New teaching paradigms in the new machine age revolution

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ABSTRACT. Make students be able to deeply understand topics, to create their own knowledge-creative system, to develop creativity and lateral thinking: those are the target of the education of the future, in the so called New Machine Age. In fact, new skills are demanded by the jobs of the future. According to World Economic Forum, top skills in 2020 will include Creativity, Critical thinking, Emotional intelligence and cognitive Flexibility. How can we build these skills? A possible answer should be the metacognitive approach. Using a metacognitive approach means to teach students how they can find their own strategy, gaining personal control over academic outcomes. It means also, for students, to understand how their mind just works, how they can learn, how they can set the right targets and measure results in a dynamic assessment system. Using a metacognitive approach in distance education means also make students able to follow their own cognitive system, passions and motivation, finding their well-suited learning tools. Any problems or difficulties on learning (even dyslexia or dyscalculia) can be solved without a personalized learning route, just because there are infinite learning paths any student can choose. Any student has her/his own learning system and can find autonomously the right, personalized teaching method. Motivation is the key point of the model. Teacher should motivate students and help learners to understand their own capabilities and how metacognitive system works, also in a distance learning system. This paper analyzes the future new needs in terms of job (soft) skills. Then, following the literature about metacognitive approaches, will delineate a new paradigm of inclusive and self-regulation based teaching for Universities, focused on distance education, advanced tools and new approaches, showing result of an application of these ideas into economics courses.

KEYWORDS: *Intrinsic motivation, Metacognition, New machine age revolution, New skill, Research theory*

The new machine age revolution: what is changing in the job market

The forth industrial revolution or, if you prefer, the new machine age revolution is going to change our lives, our needs, and the way we intend the work (1). The developing of automation, also in decision making processes, has evident advantages: it is increasing productivity, efficiency and effectiveness, reducing risks and fatigue. Big data gives us the possibility to measure phenomena as never before, because machines can maximize rationality and rapidity of decisions. On the social field, it also means more available time for human beings and the flourish of ideas, arts, innovations, philosophy and culture. According with World Economic Forum's Report on the future of jobs, across the countries covered by the research, current trends could lead to a net employment impact of more than 5.1 million jobs lost to disruptive labor market changes over the period 2015–2020. With a total loss of 7.1 million jobs (two thirds of which are concentrated in routine white collar office functions, such as Office and Administrative roles) and a total gain of 2 million jobs, in Computer and Mathematical and Architecture and Engineering related fields (World Economic Forum, 2016). What is going to happen to those 7.1 million people?

About the "technological unemployment 4.0", there are different positions among economists: some are quite optimistic, some other very pessimistic.

Optimistic economists say that, as in the previous industrial revolutions, it is unlikely a long term technological unemployment. As in the past, some jobs will disappear but new more complex roles are going to be created, and also traditional sector employment is going to increase in consequence of the economic growth, fostered by higher productivity of innovative sectors (Acemoglu, Restrepo, 2016; Frey, Rahbari, 2015). Two forces would act to make the labor market find its equilibrium. The first is the so-called *O-ring theory of economic development* (2) (Kremer, 1993) that assure the growth of supply: more productivity means more innovations and a larger number of completely new products. On the demand side, we are sure that new needs will be generated by innovation and new innovative products, for the well-known no-satiety law of human nature.

According to pessimistic economists, instead, the economic growth pursued by automation could increase the income inequality, among technological and non-technological workers and between profit and wage recipients (Brynjolfsson, McAfee, 2014).

Another consequence is the widening of the skill-gap between supply and demand.

One of the key questions here is: how can we imagine the labor demand of the next future?

Trying to give an answer, we have to compare what machines can do more effectively and efficiently than workers can and in what humans are (still) better.

Technology is going to replace human labor in all efficient and productive tasks (also intellectual tasks) and processes about what we have a large number of cases and solid statistics. Machines are consequently more effective also in known problem solving. Technology cannot substitute human beings in non-efficient or productive jobs or the ones that concerns new stuffs. Machines are also great in giving answer, but not in setting questions. Machines can solve problems using a rational approach, but fail with lateral thinking.

That means that skills like *creativity*, *empathy*, *problem finding*, *ethics*, *moral* and *justice* are going to be the most relevant human activity in the incoming future world of the self-driven cars.

According with the World Economic Forum Report, requested top skills in 2020 are going to be very different from the ones of the 2015, as clarified in the following graph.
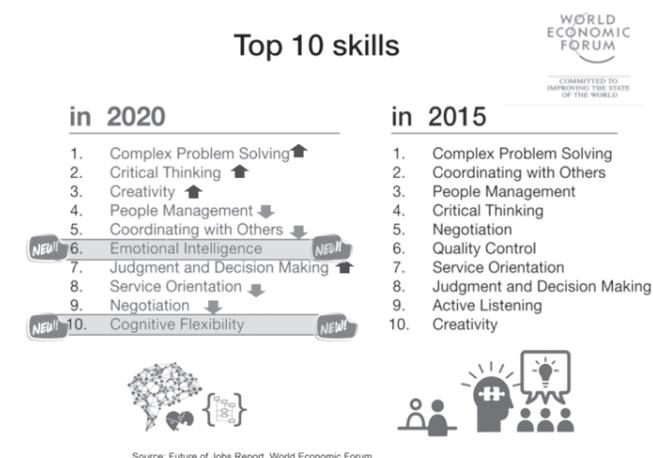

Top 10 skills

Figure 1. Top 10 skills in 2020 compared to the present

In particular top three skill are going to be *Complex problem solving* (that include problem setting), *Critical thinking* and *creativity*. New entries in the top ten (that probably are going to go up in the ranking) are: *Emotional intelligence* and *Cognitive flexibility*.

The clear fact is that the crucial competences of the future will be a group of soft skills that presently our education and training systems are not able to develop in learners and students.

Consequently, the present challenge of any educational system is to completely rethink the teaching system (and philosophy), making people able to self-develop these competences. It is not just an upgrade, it must be a revolution.

What can make student increase creativity, critical thinking and soft skills. Intrinsic motivation vs rewards

Previous industrial revolutions have left us an idea of students and workers (and largely human beings) as lazy people that can get results only by using procedures, punishments, rewards. Therefore, our institutions and organizations have created a system (including education) made by simple and boring tasks (easily controllable), procedures and rewards for good job and punishment for bad behaviors. At school, you have to study to get good marks, and you get good marks to obtain a well payed job. The simplistic idea is that you work hard to satisfy your needs and have happiness in the future. But long term never arrives: while you are satisfying present needs, new desires appear in your life.

What is the result? Bored people who hate their tasks (also studying at school), are not involved in their jobs and consider work and school as necessary evils they have to face before they can live their life (in the weekends and holidays, in the "future"). Those who have created this system are convinced that to improve productivity and make people do more, they must increase rewards. They are fans of extrinsic motivation. But the fact is that people are lazy demotivated just in consequence of this model and not independently.

The problem is that rewards and punishment can act only within a specific range. After a specific level or if you need creativity, passion, involving, simply they do not work. There is a large number of social experiment, done for nearly 40 years, that demonstrates that rewards for many tasks actually do not work or, often, do damages. In particular, if you design incentives to sharpen thinking and accelerate creativity, you just get the opposite; it blocks creativity and thinking (3).

According to Daniel Pink intrinsic motivation is the real significant factor to get the higher possible performance (in work, study and life) also developing soft skills like lateral thinking, creativity, emotional intelligence. In particular, walking around decades of scientific research on human motivation, he defines the main elements of intrinsic motivation: *autonomy*, *mastery*, and *purpose* (Pink, 2009). In brief, the *autonomy* can be considered the possibility (and the aspiration) to direct one's own live; the *mastery* is the impulse to improve and increase one's own competency and the *purpose* is the desire to do what we do in the service of something larger and more important. Pink's the three elements can be defined and named in different ways, but the sense is that intrinsic motivation is connected with the task and our relation with it. We are motivated if we feel we have the *power*, we are facing a *sustainable challenge*, and finding *a sense* in what we are doing.

The problem is that in education often we think (as teachers, professors, managers, parents and, often, also students) that a plan of rewards (connected with marks) is the best way to motivate students to get a high performance. Social science simply have demonstrated that we risk to obtain the exactly opposite result. In a way all turn around the so called "*Tom Sawyer effect*". As you can image, this effect is connected with a scene in the famous Mark Twain's novel. Tom faces the boring task of whitewashing Aunt Polly's 810-square-foot fence. Tom convinced his friend Ben that that was not a work, but an *opportunity*, obtaining that Ben payed him (his apple) in exchange to do that work. After Ben, other boys arrived and payed to whitewash the fence. Why? Because, according to Mark Twain: "*Work consists of whatever a body is obliged to do, and that Play consists of whatever a body is not obliged to do*". How we have created education, it appears as a system of tasks that student are obliged to do, consequently reaching a result, in terms of opportunities and level of competency. Marks are the rewards (or the way to reach it). Fail exams and follow again courses are the punishments.

Doing that, we are transforming learning (that is an intrinsically interesting and involving task) into a sort of duty and obligation. We are turning *play* into *work*. Consequently, we reduce intrinsic motivation, performance and creativity. That's the "Tom Sawyer effect", one of the most famous (but neglected) evidence in social science experiments, particularly inside schools (4). Here we have obtained a (solid) counterintuitive evidence: rewards are perhaps successful in the short-run (sometimes), but are not able to change behaviors in the long run. The *if-then* reward system has bad effects in the long term in many tasks. According to Daci "*Careful consideration of reward effects reported in 128 experiments lead to the conclusion that tangible rewards tend to have a substantially negative effect on intrinsic motivation. […] When institutions-families, schools, businesses, and athletic teams, for example-focus on the short-term and opt for controlling people's behavior*", they do considerable long-term damage (Deci, Ryan, Richard, 1999). We must consider that the aim of an education system is *to make people learn how to learn*. Therefore, the prospective of its action should be necessary oriented to the long run.

According to Robert Dilts, a strategy based on the *if-then* approach (rewards-punishment) can act only in the lower rung of the pyramid of (neuro)logical levels (5) (the levels of environment and behavior). And when punishments or rewards stop, people return to act as before: because in absence of constrains or pressures, behaviors are oriented to established personal values, identity, purpose (Dilts, 1999). If we want to obtain a long run change in behaviors, we should act on convictions and identity, and, if possible, values and mindfulness. Changing them, we are sure that, also in future, expected behaviors will be performed spontaneously, at least as far as values will not change.

Setting rewards, we narrow other's autonomy, so they associate their behavior to rewards (or punishment to avoid) and not to their own decisions or needs. They also consider their activity a work and not a pleasure, losing motivation and emotional impact.
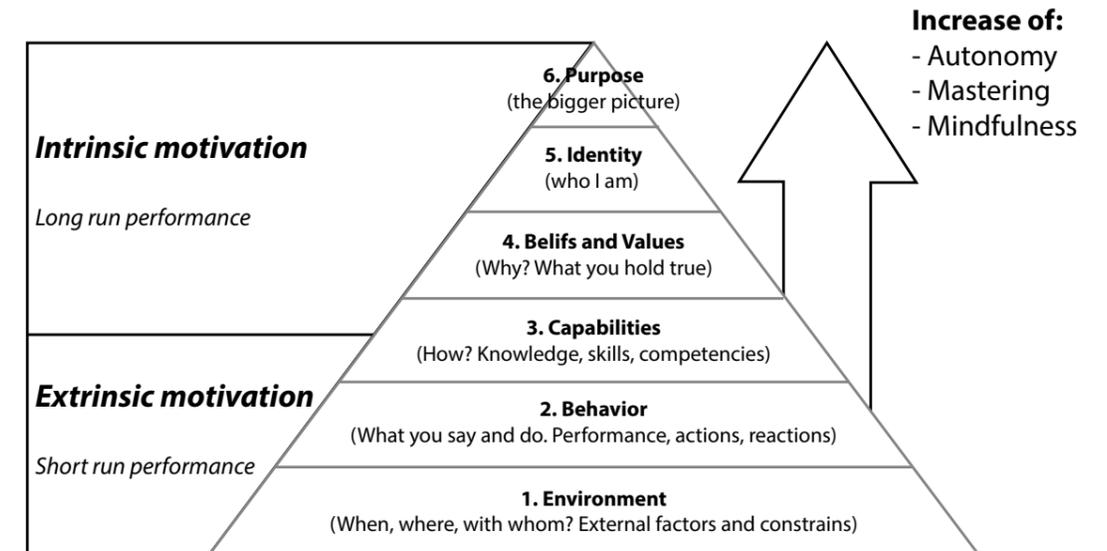

Figure 2. The (neuro)linguistic pyramids and motivation

We can agree with Reeve: "*people use rewards expecting to gain the benefit of increasing another person's motivation and behavior, but in so doing, they often incur the unintentional and hidden cost of undermining that person's intrinsic motivation toward the activity*" (Reeve, 2005).

The intrinsic motivation is, at the end, the only real powerful mean we have to make people be high performing in a changing context, especially if they are facing a creative job. And learning is the most important creative activity that characterize human beings.

The real challenge is now to bring *autonomy, mastering and prospective* into the teaching system, to make student be able to manage their own learning path, follow their passions, experiment a particular moment of their creative process called *the flow*. According to Mihaly Csikszentmihalyi when you live the *flow* all your focus is on what you are doing in that moment, your intrinsic motivation is at its highest level, and your full enjoy is in doing what you are doing. Teaching can help people to understand how to find their own capabilities and how to get (and maintain) satisfaction in learning during all their life. According with this approach, the goal of learning must be to understand what is happening around us and develop a personally meaningful sense of the world: the end of formal education should be the start of a different kind of education that is motivated intrinsically (Csikszentmihalyi, 2008).

The flow is a creative situation in which we find ourselves when we think that we are in front of a challenge more difficult than the average, and that asks mastering a high level of skill. The challenging task looks hard but practicable to us. According to Csikszentmihalyi, to make *flow* acting, we have to look at two variables: the amount of challenge people experience at that moment and the level of skills that they feel they have at that moment. Obviously this situation is different for anyone, so we can imagine different "average points" (the center of the diagram below), moving from which we obtain different reaction in people's motivation in different fields (Csikszentmihalyi, 2008; 2013).
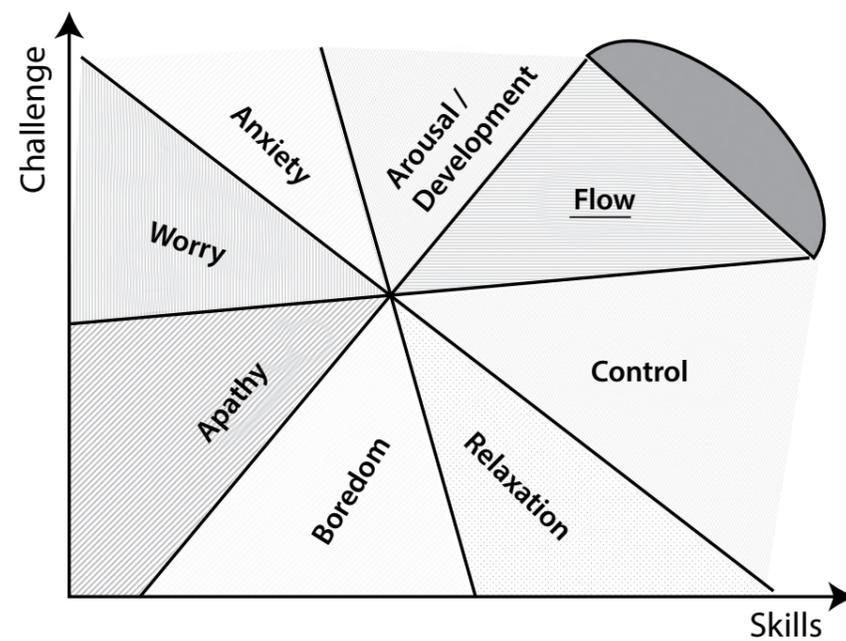
Figure 3. The "flow" according to Csikszentmihalyi

Following this point of view, you will be in the "flow", when you feel that both challenges and skills are higher than average, and you are doing what you really like to do (that can be very different from one to another). Of course, feel the challenge means that you want to do that activity and you are intrinsically motivated to do it.

In the graph, you can also see the other different situations you can face if you are out of the flow channel (6). Staying to the right side of the graph make you get a positive motivation. As you can image, apathy is the worst situation: there is no challenge and you are not using your skills (so you are losing them). Unfortunately, according to researchers, it is the most common situation among people.

Learning is a process that can make you arrive to experiment *the flow* starting, for example, from the arousal area. There, you are motivated by the challenge, but just you need a little more skills.

When we want to create a new idea of creative workers, our goal as teachers is to make learning a flow experience, and, consequently, to help anyone to stay in this productive and enjoyable situation also out of the formal education context. That means that we have to consider that any student is different, has different passions and way to learn. Therefore, we have to personalize our teaching strategy and create a new curriculum counseling system to help them to find what they really like (to learn). In this work, we will only consider the first aspect, but the second one remains crucial for our aim.

Metacognitive strategies and Constructivism

Use a metacognitive learning strategy means to make students think about how they think. More largely, it is a complex system that should help learners to understand and control their cognitive performance.

It means increase autonomy, self-confidence, self-efficacy, and, at the end, intrinsic motivation to learn. The aim of this approach is to make people be independent and responsible of their learning, aware of how they learn, conscious of what they have to learn to reach the skills they need, and mindful of what strategies they can use to reach their goal (Hacker, Dunlosky, Graesser, 2009).

According to other authors, metacognition enables students to be more active in their learning, activating all of their resources in order to have successful learning experiences. In order to do this, they should know how they learn: all the steps that they follow and the means they use to acquire knowledge, solve problems, and perform tasks (Gagné, Leblanc, Rousseau, 2009).

Metacognition consist in two interacting processes: knowledge (of factors that influence the performance and possible learning strategies for learning) and regulation (setting learning goals, monitoring evaluating results). Understanding their learning way, students gain control of their learning process and gradually develop the ability to master their mental processes more effectively. Inside a course designed to develop autonomy, you have to provide systems to help learners finding their own metacognitive strategy.

Using a metacognitive approach in education means make students able to follow their own cognitive system, passions and motivation, finding their well-suited learning tools. It also means that any problem or difficulties on learning (even dyslexia or dyscalculia) is solved without adopt a different teaching strategy. Difficulties on learning just disappears because they have never existed. They really represent problems in *teaching* and not in learning: have a standard teaching system is an attempt to standardize the learning process, but it is a big mistake that make the largest part of learners lose their motivation. In fact, there are infinite learning paths any student can choose and any student has her/his own learning system that should be helped to find autonomously. And it has been demonstrate that when students can manage their own performance on a task, they perform better and their learning is more meaningful.

A metacognitive teaching strategy can be realized adopting a *constructivist approach*. According to the Constructivism, people "construct" their knowledge through experiencing things and reflecting on those experiences. In this order of things, learning is an active process; knowledge is constructed from experience and shaped by them. On this point of view, learning is a personal interpretation of the world (Jonassen, 1991).

A Constructivist approach can help students to pursue their personal interests, to use and develop their capabilities, start a life-long learning path. Applying constructivism in the classroom means pose problems that are or will be relevant for students. In this context, teacher should encourage and accept student autonomy and initiative; use a wide variety of materials, in particular interactive ones, encourage students to ask questions to each other and assess students' understanding through application and performance of open-structured tasks (Brooks, Brooks, 1993). For that reason, technology can really help to personalize teaching, helping teacher and learner to find the best learning path (Ganatra, 2012). But, as I demonstrated in other works, new technologies can be a real decisive factor only if there is a different way of teaching (Petrocelli, 2016), otherwise it remain actual the well-known assumption of the "*no significant difference phenomenon*" of elearning (7).

Learners, experiencing the world, create subjective representations of the reality, based on senses (vision, audition, tact, olfaction and taste), language and meaning. People describe and understand the world in terms of different sense-based subjective representations, usually preferring one sense to the others. Any student will think and remember by using a different sense and need to put his

learning inside a bigger picture of knowledge. A better-organized way to learn can be obtained by the harmonization of knowledge delivery and by using all possible channels (textual, audio, visual, feelings, and virtual experiences). Students, also, have different capabilities, interests, expectations and learning strategies. They learn by adopting different personal information strategies, in this way they integrate new information items into an existing logical scheme, in different ways. This process has, of course, implications for learning and consequently should have consequences in teaching (Hershkovitz, Abu-Kishk, Bergman, Nachmias, 2009).

In this context, as we will better express in following paragraphs, eLearning tools are fundamental to make this revolution.

Trying to follow a constructivist *and* metacognitive approach in education, we can do lots of different activities inside courses, in pre and post training activities and in any learning experience, for example:

- Start making student think about what they know about the topic. They can start from their own cognitive map and insert new concepts and reflections inside it
- Ask questions and ask students to question about the topic and the relations between it and their world
- Enforce collaborative learning and ask learners to reflect on the role they play when problem solving in teams
- Encourage learners to critically analyze their own assumptions and how this may have influenced their learning
- If it is possible, teach metacognitive strategies as a part of the course
- Make students think aloud, it helps them to consciously monitor and reflect upon what they are learning (the teacher should do the same)
- Explicit Teaching Model: it can help students understand what is expected of them through a clear example of a skill or concept
- Promote Autonomous Learning or from other students
- Promote experiences where novices can observe the proficient use of a skill and then gain access to the metacognitive strategies of someone who can become their mentors
- Self-explanation. Self-explanation in writing or speaking can help learners improve their comprehension of a difficult subject
- Provide Opportunities for Making Errors. When learners are given the opportunity to make errors while in training, such as during simulations, it stimulates reflection on the causes of their errors. Creativity and innovation are the result of a long list of errors

In particular, we can use technology to:

- emphasizes *problem setting* and *problem solving*, also by using authentic tasks, experiences, assessments
- present content holistically, not in separate smaller parts, able to create a big picture that learners can explore following their own interests, preferences, ideas, times
- Put out problems of emerging relevance to students, coming from their life, their social context and their real-world experiences
- Seek and value any students' points of view

Learning tools for a new teaching strategy

Previous considerations bring us to consider some aspects designing our courses, that I can here recapitulate:

- Skills needed in the incoming future regard creativity, critical thinking, problem setting, self-motivation, life-long learning, ethics, social competences
- Intrinsic motivation is more important than extrinsic when we want to obtain high performance, in particular in creative and innovative tasks and jobs
- Intrinsic motivation is connected with autonomy, mastery and meaningfulness
- The top performance is obtained in the *flow area*, when people feel that both challenge of the job and their own skills are higher than average (in that moment intrinsic motivation is at the highest level)
- For a creative long-life learning any student must find her or his own strategy, developing metacognitive skills
- To be motivated, they must be involved in what they are learning

It is clear that tools are factors only if they are considered inside a teaching strategy with clear targets and based on different learning strategies of students. Professors and teachers should modify their approach every year, preparing their next class, by using the feedbacks coming from previous years. For teachers it seems to be very difficult to understand that, before all, they should be learners about teaching methods, and they should be worried about that, in the same way they feel important to upgrade their knowledge in the subjects they teach.

Generally, we can consider that classroom (virtual and in presence), social media, online course, tutors' support, simulations, games, virtual experiences and laboratories are all a set of stimuli that can delivery concepts and, more, they can make student build their knowledge along their skills and capabilities, also making them use all their senses, and any learning strategy.

Lessons (both in eLearning and in presence) should maintain an high level of focus and motivation and should consider all the sensorial channels (video, audio and kinesthetic), using and continuously combining them. They also should have one or more puzzles inside, coming from the real world and the life context of students. That contribute to create a *feeling of suspense* that make people be focused on what's happening. Closing a lesson with a question that will be solved in the following one, could be also another interesting way to capture focus of students and make them start with the other lesson with interest and curiosity. Our brain continues to think to unsolved questions, so it will be involved studying the next topic (Cialdini, 2017). In other words, put a little mystery in your lessons (Cialdini, 2005) because mysteries are stories (and you want to follow the story), hold the audience's focus until the end and make audience pay attention to details (that are imports when you have to solve an enigma). Simulations and games are very powerful instruments to develop proactive behavior and increase students' motivation. Lots of recent researches show how games should be useful inside a learning strategy and how it could be possible to coordinate their usage with the complexity of contents (Chen, Liao, Cheng, Yeh, Chan, 2012, Panoutsopoulos, Sampson, 2012). Designing the education game/simulation (and before to decide if to undertake it) means to analyze purpose (also in terms of motivation and students' behaviors), expected outcomes and results of the teaching path, and, finally, find the way to get there (Yang, 2014).

Of course maps, charts, team works are all well-known effective learning tools inside our teaching strategy. Another very interesting (unexpressed) learning tool should be the blog. Blogs facilitate information organization, inside a constructive cognitive process that can make learning more effective by a personal external representation of information (managing information, the writer relates them to the context of its future research and use), facilitating new knowledge creation and, therefore, autonomous learning. In addition, when learners reflect and monitor their own learning in public, the level of self-regulation increases, rising self-efficacy. Working independently in a positive environment should increase self-efficacy for that task in the future. Blogs are not only tools for self-expression or social interaction, but they also have the potential to influence the cognitive processes of learning (Baggetun, Wasson, 2006; Yeo, Lee, 2014). But the most powerful tool you need to make people learn remains the personal relation with them. You should have your students in your mind in any phase of the learning process. Projecting courses and learning tools, you should use all the possible strategies, making information flow by all the senses, also helping both the analogic and synthetic approaches. That is why the media integration is so important. Also video-lessons are important and the way what we are teaching is delivered by using the subjective world of any students. Real life exempla and metaphors are the best way to help the learning process from the tacit to the explicit Knowledge. When, after, you can personally enter in contact with your students, the tutoring and the coaching aspect of your work must do its job. Therefore, you have to address any student to their own specific learning path, helping them to put any concept, information or communication element in their representative system in the right way. Then, you can use different teaching tools to personalize the learning experiences inside the redundant learning world you created by projecting your online course (Petrocelli, 2015).

The new teaching/learning system in the Economic courses at Marconi University. First results

At Marconi University's Economic classes, we are trying to experiment new teaching systems until several years. Explaining economics, you must talk about a changing world, full of connections and proactive and virtual situations. Designing our courses, we want to build a bridge with business training, searching a new learning way to create a knowledge creating system, more than the sum of different learning objects. And also encouraging the development of creativity, problem setting and problem solving skills. Consequently, we think that it is important to give students new points of view and new models to help them to understand what is going on. Our project have involved the design of new courses, which would develop both technical and problem solving skills, allowing for a creation of a sort of laboratory where students could deal with new paradigms and new ideas. In particular, redesigning the courses in Economics and Monetary Economics we:

- extended contents of the course by giving different prospective and paradigms (by changing the point of view often used)
- provide video-lessons based on questions and real world evidence
- introduced new interactive teaching/learning tools, allowing students to deal with complex changing systems, in particular simulations and serious games
- enforced collaboration among students in specific virtual classrooms
- asked students to question and propose different solutions for the same problem

We are also working on the creation of a laboratory where students can develop a new systemic and holistic way of thinking. Simulations are our most powerful tool, even if it is not the only one. With our simulations we are able to drive concepts, paradigms, but overall the sense of the knowledge evolution and, with our latest projects, making students (and learners in general) able to understand the value of collaboration. The goal has been to make students think in a strategic way, teaching them to build their own paradigm to explain real world. Generally, we introduce a role-playing tool (in this case a simulation or a serious game) when we want to make people develop problem-solving strategies in a complex system (8), thinking in a lateral way, considering the system both as the addition of its parts and as a whole. (Petrocelli, 2014; 2015).
We have also extended the use of simulations inside all business training and education, increasing learners' performance inside complex social systems and the speed of their own response in case of unexpected events (in business it is useful to manage crisis in advance, for example).
The most important simulation we are using in our courses and training are:

- *Macroeconomic Simulation* (9): the first simulation realized inside an academic course: the student play the role of the leader of a country, and has to complete his mandate satisficing families, workers, enterprises, financial system, by choosing the right economic policies
- *The crisis at Dubai*: there is a presentation of the financial crisis of Dubai during 2010 and 2011. In the serious game the learner is the Emir who has the possibility to find a solution to the crisis
- *Seles network Simulation*: the first simulation usable on PCs and mobile, the student play the role of the commercial director of an enterprise with a large international commercial network, in 5 years the learner have to achieve the targets, choosing the right tools and strategies
- *Management of the Financial Business System and Source of Finance simulation*: the student play as the CEO of a very indebted firm that must solve the financial problems, ensuring investments, by using different financial tools available in the international market
- *Simulation about productive offshoring*: the learner plays as the production manager of a Multinational Company who has to decide where, what and how much to produce, in which countries to deliver their investments, which professional figures to use, etc.
- *Logistic System Simulation*: this simulation is oriented to develop cooperative behaviors among students involved in the game. It is a multiplayer platform with a dynamic simulator where it is possible to play up for 4 players at the same time, that plays as Purchasing, Production, Warehouse, Sales and Marketing Managers. Organizational targets can be reached only if all the team cooperate. The roles can be also played by the computer, that can behave in a strategic way

The first two simulation are our first generation serious games (based on flash and available only on the PCs). The others represent our simulations 2.0, usable also on mobile devices and oriented more to a business context.
In all simulations you can find the crucial aspect of gamification:

- contents are primary given by Non Playing Characters inside the context of the game
- learners can experiment in a real life situation the use of theories and concepts
- there are several different variables and behaviors, so the students have to consider the consequences of their decisions in an holistic way
- there are different levels, so students can choose the one that fits better to their skill level,
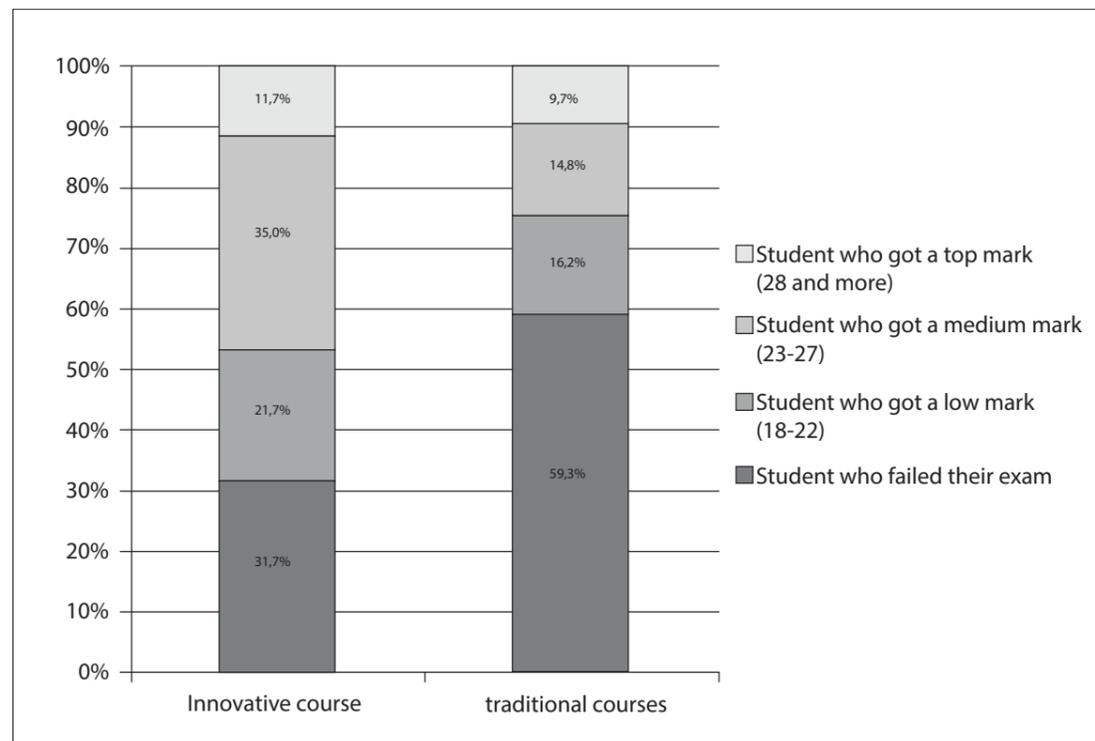
choosing higher levels when their expertise rises up, making them remain in the "flow state" of Csikszentmihalyi
- there are also random levels, so it is possible to explore unknown and very hypothetical situation, never having the same scenario, increasing the challenge if the skills are at the top
- the game provides frequent feedbacks, one at the end of any turn of game

Our last simulation about Logistic System has another important element: show the value of collaboration and help to develop behaviors based on collaboration (10). In the simulation, as in the real life, the success of the business not only depends on single initiatives but on coordinated actions of team members. If anyone is only focused on their own goals and activities, they will surely fail as a group Is our strategy working? We can try to analyze quantitative and qualitative effects on real students of our approach
On the quantitative side, we have compared the results achieved by students of "innovative classes" with the ones of traditional courses of equivalent subjects, in the same University.
The following graph shows the evidence (Petrocelli, 2016).

Also talking about the marks, we can note that in *innovative classes* there are higher levels of top performers than in traditional ones (11,7% against the 9,7%). In addition, in our innovative course, the 68% of students gets a medium or high mark. In the traditional courses only the 41%.
Under the qualitative aspect, we have seen that in the innovative courses:

- Students generally enjoy the class
- Students who played the simulations, on average, decide to do it again for several times
- In their final thesis, students ask to study complex aspects of the reality, preferring project works to non-research dissertations
- They try to find out new ideas and solutions for new and old problems

Figure 4. The quantitative results of an innovative course

First evidence: inside innovative courses the **68,3%** of students passed their exam, against only the **40,7%** of traditional ones. It means that these tools can make students understand better all the concepts and the tools. That because they are more motivated to learn, and they can experiment in their real life what they are studying.

Note

(1) "The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. The Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. There are three reasons why today's transformations represent not merely a prolongation of the Third Industrial Revolution but rather the arrival of a Fourth and distinct one: velocity, scope, and systems impact" (Schwab, 2015).

(2) The O-ring theory of economic development is a model of economic development, by Michael Kremer, according to which high level production is possible only if all the tasks are executed at the same high level. The name comes from the 1986 Challenger shuttle disaster, a catastrophe caused by the failure of a single O-ring of the space missile.

(3) For a very large review of the experiments demonstrating that the "Carrots and Sticks" approach very often doesn't work see Deci, Ryan, Richard, 1999.

(4) One of the famous experiment was the Mark Lepper, David Greene and Robert Nisbett's one. They watched a classroom of preschoolers for several days and identified the children who like to spend their "free play" time drawing. They divided the children into three groups. The first was the "expected-award" group who they promise a certificate as reward for drawing. The second group was the "unexpected-award" group: children were asked to draw, and at the end, they give them the certificate. The third group was the "no-award" group. Researchers asked these children if they wanted to draw, but neither promised them a certificate nor gave them one at the end. Some weeks later, back in the classroom, teachers observed that children previously in the "unexpected-award" and "no-award" groups drew just as much, and with the same relish, as they had before the experiment. Instead, children in the first group showed much less interest and spent much less time drawing. For them, now drawing is a work, not more a play (Lepper, Greene, Nisbett, 1973). Lepper and Greene replicated these results in several subsequent experiments with children. Similar results are found also with adults.

(5) According with Dilts, They define six levels of thinking or situation: environment, behavior, capability or competence, beliefs, identity and spirituality/purpose. They are set in a hierarchy, if it seems impossible to solve a problem at any level, it is possible to overtake the block by changing something at the superior level. Any level can be also explained by some questions. *Environment* is about the external conditions in which behavior with is opportunities and constraints. The questions answered at this level are "Where?", "When?", "With whom?". *Behavior* regards actions and reactions by an individual within the environment: a person operating at this level will be describing what they thought and did, and what effect that had. The connected question is What? *Capability* is the 'how?' level: people operating at this level, are thinking about 'how' (in terms of skills and capabilities) to achieve goals. *Belief and value* is the level of 'why?': the reasons behind the behavior, including any underlying values. Beliefs and values can either reinforce or undermine capabilities. *Identity* regard 'who' you are, and could be considered as the sense of self. *Spirituality and purpose* level regards the big picture in the mindfulness of the person, and answer to the question "for what o for whom?" This, as the *wisdom* level and others exclude it altogether, or link it to identity, as being part of how you see yourself.

(6) Arousal is the area where you feel the challenge, but you think you have not enough skills. Control is our "comfortable area", where we can manage situation, but you are not motivated do make changes or innovate. Relaxation has good effects, but it is not a situation to stay too much. The other ones are the negative areas. (Csikszentmihalyi, 2008).

(7) The "no significant difference phenomenon" has been the result of several researches, over the years, that compared traditional classroom lessons with other learning media (video and audio lessons delivered by tv or online, using mobile devices, etc.). Replacing one technology with another, without any change in how we intend teaching, will have little impact on learning. In another article, I demonstrated that, otherwise, we do obtain relevant gains if we change technologies but using new teaching paradigms, able to face the digital learning environments.

(8) Complex systems are counter-intuitive: when you link a large number of variables, you consider only few relations that you consider dominant in your representative system. Going from one variable to the next, you continue to determinate a causal-effect correlation (not necessarily true), based on very few relations only by using linear thinking, modelling the reality on your way of thinking, obtaining very big mistakes. By using a simulation, than can correctly connect many of the known variables, considering most of the strong and weak relations among them, you can extend your map and consider secondary interactions, in particular if you are facing human or social strategic behaviors.

(9) In 2013, thanks to this serious game, the Marconi University was awarded as "The best e-learning solution at the higher educational establishments and educational centers", within the E-Learn expo in Moscow.

(10) An interesting aspect is the relation between the nature of simulation and its social effects. It means that activities from a video game translates into activities outside of the game environment, in the social real life. Experiments demonstrated that prosocial activities within the game (for example games in which you have to save or help someone else) would encourage prosocial activities in the real world, making people more oriented to help the others in different contexts (Kapp, 2012; Gentile, et al. 2009).

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Sintesi

Nuove competenze sono oggi richieste dal mondo del lavoro. Gli obiettivi dell'educazione del futuro, nella cosiddetta "New Machine Age", devono rendere gli studenti in grado di comprendere a fondo gli argomenti, sviluppare il proprio sistema di conoscenza e creatività, potenziare il pensiero laterale, contemplando i problemi da più angolature, cercare soluzioni che comprendano la pluralità dei punti di vista. Secondo il World Economic Forum, infatti, le migliori competenze nel 2020 dovranno includere creatività, pensiero critico, intelligenza emotiva e flessibilità cognitiva.

Come è possibile costruire queste abilità? Una possibile risposta riguarda l'approccio metacognitivo. Il che significa insegnare agli studenti – nell'insegnamento a distanza - come trovare la propria strategia, attivando il controllo personale sui risultati accademici, ma anche capire come funziona la loro mente, come possono imparare, come possono impostare obiettivi corretti, misurare i risultati in un sistema di valutazione dinamico. Questa pluralità dinamica di approccio può risolvere problemi o difficoltà diversi nell'apprendimento (anche dislessia o discalculia) senza creare un percorso di apprendimento individualmente personalizzato, poiché ogni studente può scegliere tra gli infiniti percorsi di apprendimento a disposizione. Ogni studente ha il proprio sistema di apprendimento e può trovare autonomamente il metodo di insegnamento per lui più efficace e idoneo al raggiungimento di risultati soddisfacenti. La motivazione è il punto chiave del modello. Il docente dovrebbe motivare gli studenti e aiutarli a comprendere le proprie capacità e come funziona il loro sistema metacognitivo, anche in un sistema di apprendimento a distanza.

Il futuro presenta nuove esigenze e richiede competenze soft di lavoro. La letteratura sugli approcci metacognitivi delinea un nuovo paradigma di insegnamento basato sull'autoregolamentazione inclusiva e autoregolata. L'educazione a distanza offre una modalità sistemica e di sintesi relativamente a strumenti avanzati e approcci innovativi. I corsi di economia dell'USGM costituiscono una riflessione e insieme un'applicazione del pensiero metacognitivo.