ENTREPRENEURSHIP TRAINING IN TECHNOLOGIC UNIVERSITY BY MODELING

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ABSTRACT: *"What distinguishes early on the worst architect from the most expert of bee, is that she built the cell in her head befor building it in the beehive",* Karl Marx
*Although drawn from its context, the reflection of K. Marx is completely suitable to illustrate what we mean by problem building or "**problematization**". Problematize, it is therefore to represent a complex situation (Vander Borght, 2006). This representation is important because it carries actions. They're no longer working on the situation but rather on its performance. This situation encountered by the architect is it different from the one met by the engineer who develops an innovative product or an entrepreneur? One of the common characteristics of these various activities to project can be undertaken under consideration from a perspective view of problematization. This is the starting point that we used in our institution in order to build and to disseminate an approach and tools aiming to train engineering students to the problematization (problem building) specifically and to the management of activities in overall project. Indeed, situations that engineers are stationed to handle refer to this need of problematization.*
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KEYWORDS: *Modelling, entrepreneurship, project, cognitive management, engineering training*

1 PROBLEMATIZATION : BETWEEN STARTING OBSERVATIONS AND TOOLS DEVELOPMENT

Through this section, it is at first mainly to emerge the concept of problematization as a need in relation to situations that engineering students will have to manage in enterprise. Secondly, we present an approach that we developed in order to help the engineering students to problematize their project.

1.1 Starting point : twofold observations

The primary motivation of our reflection is mainly around two points regarding the engineering students who attend our courses of studies: a pressing increasingly presence of the activities for projects in the daily life of the engineers, and consequently the need for resorting to different modes of reasoning, adapted to the activities to project.

1.1.1 The importance of activities to project

The first observation refers to the position of the activities to project within the professional practices. Behind this interest for this activity, it is possible to discuss the democratization of the activities to project (Boutinet, 1993). As highlighted G. Garel (2003), the activity to projects is no longer, nowadays, the preserve of a few engineering specialists. This activity constitutes "*a typical form of modern culture*"; (Joly and al., 1994), even the modern capitalism, (Boltanski and Chiapello, 1999). It reflects the distance between current and repetitive activities which monopolize the daily life and the anticipation activities positioning themselves in the medium and long term. In other words, the enterprise must adapt to situations which are characterized not only by their variety but also by the fact they are never completely identical, requiring the introduction of innovative and imaginative approaches. Overall, as highlighted Martinet (2000), the situations faced by actors of the enterprise resemble increasingly to those that characterize the design and development of new products. To describe this situation, Midler (1993) talk about "contamination", of the daily functioning of the organizations by the activities to projects.

1.1.2 Modes of reasoning: the problemmatization in the heart of activities to project

If we consider that the activities to project that should be managed by the engineering students are different from

the activities related to the trade, it is suggested to question themselves on the reasoning modes that they will have to mobilize. From this, the activities to project such as entrepreneurship, innovation, creativity or the invention have in common to establish so-called situation "opened situation". An opened situation, according to Fabre (2006) is a situation in which the data are not known. Thus, it is possible to identify two parts in a situation bringing up different modes of reasoning: the problematization of the situation and resolution of the problem. Problematization is the construction of the situation. Indeed, very often in the activities to project, the situation's data are unknown; the situation is to construct (Schmitt, 2009). In addition, the resolution of the problem occurs when the data of the situation are known. From this point of view, there are many tools for solving this problem. Firstly, in the field of entrepreneurship, let us quote the business plan which is a tool widely used in the piloting of the activities to project (Christmas and Séniocourt, 2003).

In the opposite, it is clear the relative weakness of tools dedicated to the construction of situations in comparison to the abundance of tools dedicated to the resolution of the problem. Very often this phase is done empirically, or problematize is not improvised. These different observations lead us to advance much of difficulties encountered by entrepreneurs are more related to the construction of situations than the resolution of the problem, i.e., the implementation of solutions.

Beyond this observation of weakness, it is necessary to emphasize that problematization and problem solving should be envisaged in a dialogical way but not in a separate and in a linear way. It is advisable here to remind of the "Ménon dilemma[1]", i.e. which one from the problematization or the resolution of the problem is the most important. Focusing on the problematization risk to minimize the resolution of the problem step which is an integral part of the process. Although the problematization is an important element in the activities to project, it should not be considered separately from the resolution of the problem. Indeed, the resolution of the problem can be seen as a local restructuring of the situation-space in a debatable under development (Hoc, 1996).

Based on this double observation, the institution has undertaken since 2002 to set up a training program allowing articulating both sides of the situations that the engineering students will have to manage: the activities to project and problematization. For this, we have resort to a singular activity to project: Entrepreneurship.

1.2 Tools to problematize : presentation of the approach ideo

If the problem is essentially to build a situation more than to resolve it, it is important to develop initiatives going in that direction. The approach that we developed, called ideo[©2] inspired directly from the canonical form of the general system of J-L Le Moigne (1990). To tackle the entrepreneurial project, it is possible to represent it through and by a system in order "to be able to debrief all of all types of complexity that can be considered" (Le Moigne, 1990). More precisely, it is possible to consider the entrepreneurial project around elements like activity, processing, context and teleology.

Compared to this approach, our position has been the one of facilitator in the sense of P. Caillé (1991), insofar as we worked to bring the engineering students to ask themselves questions in order to problematize their project.
It remains to specify a point of view more instrumental of the elements that make up this problematization process of the entrepreneurial project

Figure 1.- Presentation of the approach Idéo[©]
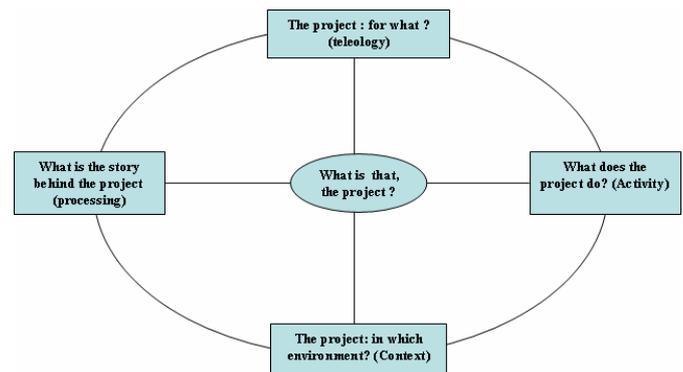
The aim, through these different issues, therefore consists to enable engineering students to learn in action and in reflection; so that the project becomes an essential tool in relation to different situations that they will have to manage in their professional career. It is thus to provide benchmarks and to promote the expression of the entrepreneurial project. The continuation of our intention is to present these various questions:

1.- "**What is that, the project?**". This exercise allows not only the teacher facilitator "to appropriate the project" but also to enable project carriers to formalize around two exercises. The first one is to summarize in one sentence the project. It is relatively dependent on the organization vision carried out by the idea carrier and exchanges with the rest of the group. The second exercise consists in drawing the project. This effort of representation allows extending the first exercise by allowing the expression of things that are not in writing mode.

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[1] Ménon dilemma can be expressed as follows: "if I don't know what I seek, how could I ever find it? And if I already know it, what is the point of seeking for it?"

[2] Idée au Développement de l'Opportunité (Idea to Development and Opportunity)

2.- **"The project is for what?".** It is here to inform from the following questions: to whom this project is beneficial? On what, does the project act? For what purpose this project exists? The answers to these questions will help to confront the finality of the project expressed to the contextual elements of it. In particular, that brings the engineering students to ask questions in relation to the potential customers (which form takes the customer?) and in realtion to the competition (how I position my project in comparison to what already exists? but ultimately what is already exists?). These issues will require from the engineering students to gather information in relation to these elements in order to validate their intuitions.

3.- "**What does the project do?".** The objective here is to describe the various activities related to the project. Beyond the activity, information brought here help to learn about resources and the results of the activity. This question refers to a projective representation of what will be the activity in a daily operation. Once again, this allows sizing the project and putting these elements into coherence between them. While engineering students feel that their project needs 2 or 3 people, this is not the same like if they had a dozen.

4.- "**What environment for the project?**". It is here to inform about the different environments related to the project and the project carriers (technical, political, economic, legal, cultural, geographical …) in relation to the activities and to the finality of the project. It is important to know the elements of context that may affect the structuring of the organization. These various projects encourage questioning a priori.

5.- « **What is the story behind the project ?** ». In a general way, the engineering students are invited to position themselves in relation to the three periods of time: past, present and future. The first period of time consists to question oneself on projects that may already exist, and also to understand how evolve demand and competition. The second one is to take current decisions which concern the projects in the light of the previously proposed text. Finally, the last period of time refers to the project development in the medium and long term. It is therefore here to include the project in a dynamic perspective.

To further emphasize on the need of problematizing, let us specify that the approach presented doesn't take much time, between 5 and 10 hours, and then helps to save time from the moment the project is well defined. In relation to these factors, it is necessary to consider these various issues repeatedly. Indeed, although it often begins by informing about the nature of the project (the project, what is that?), the answer to this question doesn't remain static. It is re-examined when addressing the various issues. It is not uncommon in situation to see where the engineering students modify, adjust the initial question.

2 DEVELOPMENT OF ENTREPRENEURSHIP TRAINING ABOUT PROBLEMATIZATION IN AN ENGINEERING SCHOOL

Entrepreneurship training developed into an engineering school is organized around three periods of time that we will describe thereafter. This training is designed specifically for the 2nd year's engineering students. Through this training, it is in the short term to prepare them for their third year where they will be numerous to manage projects during the training period and to work on projects during their internship at the end of their study. In the long term, to train them to handle a certain type of situations that will be their daily ones. Every year nearly 180 students attend this training which is materialized by the construction of the project specifications for the problematization part and by building a business plan for the part of the resolution of the problem. Since the introduction of training modules, more than 1000 engineering students of the institution were able to benefit its implementation. As shown in figure 2, in addition to these two periods of time, we added a third one, which is the valorization.
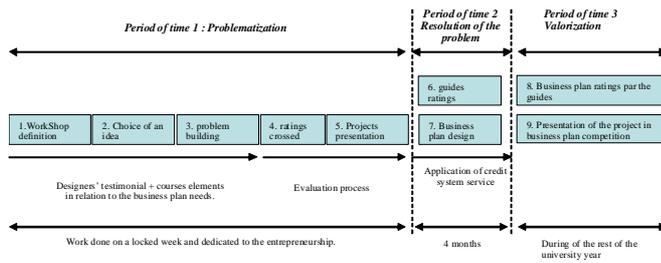
2.1 The problematization period

This first period of time aims to provide to the engineering students a certain number of tools to problematize their starting idea. Problematization will be the action allowing discussing various aspects of the product or service selected in order to identify the facts of the situation. The interest is to go from an ordinary idea centered on one product or service to an entrepreneurship project, i.e. a management situation within the meaning of Girin[3]. Therefore, the engineering students are required to work in groups. From a business idea chosen by them, they are led to question themselves specifically on the evaluation of this idea. This work is particularly important in practice, the contractors, including engineers, have a strong propensity to work the technical aspects of the idea and forget to work on the managerial aspects of the project.

Figure 2.- Presentation of the entrepreneurship training organization

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[3] When participants are met and must achieve in a given time, an action that leads to a result subjected to an external judgment.

Period of time 1 : Problematization	Period of time 2 Resolution of the problem	Period of time 3 Valorization

					6. guides ratings	8. Business plan ratings par the guides
1.WorkShop definition	2. Choice of an idea	3. problem building	4. ratings crossed	5. Projects presentation	7. Business plan design	9. Presentation of the project in business plan competition

Designers' testimonial + courses elements in relation to the business plan needs.   Evaluation process   Application of credit system service

Work done on a locked week and dedicated to the entrepreneurship.   4 months   During of the rest of the university year

Through this first period of time, we try to work on the cognitive ability of people to develop a plan in order to make a drawing (Boutinet, 1993), referring to what Leonardo Da Vinci called *disegno*. Problematization requires an imagination work organized and structured[4] (Boutinet, 1993). This requires method and efforts (Filion, 1997). The entrepreneurial project is the place where the problematization is expressed through the image of a desired future state that we want to achieve, the vision[5]. This vision will help to build a complete scenario, i.e., taking into account aspects of marketing, financial, organizational, human, and technical ... As an example, let us take a starting idea retained by the students: the company launch of a chips manufacturing with a sweetened taste. Beyond the product, the sweetened chips, it is possible to ask some questions related to the external aspects of the project (as an example the potential customer or even competition identification) and to the internal aspects (activities to develop within the company and the resources needed for these activities, for example). These different issues are as much a questions guide to be asked to develop an entrepreneurial project as questions enable the representation of the project. Thus, if we turn the product towards the major outlets or not, that will have a strong impact on the representation of the project. It is not at this stage of reflection, to have the engineering students go collecting information outside. Quite to the contrary, it is a reflection that occurs "in sealed off"; in interaction with teachers playing a role of facilitator within the meaning of P. Caillé (1991).

To discuss this robustness, we have set-up an evaluation process to make a return on this work of problematization. Therefore, each group is asked to evaluate the project of two other groups. The exercise is interesting on twofold reasons. Indeed, that initially helps to put the engineering students in an assessment situation so they can understand the expectations of a project: the idea is not everything, it is still necessary to provide evidence on the whole situation to manage. In a second time, it enables the engineering students to get feedback on their reflection with such questions and suggestions from the evaluator group. This evaluation is completed by a pres-

entation of the project to obtain further comments particularly from groups who have not done the evaluation of the project. All of this work takes place over a period of one week where engineering students are mandated to fill out a document called ideo[©] that matches the specifications of the project.

2.2 The period of time for the resolution of the problem and the valorization

Period of time 2 : the resolution of the problem. The objective of this second step is to get the engineering students to formalize their reflection around a business plan. This work is as much more accessible that the engineering students have problematized their project previously. In this view, they will be able to use the assessments made by their colleagues[6] and teachers - guides[7]. They have to validate or invalidate the robustness of the scenario and the elements of this scenario developed at the first period of time. This second period of time helps the engineering students to confront their reflection on the field. Let us take a police metaphor to illustrate the bond between problematization and the resolution of problem: a screenplay from a novel by Agatha Christie and another one from the famous TV Show called Columbo. The difference between the two of them results in the method implemented to discover the guilty. In the first case, the scenario usually implemented by Agatha Christie doesn't allow to know the guilty before the lasts pages. In other words, the reader must discover in the course of the intrigue, between the wrong tracks and the relevant indices, the real guilty. Whereas in the scenario of the TV Show "Columbo", the guilty is known from the beginning and the role of the famous police inspector throughout the episode is to confuse the guilty.

Period of time 3: the valorization. Regarding this last step, it takes two complementary forms: the pedagogical valorization and the one in the business field. Both types of assessments are done from the business plan submitted by the engineering students at the end of the semester. In comparison to the first form of evaluation, the objective is primarily to bring the engineering students to work in limited time. It is about to explain them that they must make a photography at a specific time of their reflection on their project. We try to focus on the consistency of the project at the exhaustiveness of the information. The research for exhaustiveness may be similar, in some way, to a Grail quest. Each project has received a rating from an evaluation grid. Beyond the notation which helps them to validate their module, it is submitted to each project group this final evaluation grid. This practice contrasts sharply with the usual acceptance of

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[4] Imagination is not about the product or service, that raises of the creativity, but rather on the organizational alignment

[5] Authors, like P. Cosette (2003), developed some methods to help the companies leaders to make their strategic vision more explicit

[6] Assessments done at the end of the first period of time

[7] Assessments done at the beginning of the second period of time

the final notation. Indeed, very often, students did not have qualitative return of their final grade. Entrepreneurship training does not stop so far this educational assessment. Indeed, in the second half of the year, the projects of the engineering students are presented in the context of a competition business plan. By facing with other professionals of the entrepreneurship, that helps also to accentuate and strengthen the speeches that teaching staff have had at the different periods of time of work. During the last two years, projects developed within the institution have won different awards regionally and nationally as the innovation award, the award for the best business plan, or the award of the institution the most enterprising of Lorraine.

Regarding those three periods of time, there are presented linearly, but there are feedbacks that occur between the different phases. Those feedbacks are important for working the robustness of the project and its coherence. The interest of that educational organization is not just to focus on building a business plan that would be in a single problem solving logical.

2.3 Back on the problematization concept: the main results.

In relation to these factors, we intervened at different periods of time to the projects, which enabled us to see a number of cases the difficulties of problematization that could exist on the projects. Since 2002, interviews were conducted to obtain feedback from the engineering students on the problematization approach of the entrepreneurial project. Analysis of the responses reveals an overall satisfaction rate very high compared to the whole process. The interviews in particular help to highlight the contributions and limitations of the approach developed around the entrepreneurial project.

- **Need to problematize**: Very often, the engineering students admit to having an idea, more or less vague, but generally, they have trouble expressing it. The work around five questions allowed them to clarify the object of their reflection. All the engineering students agree to say that they do not have tools to help visualize the situation. Moreover, that does not correspond to daily activities; they are not accustomed to reflect on problems not or poorly defined. Finally, the engineering students emphasize the importance of the problematization to their particular level to give sense to the information gathering. Very often, the phrase that served as the starting point of the reflection has evolved compared to the final sentence. Let us evoke the case of this project in the field of micro brewery defined initially like the "production of a custody regional beer for an audience of connoisseurs" and which finally became "production, distribution and commercialization of a custody regional beer for an audience of connoisseurs". The project has included a greater number of activities in order to get closer to the customer.

- **Need to interact around the project:** The approach proposed by the engineering students, facilitates the communication around the project and the people that may be linked near or far to the project. This communication is especially done during the phase of the problematization of the project. It is also done once the problematization phase ended. The metals project of shape memory is a project in which the technical aspects are very strong: it is about a project born from university research. The work of problematization has allowed the project carriers to grab a speech that they were struggling to make initial contact and different people to explain the project. This communication work is important in the evolution of the project insofar as it participates in the work of structuring

- **Building and development of a vision:** The engineering students have expressed themselves in the interview on the concept of vision. Many have insisted on the fact that the proposed approach allowed to define the original vision. For some people, the vision that they had, was relatively blurred and that helped them build a vision. For some others, work has rather been to develop an existing vision. In this case, it is often good to specify clearer the things. A certain number of engineering students have made emerge the elements that they had not considered before, including difficulties or consistency problems. Let us quote an example of this project group that was designed to sell an innovative fruit juice in vending machines and, with the work done, see that the values conveyed through this mode of distribution correspond to the values conveyed through product. Or those engineering students who realize that for their project of adventure park, the main barrier is not necessarily financial, as imagined, but rather political, because the land they covet are primarily public and are often municipal management task.

- **Search for the approximation rather than the accuracy:** The entrepreneurial project is not a replica of the reality, but rather a construction of sense in relation to a perceived reality. Through this logic, the implementation process rather promotes the development of approximation capacities relative to the project. Behind this, it is to have orders of magnitude regarding different points of the project. As an example, let us take a project in the computing field. The exact number of competitors in this field in a specific city is considered as relevant information. As the matter of fact, find out if there are a dozen or a fifty or a hundred; gives another type of information, particularly on the competitive pressures of the market, more relevant to treat. It goes therefore from an exact arithmetic, often advocated in management, to a rough arithmetic, needed to problematizing of the entrepreneurial projects.

Conclusion

As it is presented through this paper, the concept of problematization has an important place in the process of activities to project, in particular entrepreneurial. As long as the approaches in the entrepreneurship field remains focused on the implicit assumption of separation between the internal (contractor) and the external (the environment), i.e. enroll around a separation between the individual (who is the contractor?) and its decisions (what does the contractor do?), the concept of problematization had no reason to exist. As the matter of fact, by reversing the perspective, considering entrepreneurship as an interaction between internal and external, i.e. as a process, the concept of problematization will play a particular role in terms of consistency between method and purpose. It is in this perspective that we have presented not only the approach aimed to operationalize the concept of problematization, ideo$^©$, but also the establishment of an entrepreneurship training regarding that concept. By now, the experimentation phase is complete and ideo$^©$ approach is being extended to different audiences: engineer, manager, hospital officer, initial training and continuing education. Moreover, this approach is tested internationally with implementations made in Morocco and Luxembourg. Finally, using this approach has found new opportunities, especially in the accompaniment of project carriers and to the accompaniment structures as a tool for evaluating the potential business opportunity.

REFERENCES

BOLTANSKI L., CHIAPELLO E., 1999. *Le Nouvel esprit du capitalisme*, Gallimard, Paris.

BOUTINET JC., 1993. *Psychologie de la conduite à projet*, PUF, Paris

CAILLE P., 1991. *Un et un font trois*, ESF, Paris

COSSETTE P., 2003. *Méthode systématique d'aide à la formulation de la vision stratégique : Illustration auprès d'un propriétaire-dirigeant*, Revue de l'Entrepreneuriat, Vol 2, n°1, p. 1-18

FABRE M., 1999. *Situations-problèmes et savoir scolaire*, Paris, PUF

FABRE M., 2006. *Qu'est-ce que problématiser ? L'apport de John Dewey*, dans M. Fabre, Situations de formation et problématisation, De Boeck, Bruxelles, p. 18-30

FILION LJ., 1997. *Le métier d'entrepreneur,* Revue Organisation, vol. 6, no. 2, Automne 97, p. 29-45

GAREL G., 2003. *Le management de projet*, La découverte, Paris

HOC JM., 1987. *Supervision et contrôle de processus. La cognition en situation dynamique.* Presses Universitaires de Grenoble

JOLY M., MULLER JL., 1994. *De la gestion de projet au management par projet*, AFNOR

LE MOIGNE JL., 1990, *La modélisation des systèmes complexes*, Dunod, Paris.

MARTINET AC., 1993. *Une nouvelle approche de la stratégie*, Introduction au dossier Gérer la complexité, Revue Française de Gestion, n° 93, mars-avril-mai, p. 62-63.

MIDLER C., 1993, *L'auto qui n'existait pas*, Dunod, Paris, 1998

NOËL, X., P. SENICOURT., 2003. *Entrepreneuriat : à la recherche d'une instrumentation* dans S. Marion et al. (dir.), Réflexions sur les outils et les méthodes à l'usage du créateur d'entreprise, France, Les Éditions de l'ADREG

SCHMITT C., 2009. *Les situations entrepreneuriales : une nouvelle grille d'analyse pour aborder l'entrepreneuriat,* Revue Economie et Sociale, n°3, p. 11-25

SCHÖN D. 1996. *Apprentissage organisationnel et épistémologie de la pratique*, in B Reynaud, Les limites de la rationalité, tome 2, Paris, La Découverte, 1997, p.157-167.

VANDER BORGHT C., 2006. *Du côté de la formation des enseignants en sciences : concevoir des problèmes*, dans M. Fabre, Situations de formation et problématisation, De Boeck, Bruxelles, p. 126-141.