Using "creativity techniques" to improve a pedagogical reform process. Impact on the reform speed and efficiency

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Abstract: Since a few years, we observe in our electronic and computer engineer school, a kind of increasing gap between the student's needs and what we gave to them. Thus, a deep pedagogical reform as well on the bottom as on the form has been engaged. We first expose the reasons and necessity of the reform. Then we point out the classical difficulties and locks in front of this necessity. And we show how "creativity techniques" classically used in business school, can be transposed in a scientific school to make the reform process more receivable and efficient. Some concrete examples are given to illustrate this approach.

Key words: Pedagogical reform, student's creativity, brain modelling, human behaviour exploration,

1. Introduction

1.1 ENSEIRB engineer school presentation

The "Ecole Nationale Supérieure d'Electronique, Informatique et Radiocommunications de Bordeaux" is one of the graduate national engineering schools, known as 'Grandes Ecoles', in France. It is also one of the oldest, as it was founded in 1920.

ENSEIRB has developed with the growth of information and communication technologies. The Computer Science Department was created in 1986 to complement the original Electronics Department and was followed in 2000 by the new Telecommunications Department.

1.2 Pedagogical reform

Since a few years, we observe in our electronic and computers engineer school, a kind of increasing gap between the student's needs and what we gave to them. A global disaffection for all theoretical lessons appeared and our traditional pedagogical reached its limits.

These tendencies we noticed in our school are confirmed by French national statistics: there is a global demotivation for the scientific curriculum. Economical, commercial studies seem to be now more attractive for this new generation of students.

In front of this situation, a Quality program has then been engaged in our school inducing a deep pedagogical reform as well on the bottom as on the form. All the scientific, electronic, and other engineering fields of the ENSEIRB program will have to be reformatted. Each one of us had to suggest improvement, modification in each own field of competence.

1.3 Classical resistances in reforming

We often practice what we call "mismatching" in Neuro Linguistic Programming words [2], in front of a new situation. We know all the small "killing" sentences: "Yes but…" "That will never go... "it is good for the others but not for us because we are a special case !". This is often a manner to reject something without thinking about before. This is also the best way to lock a situation (like closing a door and forgetting to look behind).

1.4. Energy mobilisation for reforming

In front of these normal and traditional human reactions, it is often difficult to mobilize energies necessary to the reform process. A good idea then consists in using the executives motivated by the operation and also the students directly concerned with the reform.

Whereas the engagement of a reform requires a spirit of opening and innovation, some well known behaviour imposes mental brakes and limits: By fear, one hesitates to imply the students in the process by estimating

sometimes that the reform looks at only the teachers and the executives of the School.

Not to consult the students is a example of these restrictive attitudes, because one cuts oneself then of a feed back information and invaluable creativity source.

Obviously, to associate the students is not in our culture. One needs much humility to accept this idea. To pass over these difficulties, an answer (among others) consists, starting from a core of motivated people, in launching the operations despite the reserves and objections. And then, we hope that there will be an extension or a positive contamination to the global structure.

2. What are creativity techniques?

The techniques of creativity are abundantly used in the industrial, commercial, publicity domains. They make it possible to bring to the community or the "decision makers" of a company, in a minimum time and with a best performance, new ideas and concept. It is really a management tool. It can be used in the definitions and the development of new products, marketing strategy, as well as for the personal development.

They are based primarily on the knowledge and the exploration of the human behaviours. Taught in the business and trade school since a long time, they are not well known in the scientific fields.

Simple to apply, their credibility in the scientific fields is often questioned, for lack of rational and mathematical evidence of their effectiveness. The transposition of these techniques in the scientific school is all the more difficult. A preliminary work intended to make the transfer easier, is thus essential.

2.1 Creativity basics

The concept of creativity is founded on three assertions:[3]

The first is "everyone is creative". This postulate can be used with the first level of language. It can also return to a spiritual and divine connotation related to the human condition and to the origin of the initial life.

One also finds this postulate in the explanations provided by the psychotherapists to their patients locked in certain mental diagrams and/or limited in their actions.

The second assertion is: "my logic is to break the logic". To apply this assertion process at any moment of the process, gives the opportunity to maximize the chances of success by allowing the questioning of all our beliefs, judgments, deeply anchored of each one.

The third assertion is that "the individual creativity is amplified and multiplied by the group effect". If each member of a group of 10 people has a new idea, the whole of the group will generate, not 10 new ideas, but between 2 and 10 times more (cf §2.1.1).

To make a creativity process successful, we give some keys hereafter:

– A neutral and enthusiast organizer [8]: the process must be supervised by an organizer external with the problems and familiar with the techniques of communication
– To leave the usual framework: to hold the seminar out of the daily work place, in order to release themselves from the constraint of the private or professional life, (to cut the mobile phone ...)
– Spontaneous (not self-censorship): the participants must feel free to express themselves in confidence and without fear of a restrictive judgement (internal or external). This requires a preliminary work of conditioning of the participants.
– Balanced mixture of "left and right" brain: a maximum creativity requires a harmonious distribution of the profiles of the participants. For this reason, the diagram of Herman (cf §2.1.2) can help the organizer at the beginning of seminar with the constitution of the "creativity groups".

2.1.1 Creativity individual mechanisms

The mechanisms of individual creativity appear starting from several processes:

– Association of ideas, images, words (related to the imaginary potential of a person, its past experiences, its visual, hearing or kinaesthetic resonance with possible situations)
– Analogy in an other application fields (for example : transposition of the use of the famous electric software of simulation SPICE to a chemical application such as modelling of molecules)
– "Individual delirious" (expressions of phantasms, repression or hiddenc desires)
– Back to the group (the group modifies transforms amplifies an idea deposited by one of its members, until a possible "group delirious")

2.1.2 Herrmann Human behaviour modelling [3]

Ned Herrmann, past manager of the formation at General Electric Company, developed a technique making it possible to easily know the cerebral preferences of an individual. At the beginning, this method was used to improve the efficiency of industrials team work by an optimized team constitution. Depending on the goals of each team (commercial, technical, management, etc) the association of perfectly chosen profiles was the guarantee of an effectiveness work. Today, this universally recognised method is intended for better understanding the preferences of an individual like his approach to particular problems.

It results in a representation of the human brain into four quadrants which correspond to the main four preferences of the individual.
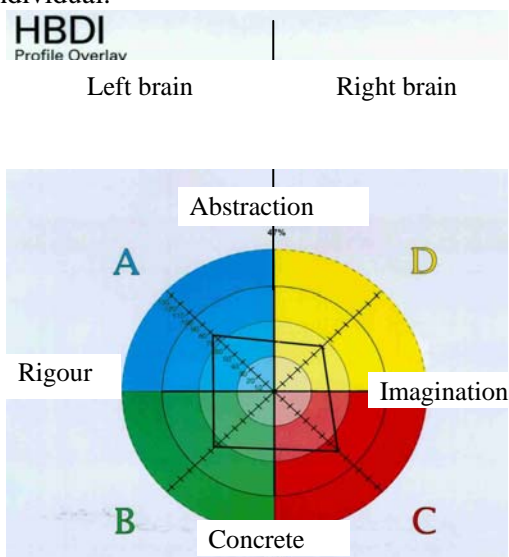

Figure 1 : Herrmann modelling

Quadrant A (blue) shows the preference of the individual for logic, modelling, (typical profile: mathematician, data processing specialist …)

B (green) its aptitude for the practice and planning (real time production scheduler, administrative profile…).

The quadrant D (yellow) shows the preference for the risk and projection in the future (typical profile: "start-up" manager, risk manager, artist…),

And C (red) for the relational one, emotion (typical profile: social and commercial workers…).

32 different profiles have been identified. But we can say that is no good or bad profiles; there are only different profiles which can be with mono or multi quadrants dominating.

Depending on the goals of the creativity seminar (finding a publicity for a new product, a new organization of a manufacturing factory, a new concept for a TV show…), the organizer, will have interest to mix (or not) different Herman profiles.

2.1.3 Herrmann modelling applied to seminar organization

Moreover, in order to be effective, the seminar of creativity must itself be in conformity with the Herman diagram:

Successful seminars [1] [6] [7] begin with a making of contact, mutual and reciprocal knowledge of the group (quadrant C). Then, they request the quadrant D making the participants conscious of their individual interest they have to follow this seminar.

Once charged interest, the motivation of the group is acquired. One thus undertakes the theorisation or the modelling of the problem to treat (quadrant A). At the end of the seminar, one decides on a calendar of application, priorities and miles stones, practical tools required (quadrant B). With this final step, all the quadrants were requested in an adequate order to improve adhesion of the listeners and their motivation for the task or teaching suggested. That makes it possible to maximise the chances of success of a seminar whatever it is.

2.2 Creativity seminar process [4]

In accordance with the §2.1.3, the seminar thus starts with making of contact, mutual and reciprocal knowledge of the group. (Request of the quadrant C). Then, the participants are invited to write on "a paper board", their interests and motivations to be taken part in the seminar (request of the quadrant D cf §2.1.3)

The seminar goes on with the constitution of groups of 5 to 10 people. With this intention, one invites the participants to sit down around tables: Unconsciously, the individuals gather by affinity. A first technique is then used to break this initial fitting. The organizer requires of the participants to be raised. Then it suggests with each one defining another participant as a fictitious target towards which it must move. This generates a general random movement, which is stopped by the organizer after a few minutes. Thus, at the end this movement, the participants are mixed by chance and can again sit down around the tables.

Each group appoints a reviewer and an internal organizer.

The work of creativity can then really start (request of quadrant A in the organization and seminar planning). Oral or written sessions of Brainstorming are organized with each table. The organizer is there to check the advance of the process and to start again if needed: indeed the individual process of creativity must be activated and then stimulated. Once engaged, the phenomenon is maintained and amplified by the group.

While using the mechanisms described in (cf §2.1.1), the seminar enters a phase of divergence which makes it possible to emerge a maximum of rough ideas. This phase can last several hours according to the topic or needs.
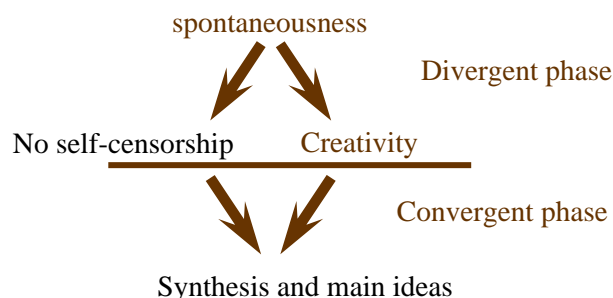

Figure 2 : creativity seminar process

All the ideas are then sorted, gathered by topics and are displayed in front of the whole of the participants. The process continues with the phase of convergence: among all the ideas, it is a necessary to select ideas likely to be usable. This selection is made by the group with a process of "positive choice": ` one keeps an idea for his qualities' instead of classically carrying out a negative elimination. This step is often delicate because our initial human conditioning did not accustom us to this positive selection. The seminar is then closed by the drafting of a report (request of the quadrant B in accordance with the §2.1.3) and the check of a possible application calendar of the adopted solutions.

3. Some concrete experimentation

3.1 Seminar efficiency validation
A mixed seminar ENSEIRB/BEM [6] made it possible to show the effectiveness of these techniques of creativity. We chose, like example support with the seminar, a technical realization of laboratory IXL: "an integrated circuit for obstacle detection in urban environment for blind people." [5]. Forty students of the B.E.M commercial school, divided into five groups supervised by two organizers worked during two full days about this topic. 1200 rough ideas in "brain storming" and divergent phase were generated. After a positive selection in phase of convergence, 40 ideas were retained. Among these ideas, between 5 and 10 could open to a later technical development and 2 or 3 were potentially patentable. From this concrete example, we have checked the effectiveness of these techniques of creativity. Indeed, it is practically impossible to obtain in a so short time, such a number of usable ideas, by another method that this one.

Then, we transposed this approach, in our school and in our field of teaching, as indicated in the following paragraph.

3.2 Practical example of creativity in pedagogical reform
After a long period of stability of our practical lesson of electronic in 2nd year studies, it became essential in year 2003, to consider a deep evolution. And we thus decided to apply the creativity process to this particular teaching field by associating our students it.

With this intention and not soliciting the students apart from school time, we thus replaced eight practical lessons by eight sessions of creativity. By group of 12 students and a four hours session, these "micro seminars" allowed to quickly define 2 new topics of interest in conformity with the wishes of the majority of the students:

    - Audio techniques: power class D amplifier, analogue mixer, various sound effects…

    - Digital modulation techniques: PSK and FSK processing.

These new practical models were produced then brought into service in the two following years [9]. These sessions also allowed to revise and to improve the contents of the texts of TP in the respect of the needs for the students.

3.3 Collateral consequences
Following these seminars, we noticed some unexpected improvements in the student motivation, group solidarity, goals definition, and team work spirit.

4. Discussion

"Nothing can be done without the human or against the human". But it is possible to obtain the adhesion and the implication of the people to a project of reform by using the adequate tools of communication. Obviously, this type of approach does not make it possible to overcome all the difficulties (in particular material and budgetary) but it makes it possible to federate the men around a joint project of evolution.

Many cultural locks did not make it possible to generalize this approach with the whole of our School. However, to use the "creativity tools" in our field of competence and responsibility is already a great step. Without that, our practical lessons could not have evolved/moved also quickly and with the support of the students.

Obviously, it is quite impossible to scientifically measure the impact of such work. What is sure is that this kind of approach improves the relations between the teachers and the students. A better confidence and mutual respect make the transmission of the knowledge easier and more effective. The global human environment of work is improved for everybody and the motivation too.

5. Conclusion

We showed in this paper that reforming something was not easy but necessary. Including and using "creativity tools" can be a good way to improve the reform process and to make it faster and more effective.

As it is possible neither to change the others nor to reform the whole system, the best is to start with oneself and its "small" field of activity.

In any case, the experimentation of this approach made it possible to become aware of the importance of the human behaviour in a process of reform: the most important is to never forget that human being is the key of everything.

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