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Article *in* AI & SOCIETY · February 2012

DOI: 10.1007/s00146-012-0427-x

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Paper for the "Journal of Economics of Education"

Mutual Learning:

A Systemic Increase in Learning Efficiency to Prepare for the Challenges of the 21st Century?

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Abstract

One of the few certainties we have about our future is that it will require a massive amount of learning, by just about everybody, everywhere. The time for generating as many creative and collaborative knowledge builders has come. Therefore, improving the efficiency of learning could very well become a key leverage point to successfully meeting the challenges of the 21st century. This paper explores the possibilities of using mutual learning as a systemic means to improve learning efficiencies. Learning efficiency is measured through three different metrics: the time required to learn, the quantity of learning that is retained over time, and the leveraging of the cost of scholarships through the use of a complementary currency designed to track mutual learning. In all three metrics, mutual learning is shown as an important approach to increase the efficiency of societal learning, at the very least as an adjunct to the conventional educational approach.

Key Words: economic development, costs, efficiency, student financial aid.

1. Why a new educational model is needed

The Knowledge Society, the Knowledge Economy, the Learning Society, the Learning Organisation have become household terms. It means that learning has become a crucial process for the development in many countries. For instance, the importance of knowledge was first pointed out in the European Commission White Paper entitled *Growth, Competitiveness, and Employment. The challenges and ways forward into the 21st century* (1994), followed one year later by a second White Paper, "*Teaching and learning. Towards a cognitive society*" (1995) and then by an OECD public report, "*The Knowledge-based Economy*" (1996), trying to indentify best practices. Since then, many strategic papers from international organisations have endorsed such a priority, and now, 15 years later, learning appears as the central plank in the EU education and training policies, as well as in many countries in and outside Europe.

But what has been done in practice during these 15 years? The Lisbon Strategy, initiated by the Lisbon Special European Council held in March 2000 aimed at gearing the European Union "*towards a Europe of Innovation and Knowledge*", and affirmed that Europe would

become "*the most dynamic and competitive knowledge-based economy in the world*" by 2010. To-day, in spite of a "*new start*" launched at the mid-term of the plan in 2005, it appears that this strategy will not allow Europe to reach its initial objectives in 2010, partially because of events beyond the control of policy makers, but also because the EU and the member states have not been able to implement the relevant structural changes, in particular in the education and training area.

The generations now coming to working age will have to face four major challenges, which go far beyond the objectives of the Lisbon Strategy: climate change, a financial crisis, the growing unemployment and the aging of the global population. All these challenges are critical, and need large scale behaviour changes, both short term and long term. If short term necessary actions reside in the economic field, the long term actions have to be rooted in renovated, if not entirely new education and training systems.

As reported in recent strategic papers, to face these four challenges, the new generations will have to be composed of "*creative and collaborative knowledge builders*", to paraphrase the title of a background paper for the OECD Innovation Strategy (Taddei, 2009), which clearly stated, in its introduction that "*only countries that implement policies to reform their education to promote adaptability and creativity in adults and children are likely to remain at the forefront of human development and technology*". Other recent reports in different countries come to a similar conclusion.

The question, now, becomes: what type of education system will allow the development of *creative and collaborative knowledge builders*? The current education and training systems tend to develop conformity and alignment instead of creativity; competition instead of collaboration; and knowledge reproduction instead of knowledge creation! The requirements seem impossible to meet without a complete transformation of the current systems. Is it possible to find inspiration in Educational sciences?

Recent research in neurology suggests that creativity uses physiological mechanisms within the brain such as lowering the level of *norepinephrine* in order to allow connections between areas which are not usually connected. But, first of all, according to this research, creativity requires abilities in divergent thinking to handle easily multiple alternative solutions and "*a high level of general intelligence, domain specific knowledge and special skills*" (Heilman, Nadeau and Beversdorf, 2003).

So, the first step in developing creativity and adaptability appears to be acquiring a high level of general knowledge and skills together with highly specialised knowledge and skills in a particular domain. This leads us to the question: what is the most efficient way to acquire and retain knowledge and skills? This has been a central question in educational sciences since the middle of the 20th century, and in particular within the behaviourist community.

This paper will explore some options to evaluate the relative efficiency of mutual learning compared with the more conventional educational approaches.

2. Mutual Learning

Mutual learning, the process in which students teach each other, is also called "learning through teaching". It is certainly not a new concept. It was first described in the Western countries in 1795 by a Scotsman named Andrew Bell, who was living at that time in India. He wrote a book about the mutual learning method that he observed and used himself in Madras.

The Londoner Joseph Lancaster picked up this idea and implemented it in his schools. This method was then introduced in 1815 in France by the "*Société pour l'instruction élémentaire*", because it was the most cost effective way to provide instruction to the lower class children. The same year, a member of this association, Lazare Carnot, happened to be appointed as Minister of Domestic Affairs and launched the "*écoles mutuelles*" initiative. This became the largest scale experiment ever for this teaching methodology because it allowed coping with the important increase in number of pupils without proportionally increasing the expenses, since only a small quantity of books, which were shared, and "*moniteurs*" instead of fully trained teachers were needed, the pupils doing most of the job. The number of young children attending this type of schools rose from 165,000 in 1815 to 1,123,000 by the end of 1820 (Gréard, 1911). After the French revolution of 1830, no less than 2,000 "*Écoles Mutuelles*" were officially registered in France.

However, universal schooling was, at that time, considered mainly as a tool of control, to keep children of the poorer classes from getting involved in mischief in the streets, and provide them with a useful occupation before they were old enough to go to work. Furthermore, the students that emerged from this educational approach were both creative and clever, but they turned out to respect the established authorities less than those trained in the conventional way. The political *coup de grace* came when it was noticed that most of the leaders of the Revolutionary Party in 1848 had attended this type of school! For instance, one of them was Joseph Proudhon (Haubtmann, 1982, 38-39), who is still considered today a major innovative social thinker.

During the Restoration period in French history, lack of respect for the established authorities was unforgivable. The *Écoles Mutuelles* were therefore dismantled shortly after 1848 during the Second Empire. It wasn't resurrected later in France because, once a body of teachers and their unions got established, they had no interest in considering mutual learning, because it reduces the numbers of teachers required.

After this large scale experiment, and a few smaller ones during the same period in other European countries (Italy, Spain, UK…), mutual learning disappeared as an official methodology, until it was rediscovered under different names: in the USA, "*Learning through teaching*" (Gartner & al., 1971), "*Reciprocal Teaching*" (Palincsar and Brown, 1984; Carter and Fekete, 2001) and "*Reciprocal Peer Tutoring*" (Fantuzzo & al., 1989; Greenwood & al, 1989; Ginzburg-Block & Fantuzzo, 1997) were used, from the 1970s onwards, in many small scale experiments with children or students having difficulties in learning, but in spite of the significant gains observed, there were no attempts to further develop these methods. To-day, this methodology has been transposed to computer-based learning by the "The Teachable Agents Group" at Vanderbilt University (TN), which has developed a "Learning by teaching agent" (Leelawong and Biswas, 2008).

The major contemporary implementation of this method is in Germany (Kettwig, 1986; Klassen, 1988; Krüger, 1975; Renkl, 1997), where the use of "*Lernen durch Lehren*" (LdL) started in the field of learning French as a Foreign Language, with the work of Jean-Pol Martin (1985, 1996) from the Katholische Universität Eichstätt-Ingolstadt. The extension of this method to disciplines other than learning foreign languages has accelerated after 2001, when the PISA survey revealed that German students' results did not reach the level that was expected. Today, a network of more than thousand teachers in different disciplines successfully uses Martin's method throughout Germany. Recent research on its effects shows that this method provides most of "*the ingredients for effective learning*", and also facilitates

the development of personal, social and methodological competencies required by the knowledge society, (Grzega and Schöner, 2007). Is this a passing fashion, or are there some efficiency arguments in favour of generalizing this approach as widely as possible?

3. Measuring Learning Efficiency

One can imagine many means to measure learning efficiencies. Given the subtle nature of human knowledge and skills, we should expect that not any one metric will be both a hard number and genuinely universal. In this paper we will use three metrics: the time required to successfully cover a given curriculum of learning, the quantity of retained learning over time, and the efficiency of the use of public funds involved in education.

3.1. Efficiency as Measured through Elapsed Time

One of the surprises that emerged from the large scale experiment of the *Écoles Mutuelles* in 19th century France was that this type of school was not only much cheaper, but turned out to be very efficient in time: the curriculum, which was designed for 5 to 6 years of study, was completed on the average in 2 or 3 years by the pupils (Querrien, 2005, 81-84). For instance, "a child learns to read and write fluently in 2 years instead of the normal five or six years" (Querrien, 2005, 54). Furthermore, such acceleration wasn't limited to elementary knowledge: those students were eager to learn more, beyond what was planned in the curriculum. Curiously, this was considered a major problem, because it was providing the children from the lower social classes with an occupation for only 20 months instead of the 8 years expected in the normal curriculum! Finally, what could the educational system of the 19th century do with large numbers of 12 to 14 year-old sons and daughters of labourers who are ready and eager to go on to study at a university level?

After all, "the main reason to make schooling obligatory in the protestant countries since the 17th century and in France in the 19th was to transform the poor into future workers. Schooling was imposed on the children of the poor, exactly as military duty. The purpose wasn't to encourage the desire to learn. Schools aimed at teaching work discipline as a duty, at training future factory workers." (Querrien, 2005, 33). It is ironic that a methodology that was initially introduced primarily because it was the most cost-effective turned out embarrassingly more efficient in time than the conventional approaches.

That the quality of the results obtained in the "*École Mutuelle*" wasn't the reason for its suppression is clearly revealed by a Report from the *Conseil Général du Calvados* in 1822. It proposed "to reserve this method for the upper class children because they would have to expand their knowledge at its maximum, and it should be in their interest to learn as soon as possible the required mechanisms" (Querrien, 2005, 106).

Though there was no formal educational research at that time, the experiment was sufficiently large in time and space to provide testimonies and evidences of its efficiency. In spite of a large number of contemporary research works on cognitive effects of mutual learning under its different appellations, most of these works focus on retained learning or on cognitive gains and psychological benefits (see next section), and as far as we know, none has surveyed the elapsed time parameter in order to confirm this finding of faster learning a curriculum through mutual learning during 19th century France.

Why is such a methodology so efficient in the speed of learning? Though, as far as we know, no specific research has addressed this issue, we can suggest at least two reasons. The first reason is that teaching knowledge and skills to others forces the "teacher" to "objectivate"

his/her knowledge or skill, to put it at a distance to be able to tell it to others, and so to really *understand* it (Piaget, 1974). The second reason might be that, doing so reinforces the feeling of self-efficacy related to the knowledge or the skill to teach to others, which fosters the learning process in a kind of virtuous circle (Bandura, 1997): the more I succeed in passing knowledge or skill to others, the more I feel like learning and transmitting new knowledge and skill, which is exactly the attitude needed to produce *creative and collaborative knowledge builders*.

3.2. Efficiency as Measured through Retained Learning

The origin of the concept of retained learning as a measure of the learning efficiency goes back to Dales' work comparing the efficiency of different media and situations for knowledge and skills retention, which resulted in what he called the "cone of experience" (Dale, 1946). "*Verbal symbols*" were considered to be the less efficient, while "*Direct purposeful experience*" was the most efficient. In between he found "*Visual symbols*", "*Still Pictures – Radio*", "*Motion Pictures*", "*Educational television*", "*Exhibits*", "*Study trips*", "*Demonstrations*", "*Dramatized experience*" and "*Contrived experience*". 20 years later, the original terms were modified, figures for retention rate were added, and the diagram appeared under the name "*the Learning Pyramid*". Though different version of the pyramid were (and are still) in circulation, the most common version, the one from the National Training Laboratories (NTL - Bethel, Maine: see Figure 1) considers as the less efficient situation "*a lecture*" (5% retention rate), and as the most efficient situation "*teaching others*" (90% retention rate).

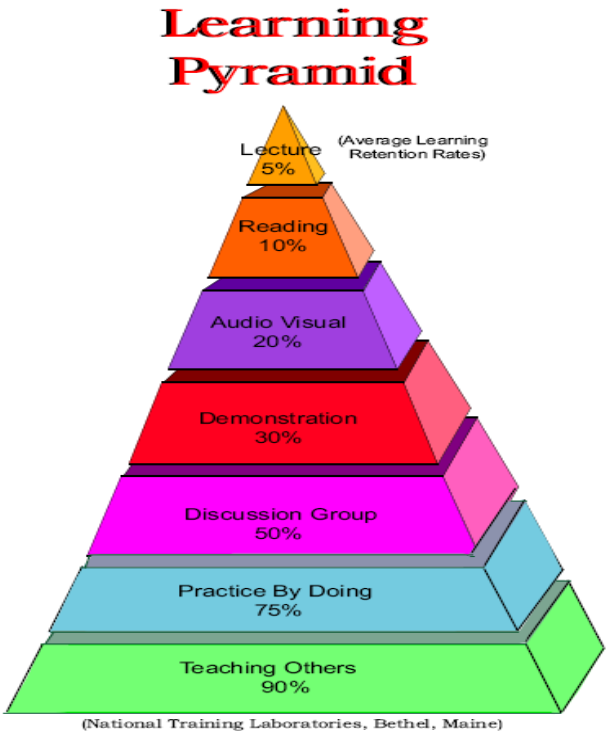


Figure 1: The Learning Pyramid

Though it has circulated during many years among the Educational Sciences community, and is generally taken for granted, it is nevertheless subject of controversy. Indeed, several vociferous critics of this "Learning Pyramid" have emerged, claiming it is not based on

reliable research. Some scholars consider it as a "*bogus information*" (Talheimer, 2006), a "*myth*" (Atherton, 2009), or at least as a questionable document (Lalley, Miller, 2007). The latter paper presents a review of researches which intended to evaluate the efficiency of learning method presented in the pyramid according to the NTL version, and claims that there is no evidence of higher retention rate for any method. This seems to confirm Richard E. Clark's position: "*Media will never influence learning*" (1994).

Nonetheless, even if research protocols on retained might be questioned, since they are often designed in order to prove what they intend to prove (Despret, 2004), it doesn't invalidate the historical evidence that at very least the *speed of learning through teaching others* is substantially improved. And if media do not influence learning, learning methods seem to do so, as shown by many research works on mutual learning under its different appellation.

The seminal research work seems to be Bargh and Schul experiment presented in their paper titled "*On the cognitive benefits of teaching*" (Bargh & Schul, 1980). Their experiment was split into two phases: in the first phase, 42 undergraduates participated. One group of students studied verbal material to learn it themselves while another group studied the material to teach it to another person. Students preparing to teach scored reliably higher than controls on a subsequent retention test. Phase 2 intended to assess the effects of actual teacher-student interaction. For both a verbal and a problem-solving task, 121 undergraduates either worked alone, verbalized their thoughts aloud, or taught another person the task while performing. There were no reliable performance differences between conditions on either task. This second phase showed that the type of teacher-student interaction had no significant effect on learning. So, it could be concluded that cognitive benefits of teaching do exist and result from utilisation by the student going to teach of a different method of study.

Another research comparing mutual learning with several other methods is the one conducted by Annis and published under the title "*the processes and effects of peer tutoring*" (Annis, 1983): the classroom effects of five peer tutoring situations were compared with 130 female students enrolled in a history course at a Midwestern university. Students read a 1525-word article and were assigned to one of the following conditions: reading an assignment to take a test, reading as if the material were going to be taught to a tutee but not actually teaching, reading in preparation for teaching the materials followed by actually teaching a tutee, being taught the material by a tutor, and reading the material followed by being taught by a tutor. Students were then administered Bloom's Taxonomy to determine the effects of various aspects of tutoring and being tutored on content-specific and generalized cognitive gains. Results indicated that tutoring compared to being tutored resulted in significantly greater gains in content-specific and cognitive scores. In addition, students who prepared to teach and actually taught generally scored higher than students who prepared only, indicating the importance of the actual teaching process for learning.

Experiments were also made with students with reading problems, starting with those conducted by Palincsar and Brown, which showed that *Reciprocal Teaching*, compared with "typical classroom practice", "*led to a significant improvement in the quality of the summaries and questions. It also led to sizable gains on criterion tests of comprehension, reliable maintenance over time, generalization to classroom comprehension tests, transfer to novel tasks that tapped the trained skills of summarizing, questioning, and clarifying, and improvement in standardized comprehension scores*." (Palincsar & Brown, 1984).

Another set of researches on *Reciprocal Peer Tutoring* (RPT) provided similar result, as indicate the following examples from the conclusions of sampled investigations:
"*A component analysis of the reciprocal peer tutoring (RPT) strategy was performed, which previous research had demonstrated to be effective in producing cognitive gains, lowering subjective distress, and enhancing course satisfaction. One hundred students were randomly assigned to one of four groups designed to systematically compare the RPT strategy with its hypothesized components: dyadic, mutual exchange, and structured-learning format. Pretest analyses revealed no significant group differences in demographic variables or pretest scores on course examinations and self-report inventories of subjective distress. Further analyses supported past findings on the superiority of the RPT strategy. This superiority was attributed to the RPT group's unique combination of elements: preparing to teach a peer teaching a peer, and accountability for this process.*" (Fantuzzo & al., 1989).
"*RPT students displayed significantly higher rates of mathematics achievement, self-report of social acceptance and behavioral conduct and higher rates of observed teacher and student task-related behaviour as compared with controls.*" (Ginsburg-Block & Fantuzzo, 1997).
"*In a series of investigations, we have found that RPT is effective in terms of cognitive gains. For example, in controlled experiments comparing students' performance following RPT with students who either worked alone on similar assignments, worked in unstructured study groups, or watched course-related films, RPT students scored an average of 83% on exams compared to an average of about 70% for the other conditions [...] RPT not only enhances academic performance but has psychological benefits as well. Students in the preceding studies were administered various measures of psychological well-being (e.g., student anxiety, depression, distress), both at the beginning and end of the term. Students in the RPT condition showed significant improvement in well-being during the semester, whereas students in the other conditions showed either no change or, in some cases, increases in anxiety and depression.*" (Riggio, 2006).

The results of all these research works are convergent. If the difference with other methods cannot always be quantified in terms of "retained learning", there are always cognitive gains and positive psychological effects induced by the use of mutual learning.

3.3. Efficiency as Measured through Leveraging Scholarship Funds

The effectiveness of the money spent on education is the third approach by which we propose to evaluate mutual learning. As already shown above, the introduction of the *Écoles Mutuelles* in France was based primarily on the argument that it was the lowest cost option. It makes sense that if the bulk of the teaching is performed by the students themselves, the cost of teaching should be lower. This was a main argument used by the *Société pour l'instruction élémentaire* to make the case for the *Ecoles Mutuelles*. In Volume III of its journal, the following comparison is given for the centre of Paris: the *Ecole mutuelle* would cost 15.000 F for 3 schools hosting up to 800 pupils, when traditional schooling will cost 30.000 F for 32 schools to host the same number of pupils (Querrien, 2005, 94). The "*Guide des fondateurs et des maîtres*" also published by the *Société pour l'instruction élémentaire* mentioned that for Paris only, traditional schooling would cost 2 279 000 francs more every year to host 50.000 pupils than would do the *Ecoles Mutuelles* (Gréard, 1911). If no recent research allows current comparisons, it is nonetheless clear that national education budgets involve a massive administration and infrastructure which have only indirect relation to the actual learning taking place. Those learning overhead expenses clearly would distort any comparison of financial effectiveness in disfavour of the conventional teaching methods.

That is why we will focus in this paper on achieving more learning through the leverage of scholarships, a cost directly related to learning. The example we choose involves the innovative use of a complementary currency specialized in the domain of mutual learning, called the Saber (meaning "to learn" in Portuguese, pronounced *Saa Bear*). It was originally designed for Brazil (Lietaer, 2006).

Financial help through scholarships is a very old concept dating back to medieval universities. One of its largest scale Modern applications was the "GI Bill" used by the United States after World War II for its veterans: government funds were paid out directly for student scholarships. However, a scholarship is helpful to only one student, as each dollar is used only once. In contrast, by introducing a complementary learning currency, a substantial "learning multiplier" can be set in motion, so that a given amount of money can facilitate substantially more learning for a greater number of students.

The initiator of the project, hereafter called the "Learning Currency Administrator" could be a non-profit organization, an educational foundation, a school or university or a country's ministry or department of Education. This Learning Currency Administrator would issue a complementary currency in the form of a specialized paper currency or as an electronic currency.

In all the examples given next, we will assume that the learning currency system is applied as an extra-curricular activity in a conventional school environment from primary school to university. However, the same principles could be applied in other contexts (e.g. if applied in society at large, it could be people who know something that others find of interest, ranging from a language or musical instrument to hobbies as sailing or mushroom hunting, etc.; or in a business context, entry level employees could be trained by more seasoned employees; etc.). In terms of the type of topics that could be thought in this chain of learning, one could leave it completely open to the choice of the teacher and the learner, or keep it within specific guidelines (e.g. topics of relevance to the school).

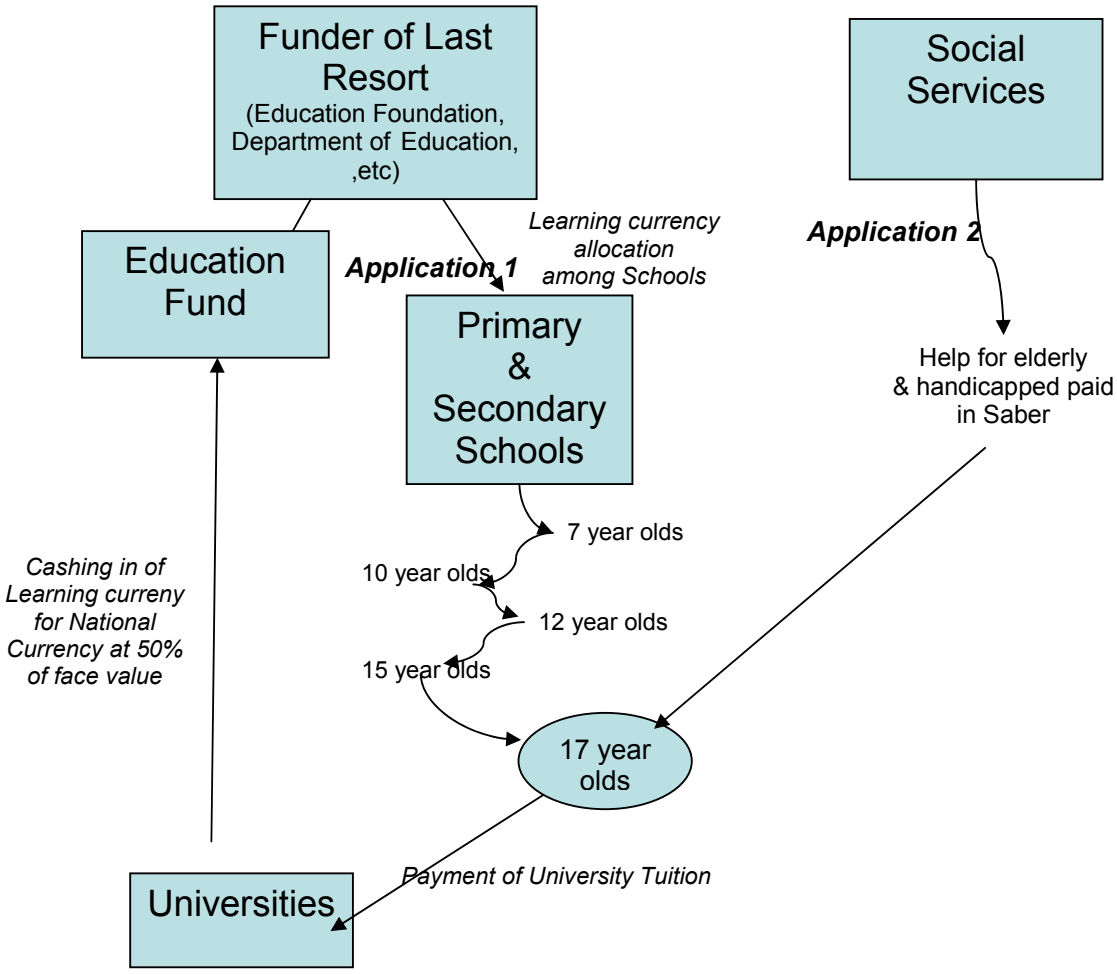
The Learning Currency units would be allocated to the lowest level of learners (e.g. in a conventional school environment this could be 7 year olds). This currency is given for free to these lowest levels at the condition that they choose a mentor (e.g. a ten-year-old). The Learning Currency units are transferred to the older student in compensation for the hours spent mentoring. The ten-year-old can do the same thing with a 12-year-old and the latter with a 15-year-old, and so forth.

At the end of this "learning by teaching" chain, one needs to create a "final sink". This final sink represents a desirable use of the Learning Currency for those at the end of the chain. For instance, the Learning Currency would go to a 17-year-old who would then be able to use his or her accumulated Learning Currency units to pay all or part of university tuition. The university in turn would be able to exchange the Learning Currency units for conventional money through the Education Fund (see Figure 2), but at a discount of say 50%. This process is possible because most of the costs at a university are fixed and the marginal cost of an additional student has little impact on those expenses.

Another final sink could be access to a desirable event that cannot be purchased with $, only with a given quantity of Learning Currency. For instance, a special concert by a band that is particularly liked by the participants in the system could be accessible if and only if one buys

the entry ticket with 10 Learning Currency units. Other "final sinks" could be spending time with a famous person, etc.

The following figure is a conceptual diagram of the flow of the learning currency for the case of the school application described above. Application 1 is the example provided purely for learning through teaching, application 2 is an example of learning through social service.



NB: 1 Learning Currency unit is equivalent to 1 National currency unit redeemable for higher education expenses

Fig. 2: "Saber" Complementary Currency System = Learning Multiplier

3.3.1. Calculating the Learning Multiplier

The key desirable effect of the use of a Learning Currency instead of a straightforward scholarship is the learning multiplier it enables for a given budget. The multiplier estimation made possible by the use of learning currency compared to a one-time-use scholarship will depend on the metric used in evaluating the quantity of learning, which brings us back to the earlier two metrics: the values incorporated in the learning pyramid (taken as they are provided by the NTL laboratory in Bethel, Maine), or the time efficiency.

In the case of the metric of time efficiency, the calculation is very simple, as it is the same as the improvement of the time efficiency. In the case of the report on the *Ecole Mutuelle* in Calvados, the Learning Multiplier would be equivalent to 4.

If one accepts the validity of the data in the learning pyramid, the learning currency triggers a chain of learning through teaching, triggering an even more substantial increase in the learning that is taking place. This process will be illustrated first mathematically, then with a concrete example.

The following variables would become relevant.

If M = the retained learning multiplier created by the learning currency compared to a conventional scholarship
Rt = Retained Learning in percent from teaching another student (= 90% if one accepts the values of the learning pyramid)
R0 = Retained Learning from conventional environment (typically combination of lecture + reading, or according to the learning pyramid an average of 7.5%
N = number of times that the learning currency circulates from a learner to a teacher before being absorbed in the final sink
Vc = Value of learning currency in $ during circulation among learners
Vd = Value of learning currency in $ as discounted by the funder of last resort

Then: $M = Rt/Ro \times N \times Vc/Vd$

3.3.2. A Practical Example of a Learning Multiplier using the Learning Pyramid
Retained learning for teaching someone is according to the learning pyramid 90% (Rt =90). Assuming that the mix of lecture and reading is 50-50, the retained learning from the conventional approach is $R0 = (5 + 10)/2 = 7.5$

We have assumed in the earlier example that the Learning Currency circulates five times before it reaches the university (N = 5). Finally, the discount that the university obtains in $ for each learning currency is 50%, therefore Vc/Vd = 2.

The learning multiplier for this example is therefore $M = 90/7.5 \times 5 \times 2 = 120$.
In other words with a scholarship fund of $1 million, it would be possible to trigger retained learning equivalent to $120 million by using a learning currency chain, instead of straight scholarships.

4. Discussion

We know for a long time that there are different forms of intelligence. Project Zero at Harvard has documented eight different types (Gardner 1993; Armstrong 1999), out of which primarily two are developed and measured in the conventional education system; i.e. the verbal/linguistic and the logical/mathematical. The other six forms of intelligence tend to be simply ignored. When a child is gifted primarily in one of the other six modes of learning - the musical, spatial, bodily/kinesthetic, intrapersonal, interpersonal, and pattern recognition – he or she will end up being considered as mediocre and become an educational failure.

One of the reasons why the conventional educational approach tends to overlook multiple forms of intelligence is that simultaneous teaching makes it impossible to cater to the individual forms of intelligence of each child. That isn't the case with mutual learning. It

should become possible to create learning groups in which the learning styles are taken into account. The increase in learning that such an approach would make possible is very likely to be staggering, particularly for those that are considered mediocre or failing students in the conventional educational system.

Not only intellectual learning should be considered relevant. Learning can also take the form of becoming aware about the worldview and social reality of others, and doing something about it. For instance, other ways of earning Learning Currency units could be introduced. Why not have young people earn Learning Currency units by helping the elderly or handicapped, even in other ways than teaching: reading to the blind, helping in shopping?

Indeed, in many countries around the world, there is a growing movement on college campuses to increase student involvement in their communities, particularly through what is known as "service-learning" in which students participate in community service activities organized by local community groups. However, in many places, this remains mainly a pious intention without real follow up, and it will remain so until there is a measuring system established to track such activities. The University of Missouri at Kansas City (UMKC) has developed a novel solution through its Center for Full Employment and Price Stability that adds community service component to the undergraduate and graduate programs.

It simply requires a fixed quantity of hours per semester for each student as a condition for graduation. They have created a complementary currency in the form of paper notes, dubbed "buckaroos" (after the UMKC mascot, a kangaroo), with the inscription "this note represents one hour of community service by a UMKC student", and denominated as "one roo hour". Each student has to pay a community service "tax" of 25 buckaroos (B25) per semester, payable in buckaroo notes. The record keeping is thereby becoming quite simple. Each student is required to pay B25 to the UMKC "Treasury" each semester. Approved community service providers (state and local government offices, university offices, public school districts, and not-for-profit agencies) are provided with buckaroos to "hire" student workers, so long as basic health, safety, and liability standards were met. The providers use their buckaroos to pay students for hours of service. The Treasury needs to ensure that the providers were, indeed, paying one buckaroo per hour of student labor—there is no need to keep track of the names of students who worked for each provider. There is no necessary limit to the number of buckaroos paid out during any semester. The number supplied to any provider would be limited only by the provider's needs for labor and by its ability to attract student workers, unless the university found it desirable to place quantitative limits on some providers in order to promote diversity of efforts. When students pay their B25 tax, they return these buckaroos to the UMKC Treasury.

There are many advantages to this system. Students are free to choose from among a wide-array of providers, and are free to switch "jobs" as frequently as desired. Record-keeping by both providers and UMKC is made very simple — providers simply pay a buckaroo for each hour of labor provided, and UMKC collects B25 per student per semester. Students are able to "hoard" buckaroos for future use, thus, can work extra hours in one semester in anticipation of a heavy course load in a following semester. Students are allowed to lend, borrow, buy, or sell buckaroos as desired. The "buckaroos" have become something like a "local currency" used on- and off-campus.

Learning could therefore become a vast and rich intergenerational game…All this would encourage intergenerational relationships, further learning, not to mention creating extra aid

for the elderly without burdening governmental budgets. Given that all countries are expecting a higher percentage of elderly people to take care of, would it not make sense to connect domains of problems – education and elderly care – into one integrated system solution?

5. Conclusions

The needs of our society during the 21st century in the world, are different from those prevailing in 19th century France. As stated in the beginning of this paper, the future of the world will depend on our society's success at producing as many *creative and collaborative knowledge builders* as possible. If today we have to make the choice between substantially higher learning efficiency and creativity at the cost of some respect of established authorities, we propose that the time has come to reverse the decision that was made under Napoleon III.

While mutual learning is again taking place in Germany, we propose that the time to generalize and expand this process to all fields of knowledge has come.

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