environments as well as the hardware platforms described in this article, which makes us subsume them as social technologies specifically favorable for entrepreneurial learning.

Learning for cultural and technological citizenship in the 21st century

Knowledge work reverses several negative (de-humanizing) trends of the industrial age, but while the demands of the workplace have changed, the educational system hasn't. Rather than developing in parallel with technology and modern businesses, education is still dominantly geared to condition its subjects to embody what Germans dub «Fachidioten» – people who are well suited to adapt into hierarchic organizations, and to perform repetitive tasks. By focusing on the potential of innovative socio-technological learning environments, we address this discrepancy by proposing an enlightened humanistic educational paradigm.

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The first paradigmatic shift from the current system is moving away from educational institutions towards learning environments where individuals are encouraged to liberate themselves from the «self-incurred tutelage»¹ and to develop an internal locus of control – thus making free choices about who they want to become. Differently put, the aim of the approach described is to generate entrepreneurial mindsets. We define entrepreneurship as the practice of identifying and creating all kinds of opportunities and then taking action aimed at realizing them². We see this proactive target mindset as the basis for enlightened self-realization.

Next to fostering an entrepreneurial mindset in the students, the objectives of humanistic

learning can be framed around the traditional Hellenistic knowledge dichotomy: *episteme* and *techné*. *Episteme* stands for big picture learning³, for learning about the world as a whole and one's position in it. It represents education towards cultural citizenship⁴, i.e. the responsibilities and contributions one makes to the society by participating in the community and generating culture. *Techné* instead focuses on learning about special traits, i.e. learning the techniques of a profession and producing economical value by performing the tasks associated with it through the division of labor – this knowledge allows for what Delanty (2001) dubbed *technological citizenship*⁵.

The overarching competence we are concerned about is enabling students to perceive the world (and esp. social technology) as a learning opportunity space. This technology can be used for critical inquiry that allows them to develop as humans and as professionals. It is a, if not the, central challenge of educators to provide students with the skills of critical inquiry.

Today, the world's knowledge is literally in the air⁶, an ephemeral library to be retrieved by the right device and the right search term. But a great deal of misinformation and disinformation is also in the air. How does one find out what one wants to know by asking the right question online? Equally important, how does one know that the results returned from such queries are factually accurate or true? Hence, we see a need for training, both in the art of inquiry and critical analysis. This question relates back directly to Freire⁷ and Postman⁸.

When all information is available, the educator's challenge is to identify and select materials.

Curiosity is the motivating force for learning in all humans, but is often blunted by traditional «delivery of knowledge from expert to novice» pedagogy. With a movement away from the knowledge container delivery method to a more active inquiry method, we witness the renaiss-

sance of curiosity. Curiosity is the most important motivating force for inquiry – which is how knowledge is discovered online.

Curiosity as cognitive fuel

The core philosophical objective of curiosity is to cause learners to release themselves from their «self-incurred tutelage»⁹ and «dare to know» (*sapere aude*). To come of age cognitively means to develop an internal locus of control and realize that one has free will and accountable agency. Once realized, this fundamental component of an entrepreneurial mindset¹⁰ instigates continuous venturing towards a better understanding of life (*episteme*) and an improvement in methods (*technê*).

But for now, let's leave the ends aside and return to the fuel itself – curiosity.

It is important to allow students to learn how to interact with others and how to be socially online.

Curiosity¹¹ is the behavior that represents a fundamental component of neophilia, defined by the New Hackers Dictionary as «the trait of being excited and pleased by novelty».¹² Colin Campbell, professor of sociology at the University of York in the UK, assesses neophilia to be an explicitly modern disposition: «Pre-modern societies tend to be suspicious of the novel. It is a feature of modernity that we are addicted to novelty». In many ways this mindset is embodied through the archetype of the British explorers, the trappers scouting the Wild West, and more recently, in hackers.

Perpetuum Addisco

The search for the *perpetuum mobile* is almost as historic as the alchemists' dream of turning metal into gold. In the world of meta-physics there has always been what we humbly call *perpetuum*

addisco (never ending learning). The equation of this learning engine can be formulated as:

curiosity + thematic scaffolding = infinite self motivated learning

Historically, the thematic scaffolding was done by elders who passed on their knowledge. Over time, more and more «knowledge transfer» techniques have been developed. The result of this model is our current system, which so woefully neglects curiosity¹³. Instead, pre-packaged knowledge containers (standardized lesson-plans, textbooks, and the unfortunate first generation approach of e-learning, where learner's interactions are reduced to a click on the «next page» link) are forced on the learner who is expected to sit back and consume (at least the basics) without asking too many questions¹⁴.

Vygotsky bounds learning within what he calls the *zone of proximal development*, which he defined as «the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers».¹⁵ Curiosity researcher Day¹⁶ describes a system with a «zone of relaxation» and a «zone of anxiety» surrounding what he calls the «zone of curiosity» where ideal learning conditions prevail.

The net is so versatile that it can be the suitable zone of curiosity for most learning endeavors¹⁷. Next to the intellectual skills of cyber literacy, it is important to allow students to learn how to interact with others and how to be socially online. Alongside the technical skills of creating and sharing informational social objects, the learners must master social skills, like facilitating a debate, dealing with disruptive participants, asking for assistance, etc. These scenarios expose users to very similar challenges to offline social interactions.

How then can we translate these concepts into innovative tools and services that allow for better learning?

The perfect cyber-storm for learning

Several early phenomena in the social technologies environment portend the promise of truly amending the educational practices and system to comprise the humanistic approach outlined above.

The Long Tail of learning

In his seminal article «The Long Tail,» Chris Anderson¹⁸ presented an astonishing analysis of how online business changed the fundamental market conditions. In all classical markets, businesses have traditionally made the lion share of their sales from the most popular best-selling products in their catalogs. While this continues to be true, the internet allows vendors like Amazon to offer an enormous variety of niche products which are sold slowly but steadily throughout the year. The volume of these sales is lower, but the cost to store them as commodities is also lower because the products are stored in low budget warehouses. Anderson's surprising finding is that, taken together, these millions of niche products can create a serious business.

Those students who participated in small study groups are significantly more engaged, better prepared for class, and learn substantially more than those students who study by themselves.

We observe a very similar scenario for learning. While there is a high volume of demand for popular subjects and courses, there is also massive demand for special interest courses, which are seldom realized. These niche courses – on e.g. Norwegian sheep breeding – cannot be offered by traditional institutions because they simply cannot afford to create or license the content nor contract a teacher. On the web however, demand is aggregated from students from all over the

world, thereby increasing the likelihood that a critical mass is reached.

Open Educational Resources

Secondly, networked technology allows for educators around the world to digitally create, share, and remix their course materials. This movement, which has been dubbed Open Educational Resources (OER), has recently been building large repositories. Once an educator has contributed his material to this pool of common resources, it evolves and becomes part of a universal knowledge base, which both educators and students can access. Courses can be translated into other languages and localized to fit more topically specific cultural contexts.

Networked technology allows for educators around the world to digitally create, share, and remix their course materials in so-called Open Educational Resources.

The most prominent OER initiative, which pioneered and popularized the idea around the world, was born when the Hewlett Packard Foundation funded MIT's Open Courseware (OCW) initiative in 2001. In what was widely perceived as an epochal strategic decision, MIT's leadership agreed to make its courses freely available on the internet. Today, after several years of OCW, MIT recognizes a very positive assessment of their initiative. Not only has it helped MIT to fulfill its mission to widely spread high quality education, it has also substantially increased MIT's institutional recognition, thus serving as a marketing tool to attract prospective students.

The OER movement is picking up momentum. Hundreds of educational institutions and thousands of educators have teamed to collaborate and pursue a practice of global sharing and cooperation towards the provision of engaging, timely and highly customized learning materials.

Social media as affordance to scale meaningful learning

Digital ethnographer Michael Wesch excellently describes how social media enables scalability of the pedagogy we are exploring. When, as discussed above, all information is available, the educator's challenge is to identify and select materials that make *meaningful connections* and generate *significance* in the learner's life. Wesch distinguishes between intellectual and personal meaningfulness. Intellectual means results from a learner understanding that «a word, concept or idea is not just meaningful for what it is, but for how it relates, connects, and contrasts with other words, concept and ideas». ¹⁹ Personally meaningful connections are created in the interaction with others and through the individual's *learning to be* a respected participant in a community. Both aspects are very much humanistic in that they focus on the creation of significance of information for the individual. Consequently, for information to reach the learner, the educator needs to aim to create a situation where the student cares about the subject.

Learning with social technology comprises an immanent shift to a new paradigm of social learning wherein students learn to be knowledgeable rather than to memorize information, and to live and experience this new knowledge.

When aiming for "care" in a reciprocal manner, the big question is scalability: in a small class it is much more possible for the educator to care about the individual. Traditionally, this resulted in a one-to-many relationship, with the educator broadcasting to the students. This is where social media based e-learning changes the class conditions dramatically. By using the many-to-many mediation services of the web, students interact amongst themselves and thereby set the stage for develop caring relationships (through discussions in the forum, sharing and commenting on blogs and social bookmarking, etc.). In this model,



- ▲ The new wave of web 2.0 platforms and services have enabled all digital natives to aggregate, syndicate, comment on, and edit content.

the educator's role isn't simply to dispense knowledge from a vessel, but instead to point out the whereabouts of the knowledge pool, and to coach students how to dip into it themselves.

In this sense the teacher serves more to catalyze interest, to instigate flows and facilitate the emergence of a vibrant learning community.

The web as a social and scientific learning environment

ETraditional media allowed for a clear distinction between private and public writing. Online, this dichotomy has blurred to the point of uselessness. Netizens have always held public (globally accessible) discussions, but the new wave of platforms and services dubbed web 2.0 have substantially increased democratization by enabling all *digital natives*²⁰ to aggregate, syndicate, comment on, and edit content through a host of desktop and mobile tools.

In fact, the participatory ubiquitousness of the web makes information-sharing so abundant

that the social context (the community) with whom one is relaying information, communicating and co-creating, becomes a key aspect of the online experience. The strength of web 2.0 lies in the tools that allow us to team-up and digitally cohabitate with other people who share our interests.

Virtual communities form very rapidly around social (information) objects²¹ weaving a decentralized discussion, or through the recognition of a common interest.

Rather than memorizing textbook knowledge students should be «error detectors».

These new ways of networking and collaboration provide an enormous potential for *social learning*²². The quality and didactic style of the educational resources is only one component that determines the learning outcome. Equally important is *how* the learner studies the material. Richard J. Light from Harvard's School of Education has reported some very interesting insights revealing that those students who participated in small study groups (even only once a week) were significantly more engaged, better prepared for class, and learned substantially more than those students who studied by themselves.²³ Treisman²⁴ also reported that cultural differences were very influential in determining the disposition towards creating and participating in study groups. Treisman's findings are especially relevant when thinking about mainstreaming trans-institutional e-learning practices globally. Hence learning with social technology comprises an immanent paradigm shift from a Cartesian understanding of knowledge as a didactically transferable substance to a new paradigm of social learning wherein students *learn to be* knowledgeable rather than to memorize information, and to live and experience this new knowledge by socially and collectively constructing it, hence making it meaningful in their cognitive context.

CCCE's director Lance Bennett describes a learning style paradigm shift from an authoritative,

text-based, one-way knowledge transmission from instructor to instructed to an interactive, project-based, peer-to-peer information-sharing hive. In his words, learning to be is characterized by participatory media creation in comparison to passive media (knowledge container) consumption. Along these lines, Postman²⁵ too called for a cure for the «itch for absolute knowledge» and encouraged teachers and students to accept imperfect knowledge. This is present in Bennett's promotion for the preference for democratic environments, where «learners participate in creating content & assessing credibility».²⁶ Rather than memorizing textbook knowledge students should, in this view, be «error detectors».²⁷ These error detectors shouldn't focus solely on the factuality of a static historical date, but instead should be alert to the potential to create new content in a credibly focused manner.

In the following section we review three educational ventures, which all in different ways exemplify the use of social media for entrepreneurial learning and cultural and technological citizenship.

Learning through Collaborative Inquiry

Our first example is Howard Rheingold's Social Media Collaboratory (CoLab). He tackles the mission of spreading an understanding of the social empowerment and self-development possible through participation in the netpublics²⁸. To that end, Rheingold has created an online-classroom and course design meant to allow students to "learn about" the tools and services which are then employed to create a vibrant public sphere. Students are also encouraged to "learn to become" an engaged and constructive netizen through collaborative and self-directed experimentation.

The CoLab provides the tools and thematic scaffolding that are needed to foster a good learning experience. More than just the tools, it is the course design itself which exploits the web 2.0 tools functionality to facilitate what Dewey called

“productive inquiry” – «to engage in productive inquiry is to be actively pursuing a problem, puzzle, point of fascination, object of wonder, or the like; it is to seek an answer, solution or resolution».²⁹

Howard Rheingold’s Social Media Collaboratory spreads an understanding of the social empowerment and self-development possible through participation in the netpublics.

In the Social Media course, this concept is pushed even further. Here, the term *collaborative inquiry* is used to stress the community and interactive learning. As a consequence of this learning philosophy, students enrolled in Rheingold’s course don’t simply receive lectures from an expert. Instead, the instructor, together with student teaching teams, invites and facilitates co-exploration of and co-experimentation with social media theory and practice. There is no static canon to be transmitted and memorized. Rather, knowledge is to be actively explored, interrogated, critically analyzed, and collaboratively assembled in what has been dubbed *the online col-laboratory*.

Self-evaluation and productive inquiry begins as soon as the student applies for the course. To be accepted in this “learning community” each learner answers a set of questions. These questions serve to build an initial profile which will make him share and reflect about his personal experience with, as well as his personal interest in, social media. This “learner profile” serves as point of departure for the inquiry and reflections of the learner as well as the instructor (allowing both to compare his activities and progress to the initial state). Throughout the course, the learner then engages in a conversation with himself (in a blog which serves as learning journal) about what the subject might have to do with (or “mean” in) the real life world, i.e. that world which the learner actually experiences. In the learning journal, the student provides the information and experiences its meaning.

Unlike traditional pedagogy, the majority of the class content (teaching, discussion, collective inquiry) is performed by the learners with the instructor serving as a coach or consultant to the learners. First, students self-organize into teaching teams which collaboratively prepare, teach, and lead inquiry during class presentations by raising questions and moderating discussion about one specific theme.

Second, following the leadership of the student teaching teams, the entire class will participate in constructing a wiki page for structuring the knowledge that was aggregated and debated during the week’s reading and class discussions. Finally, students organize into teams of four to conduct an independent inquiry (research project) which occurs throughout the last half of the course.

At the CoLab, the majority of the class content is performed by the learners with the instructor serving as a coach or consultant.

All teams form and self-organize based on a shared interest of inquiry. Once formed, the teams review the annotated list of resources provided by the instructor. But rather than just take resources from the instructor, these teams also have to select materials for the remaining students. These materials must include four hours worth of specific assigned readings and videos for the week prior to the following class meeting. The team is thus able to pursue their own locus of inquiry by recommending the readings best suited to share their insights.

Additionally, each teaching team formulates five questions for five different in-class student groups. These questions are designed to initiate the inquiries most likely to lead to deeper knowledge of the text’s subject. Finally, the teaching team leads the wiki-based process of capturing and distilling collective knowledge from in-class and online discussions. The team aggregates this information before, during, and after each class meeting.

The overall grade a student obtains is based 25% on his/her reflections about social media and on-line communities which were documented in her/her personal learning journal. Another 25% of the grade comes from his/her contributions to the discussions and of the knowledge socialization and codification which occurred in the wiki, and other social media tools. A further 25% is based on his/her contribution to the teaching and the insights reached by collective inquiry. The final 25% is allotted upon the results of the group research project.

Supercool creation of learning opportunities

Another example of a venture that has set out to change the way we learn and to promote a learning lifestyle is Supercool School. Supercool School is an online learning marketplace that empowers everyone to learn and teach using a simple webcam. The recently founded Silicon Valley based stealth start-up is a live social e-learning marketplace, which means that it allows learners to request or offer classes on whatever the individual is interested in, or feels competent about, and then make this class available for others to join and eventually have a live online class using video and audio chat as well as a shared presentation to guide the learning.

Supercool School gives learners the possibility to request classes on any subject and hence to team up with others who are interested.

It is the antithesis of a standardized curriculum. On Supercool School what matters is the intrinsic motivation to learn or teach about a subject. The school's founder Steli Efti believes that each individual has a dormant passion to learn. According to him this innate curiosity has been lost through the years of forced competitive learning deployed by the educational system. Supercool School is meant to allow the learner

to regain and gradually develop a new passion for learning because the content is meaningful and the setup is informal.

Practically, Supercool School consists of a learning marketplace and a live online classroom. In the marketplace, participants can create class requests or offers, or browse the existing class-pages and sign up as student or teacher. Each class-page has a description of what the creator wants to learn or teach, and this description serves to attract learners and especially a teacher who feels competent to give the class. The page also offers a forum to coordinate the scheduling of the actual live class, as well as pre- and post-class discussion and reflections. At a pre-scheduled time, the students gather in a live online classroom in which the teacher's voice and web-cam video are broadcasted to the students while the teacher explains concepts with the aid of a presentation. Students can interact with the teacher and with their peers via chat. The live classes are recorded and uploaded to a public web-video provider so teachers can further leverage their efforts, and prospective students can catch up with the information covered in preparation for follow-up classes.

Most classes on Supercool School deal with rather broad subjects such as introductory courses to foreign languages or internet marketing. But the venture's team believes that this is due to the early stage and still relatively small user community. They stress that Supercool School gives learners the possibility to request classes on any subject and hence to team up with others who are interested to collaboratively pursue the exact inquiry or theme they are interested in. This claim seems reasonable given that the universal nature of the web can bring the very few people interested in Norwegian sheep breeding together, as long as they have the media competence to signal their interest and participate in the exchange.

Another aspect of learning the Supercool way is the setup to promote recursive, active learning or learning to be. People who take classes on Supercool School are meant to use the platform not

only to learn through the classes imparted by knowledgeable members of the community, instead learners should use their increased competence and extend their learning by preparing and imparting classes on a level they feel they master. This setup not only provides a more comprehensive platform for *learning to be*, but it is also meant to make the Suprecool School model sustainable, because if only a part of the students give a class on the same subject the learning continues.

Supercool School is a truly liberal platform as it does not influence what nor how learning happens. They write: «We believe that there are infinite paths to knowledge and that to attempt to steer is to constraint and to forge new chains. The aim is to provide an evolutionary environment where good practices prevail naturally». ³⁰ This approach is in line with educational reformer John Holt, who wrote: «Since we cannot know what knowledge will be most needed in the future, it is senseless to try to teach it in advance. Instead, we should try to turn out people who love learning so much and learn so well that they will be able to learn whatever needs to be learned». ³¹ The vision is that «once education is understood as learning to make life more wonderful» ³² rather than to fulfill expectations, natural curiosity becomes an all-encompassing intrinsic motivation for self-directed learning.

Why teach for free?

At Supercool School all standard teaching is done for free. What motivates the teachers to dedicate their time and effort? The Supercool team identifies three key motivations: one is that teaching and learning are concomitant; that is, teaching is also a learning process that enhances one's understanding of a subject. ³³ Secondly, teaching satisfies a social need ³⁴ to feel of value to a community of individuals – no matter how geographically diverse – who share the same interest. Last but not least, a Supercool teacher, like a blogger, builds a reputation through the profile created by learner evaluations and by the constructive critiques offered by the social network of learners

familiar with the teacher's expertise. These critiques serve as direction how to improve their skills. Plus teachers with excellent reputations will attract greater numbers of students and professional opportunities based on the trusted networking of the learning community.

Qualitative and Discrete Performance Measures

At Supercool School there are no exams to pass and no test-scores to reach. True learning is motivated by understanding and what is understood brings one to the next level, hence progress is reflected through further learning and especially teaching activities that allow learners to build a personal profile. Peer learners and teachers are encouraged to share their impressions of the level of understanding and give social feedback by describing him/her using keywords (tags), both meant to be foremost a constructive recommendation for concrete improvements and referrals to additional learning resources. This is yet another practice where this school turns tradition on its head: it is foremost

The screenshot shows the Supercool School website. At the top, the browser address bar displays 'www.supercoolschool.com/'. Below the browser, the website header includes the Supercool School logo (a stylized 'S' with 'supercool school' text) and navigation links for 'About', 'Blog', 'FAQ', and 'Contact'. The main content area features the heading 'Infinite Learning Power For You' and a sub-heading 'Join our request based learning marketplace on Facebook and learn whatever you want in the most powerful social network world-wide. Click the button below and let the fun begin!'. A prominent blue button labeled 'Login via Facebook' is visible. Below this, there is a section titled 'Wanna stay in touch with Supercool School?' with the sub-heading 'Signup Below To Get Supercool Updates'. This section contains input fields for 'Name:' and 'Email:', followed by a 'submit' button. To the right of the text, there is a graphic of several stylized human figures in orange and grey, some with the Supercool 'S' logo on their heads. In the background, a blurred image of a Facebook social network interface is visible.

- ▲ Supercool School is an online learning marketplace that empowers everyone to learn and teach using a simple webcam.

the teacher who is assessed by the students. One advantage of the qualitative tagging of the teacher and co-learners is that not only thematic competence but also personality traits like passion, humor, or patience are assessed – and all evaluation is “³⁵open” in the sense that there are no pre-defined categories. The innovators at Supercool School believe that the resulting profiles will tell much more than a traditional report card, as they reveal not only the skill of the teacher but also the efficacy of the learning experience itself for all of the participants. The idea is to create a record of the informal learning activities by formally codifying learning through the collection of information about the learners’ interests and level of understanding distilled from the actual learning activities and the impression left with co-learners at Supercool School.

Cooperative learning groups, in which members teach each other, improve attitudes, motivation and learning.

The system puts into practice what researchers have known for years. Benware and Deci found that learners who were given material with the instructions that they will have to teach it to others (a setup which was meant to cause more active learning) learned significantly more than students in a control group who were instructed that they will be tested after the learning period. Similarly, Aronson et al. (1978) found that cooperative learning groups in which members taught each other improved attitudes, motivation and learning. Not only is the Supercool setup meant to increase active learning by causing students to be more receptive during class (as found by Deci & Ryan³⁶) but it also allows for an improved form of collaborative assessment.

Recent trends in education are towards more and more standardized testing which almost always translates to automated testing setups performed by machines. However, we agree with educational entrepreneur Steve Downs, who does not believe that this is neither a good nor a sustainable trend.

In the future, «people will not be judged by machines». ³⁷ Rather, assessment (such as constructive critique) will be conducted to improve learning and to develop peer and community recognition and reputation.

Yet another traditional separation is overcome by the Supercool approach: there are no cohorts. While there is a certain logic to grouping children according to their age, it is not the adequate means for clustering many learners. Alternatively, ambition and personality types may be more accurate as indicators of the students’ compatibility. In fact, the Supercool profiles are meant to facilitate just that.

Supercool School sees itself as an institution of the new culture of learning that emerges at the heart of the knowledge society. The vastness and multiplicity of the netpublic’s online knowledge sphere (fora, blogs, wikis, etc.) may be viewed as a single, complex educational institution, a global cyber agora where the distinct economies of knowledge are immanently understood, practiced, and developed by digital natives.

Teachology – Sowing the seeds for a more creative society

The last innovative approach to education we want to review is the brainchild of Mitch Resnick, whose passion is inspiring especially young learners to engage in a virtuous circle of learning through the process of creation, use or play, and feedback or reflection which in turn triggers a new round of learning, which he understands almost as a “by-product” of creation. His research lab at MIT goes by the name of Lifelong Kindergarten, because for him technology is above all an enabler to creation and expression, and should be as accessible as the finger paint and Lego blocks kids use to explore and learn. The most widespread product that has its roots there is Lego Mindstorm (intelligent Lego bricks that can be programmed really easily to cause reactions to pressure, light or sound).

Currently he and his team work on two more learning devices: Cricket is meant to be the swiss-army-knife of digital hardware. «Crickets are small programmable devices that can make things spin, light up, and play music. You can plug lights, motors, and sensors into a Cricket, then write computer programs to tell them how to react and behave»³⁸. Scratch is Cricket's complement on the software side. Without the burden of complex programming syntax, learners use the Scratch programming environment to «teach» the machine what to do in what circumstances. Scratch uses natural everyday language instead of tech-lingo and most aspects are build up using a modular, Lego-like construction environment. Learners combine hard and software engineering «to create all types of interactive inventions: musical sculptures, interactive jewelry, dancing creatures».³⁹

A boy used Cricket and Scratch to build his own version of a computer game. To do so, he had to learn a whole variety of subjects, not because someone else told him to but because he had a genuine interest and was able to create something which was meaningful to him.

After the launch of Scratch over 20 000 programming projects were registered within the first three months, on the site where learners can share their creations. And a surprising 15% of the projects are extensions to those creations done by prior learners. Hence the technology is only the hook that sparks interest. In this scenario the teacher is much closer to a learning consultant serving as enabler to allow the learner to learn what is needed to realize their vision.

That is why we decided to dub these immanently learning evoking devices teachology.

One illustrative recent example Resnick told us about is that of a boy, who after playing the hugely popular console game Guitar Hero was inspired to use Cricket and Scratch to build his own version of

this IT music extravaganza. In the process of building the guitar (simulator) he had to learn a whole variety of subjects, from electronics, to programming, but most importantly about music and how to understand and write notes. Not because someone else told him «it's important», nor because he would be punished if he didn't (like in a school exam), but because he had a genuine interest and was able to create something which was meaningful to him and brought him respect from many who were impressed and appreciated his creation.

Silicon Valley's TechShop is the first to offer unlimited access to a high end machine shop, prototyping facility, and to a community of fellow maker-entrepreneurs.

Resnick concludes what he perceives as relevant learning objectives on the way to a more creative society: «students must learn to think creatively, plan systematically, analyze critically, work collaboratively, communicate clearly, design iteratively, and learn continuously».⁴⁰ The aim of Rheingold's Collaboratory resonates well with Resnick, who likes to expand the "voice" concept to not only relate to political voice and citizen duties, but to include all forms of self-expression; especially artistic and the connection to other people. In his view, one important aspect of this kind of entrepreneurial learning is accepting the risk of being wrong. Ken Robinson epitomized this aspect that one has to «be prepared to be wrong – or otherwise you will not be able to create something original».⁴¹

The bottom line here is that computers are wonderful for transmitting and accessing information, but they are, more broadly, a new medium through which people can create and express themselves. And it seems this understanding is emerging as a new trend.

This learning by doing is also the motivation among the entrepreneurs of Silicon Valley's TechShop⁴². First of its kind, the TechShop offers its members unlimited access to a high end machine shop, prototyping facility, and to a

community of fellow maker-entrepreneurs. The model, which the TechShop founders plan to replicate and export around the globe, is not new as such (shared workshops are a common practice among craftsmen), but what is extraordinary is the kind of sophisticated equipment enabling users to apply otherwise unimaginable techniques like rapid prototyping for the high tech innovations Silicon Valley is famous for. What is also different to the traditional common workshop is that TechShop members are a heterogeneous mix of technologists, engineers and hobbyists from all walks of life, what allows for extensive cross-fertilization and learning.

Conclusions

Four trends that will hopefully bring new impulses to and complement the formal educational system have been identified:

- ▶ High quality learning materials are being made available for free and educators as well as self-directed learners can complement and remix them to create ever more customized learning opportunities.
- ▶ The new social tools of the web allow for ever more special interest communities to reach critical mass and develop as vibrant online learning communities.
- ▶ The “open” mentality and technology that enables a see-for-yourself and do-it-yourself maker culture has sown the first seeds for more social technology and entrepreneurial mindsets.
- ▶ Digital natives grow up in a world where dealing with enormous amounts of information is second nature. We can only speculate what informational capacities these generations will develop. Some claim that the result will be mainly short attention spans and an enormous accumulation of trivial knowledge about football, stars, and brands etc. They might be right that the current trajectory looks like it is going in this direction, but if we go back to conceptualize the web

as a mind amplifier and the medium to promote “perpetuum addisco” things look brighter. Therefore let us re-examine the two components of the formula: thematic scaffolding + curiosity = infinite self-motivated learning.

The web as the ultimate personalized learning environment

The web, and search engines in particular, have profoundly changed the way we are willing to engage in things we don’t know how to do. In online learning «there is no longer a person standing at the front of the room to guide the student through a lesson for an hour». ⁴³ These days one is not stared at with disbelief when claiming that the internet is quickly evolving to hold the most complete representation of human knowledge. The part that holds content that is explicitly educational is still small, but one can easily imagine the collection of Open Educational Resources to become the world’s biggest collection of educational materials. In this context it seems adequate to envision how, over time, educators will remix and customize these materials for a multitude of learners allowing them to penetrate the body of knowledge through an entry point that takes their individual background, current knowledge as well as specific inquiry into consideration.

The key ingredient to fostering curiosity is the *social learning* potential of social technology.

In this scenario one imagines (traditional) education institutions like universities to provide learning spaces equipped with special affordances and teachers, who are experts consulting with the learners on how to realize their projects. This type of learning is pioneered by innovative institutions like Stanford’s d.school⁴⁴ – a design thinking laboratory, where students learn creative solution oriented thinking, multi-disciplinary team work, and iterative development and refinement of prototypes. Because student teams are working with real problems of real

clients and because of the multi-disciplinarity, the applied learning that is happening is profound and meaningful.

In order to benefit and strive in this global learning environment local and regional decision makers should encourage and set incentives so educational institutions and their educators become aware of these open repositories and learn how to participate in the expansion, optimization and localization of the educational resources offered by the web.

The last frontier is the human mind (or how to find the well of curiosity)

We discussed in the section on curiosity that open networked technology by itself has a positive but limited influence on the learners' curiosity, but the key ingredient to fostering curiosity is the *social learning* potential of social technology. On the web thematic peer-learning communities allow learners to practice the trait in question. It is through this relationship building (peer-caring) that social technology can increase overall curiosity. The *netpublic* created through social technology has its roots in the complex emergence of relationships expressed by its users. It is the social interplay and participation in the weaving of this web that generates significance, engagement and therefore curiosity.

The global nature of the networked technology sphere has the potential to foster global thinking and cosmopolitanism.

It is through relationships, through the weaving and dancing together that networked technology allows for a new perception and self-definition of oneself, which, in our view, favors the development of an internal locus of control, which lies at the very center of an entrepreneurial mindset.⁴⁵ Additionally, the global nature of the networked technology sphere has the potential to foster global thinking and cosmopolitanism. In

short, the intrinsic conditions when using social technology are favorable for both aims of the humanistic educational approach described – big picture learning and discourse (*episteme*) as well as development of highly specialized professional expertise (*techné*).

Technology in itself, apart from social context and human agency, is neither good, bad nor neutral. Instead it is up to each individual to engage in peer-producing the learning space that allows him to pursue his interest. Technology generates learning experiences, these experiences have to be translated into meaningful competencies and practices. What matters is how the experience can be exploited to generate personal development or professional knowledge.

All ventures we reviewed shared a conviction and dedication to use ICT to empower the learner to release themselves from their «self-incurred tutelage», give him «reasons to continue educating themselves»,⁴⁶ by making him digitally fluent, which «involves not only knowing how to use technological tools, but also knowing how to construct things of significance with those tools».⁴⁷ It is in this creative power that we assess a great potential for social technology to foster an entrepreneurial mindset and thereby innovation. This is why we assess cyber-literacy as trained in the Social Media Collaboratory to be so instrumental for meaningful participation (*learning to be online*) in today's and tomorrow's societies. Efforts to enable citizens to use and contribute to the *netpublics* should therefore have high priority for decision makers aiming to secure the competitiveness and innovative capacity of their constituency.

While this article embraces a positive perception of the new technologies of learning, we want to close by pointing out one of the great remaining challenges. Even though we agree with Wesch⁴⁸ that information has individual relevance for each learner, there can be no doubt that there is different quality of information. Thus a balance has to be found by the educator between giving learners freedom to explore and develop their individual curiosity

or interest in a subject and him/her providing access to the concepts, ideas and findings that have won legitimized recognition. In other words, if the objective of inquiry is to generate an understanding of the truly essential, then educators are facing the paradox challenge to

encourage learners to use the new environments described, but also to stay focused and not to get carried away surfing and chatting, rather than «standing on the shoulder of giants» and taking in and understanding what tradition has selected as the essential insights.

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References

- BENKLER, Y. (2006). *The wealth of networks: how social production transforms markets and freedom*. New Haven [Conn.]: Yale University Press.
- BENWARE, C. A., & DECI, E. L. (1984). Quality of Learning with an Active versus Passive Motivational Set. *American Educational Research Journal*, 21(4), 755-765.
- BOROWSKA, K. (2005). *Curiosity and Motivation-to-Learn*. Paper presented at the ACRL Twelfth National Conference
- BROWN, J. S., & THOMAS, D. (2006). You Play World of Warcraft? You're Hired! *Wired*, 14 April, from <http://www.wired.com/wired/archive/14.04/learn.html>
- BROWN, J. S., & THOMAS, D. (2008). The gamers disposition. *Harvard Business Review* (February).
- CARSON, B. H. (1996). Thirty years of stories: the professor's place in student memories. *Change*, 28 (6), 10-17
- d.school. (2008). Developing a Point of View. Retrieved 15 Sep. 2008, from http://www.irishideas.org/cia_pov_overview.pdf or <http://tinyurl.com/69lhhu>
- DECI, E. L., & RYAN, R. M. (1981). Curiosity and Self-Directed Learning: The Role of Motivation in Education. Retrieved 25 Sep. 2008, from <http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED206377>
- DELANTY, G. (2001). *Challenging knowledge : the university in the knowledge society*. Buckingham [England]; Philadelphia, PA: Society for Research into Higher Education & Open University Press.
- ENGSTRÖM, J. (2008). Nodal Point. *The Web and Beyond 2008*. Retrieved 16 Sep. 2008, from <http://nl.youtube.com/watch?v=SiW-jAVcWK4g>
- EUN-News. (2008). Xplora hands out the Millikan web experiment to Finnish school. Retrieved 24 Aug. 2008, from http://www.europeanschoolnet.org/ww/en/pub/eun/news/news_headlines/2407.htm
- FREIRE, P. (1970). *Pedagogy of the oppressed*. New York: Herder and Herder.
- HOLT, J. C. (1964). *How children fail*. New York: Pitman.
- KANT, I. (1990). *Foundations of the metaphysics of morals and, What is enlightenment* (2nd ed.). New York, London: Collier Macmillan.
- KASHDAN, T. B., ROSE, P., & FINCHAM, F. D. (2004). Curiosity and exploration: Facilitating positive subjective experiences and personal growth opportunities. *Journal of Personality Assessment*, 82(3), 291-305.
- KEATS, D. W., & SCHMIDT, J. P. (2007). The genesis and emergence of Education 3.0 in higher education and its potential for Africa. *First Monday*, 12(3).
- LAVE, J., & WENGER, E. (1991). *Situated Learning: Legitimate Peripheral Participation* Cambridge: Cambridge University Press.
- LIGHT, R. J. (2001). *Making the Most of College: Students speak their Minds* Cambridge: Harvard University Press.
- LITTLE, S. E., & RAY, T. (2005). *Managing knowledge: an essential reader* (2nd ed.). Thousand Oaks, CA: SAGE Publications.
- LOMBARDO, T. (2007). The Pursuit of Wisdom and the Future of Education [Electronic Version]. Retrieved 28.May.2007 from http://www.mcli.dist.maricopa.edu/dd/wisdom05/pursuit_of_wisdom.pdf.
- MARTIN, J.-P. (1985). *Vorschlag eines anthropologisch fundierten Curriculums für den Fremdsprachenunterricht*. Tübingen: Narr.
- POSTMAN, N. (1995). *The end of education: redefining the value of school* (1st ed.). New York: Knopf.
- PRENSKY, M. (2004). The emerging online life of the digital native: What they do differently because of technology, and how they do it. Retrieved 10 July, 2008, from <http://www.selma.bsu.edu/dixon/digital%20natives.pdf>
- RESNICK, M. (2008). Sowing the seeds for a more creative society. *Learning and Leading with Technology*.
- ROBINSON, K. (2006). Do schools kill creativity? Retrieved 25 Sep. 2008, from http://www.ted.com/index.php/talks/ken_robinson_says_schools_kill_creativity.html
- ROSENBERG, M. B. (2003). *Life-enriching education: nonviolent communication helps schools improve performance, reduce conflict, and enhance relationships* (1st ed.). Encinitas, CA: PuddleDancer Press.
- SENECA, L. A., & MOTTO, A. L. (1985). *Seneca, Moral epistles*. Chico, Calif.: Scholars Press.
- SENGES, M. (2007). *Knowledge Entrepreneurship in Universities: Practice and Strategy in the case of Internet based Innovation appropriation*. UOC, Barcelona, 9 Sep. 2008, retrieved from www.knowledgeentrepreneur.com.
- SMITH, R. M. (2008). Design with Learning in Mind. In *Conquering The Content: A Step-by-Step Guide to Online Course Design*: Jossey-Bass / Wiley Imprint.
- SUPERCOOLSCHOOL (2008). Supercool Educational Philosophy: Learning to be Free. Retrieved 25 Aug. 2008
- TREISMAN, U. (1992). Studying Students Studying Calculus: A Look at the Lives of Minority Mathematics Students in College. *College Mathematics Journal*, 23(5), 362-372.
- VYGOTSKY, L. S., & COLE, M. (1978). *Mind in society: the development of higher psychological processes*. Cambridge: Harvard University Press.
- WESCH, M. (2008). A portal for media literacy. Retrieved 11 Sep. 2008, from <http://www.youtube.com/watch?v=J4yApagrn0s>

Notes

1. KANT, 1990.
2. SENEGES, 2007.
3. LOMBARDO, 2007.
4. DELANTY, 2001.
5. The result of education and research on the episteme side is critical thinking (HABERMAS, 1978) or reflexive capacity (DELANTY, 2001; HARVEY & KNIGHT, 1996). The results of *technè* are trained workers, technologies and knowledge about the physical reality.
6. In the form of wireless internet.
7. 1970.
8. 1995.
9. KANT, 1990.
10. SENEGES, 2007.
11. Curiosity is the innate drive that makes us explore the world and thereby learn about it. Hence a curious person shows a systematic and targeted explorative behavior. Experts (BOROWSKIE, 2005; KASHDAN, ROSE & FINCHMAM, 2004) prescribe liberty and stimulating environments as favorable conditions to foster curiosity. Pedagogues traditionally stress the great importance of curiosity for the development of the motivations towards a disposition of striving for education, knowledge and insights.
12. RAYMOND, 1991.
13. Surprisingly, little has been done in terms of measuring how successful educators are in arousing curiosity. One attempt is the US National Survey of Student Engagement (NSSE), which surveys learners to check for successful engagement. However, the questions themselves allow only for a rather superficial analysis. Nevertheless, while limited, this example is one of the very few starting points.
14. We have to put a disclaimer at this point: yes, there is a lot of information *about* topics that has to be memorized and e.g. video lectures, podcasts and textbooks are a viable (re)source for learning. What we argue for here is a paradigm shift which is less about content and technique, than about sparking the engine – daring to know.
15. VYGOTSKY i COLE, 1978, p. 86.
16. 2005.
17. Currently we are talking primarily about intellectual learning, but once Wii style physical activity simulations have reached a higher level also physical skills can be learned.
18. 2004.
19. WESCH, 2008.
20. PRENSKY, 2004.
21. ENGSTRÖM, 2008
22. BROWN i THOMAS, 2008
23. LIGHT, 2001.
24. 1992.
25. 1995.
26. BENNETT, 2008.
27. POSTMAN, 1995.
28. <http://networkedpublics.org>.
29. LITTLE & RAY, 2005, p. 62.
30. SUPERCOOL SCHOOL, 2008.
31. HOLT, 1964.
32. ROSENBERG, 2003.
33. SENECA i MOTTO, 1985.
34. MARTIN, 1985.
35. 1984.
36. 1981.
37. DOWNS, 2008.
38. <http://llk.media.mit.edu/projects.php?id=1942>.
39. RESNICK, 2008.
40. RESNICK, 2008.
41. ROBINSON, 2006
42. www.techshop.ws.
43. SMITH, 2008.
44. <http://dschool.stanford.edu>.
45. SENEGES, 2007.
46. POSTMAN, 1995.
47. PAPERT i RESNICK, 1995.
48. 2008.