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Caroline Verzat, Dominique Frugier, Rémi Bachelet, Aïni Hannachi. Helping engineers to become entrepreneurs; attitudes, behaviours, beliefs, skills: what are the educational factors of their entrepreneurial spirit?. IntEnt 2003 Internationalising Entrepreneurship Education and Training September, 8th – 10th 2003 in Grenoble/France, 2003. halshs-00112652

HAL Id: halshs-00112652

<https://shs.hal.science/halshs-00112652v1>

Submitted on 9 Nov 2006

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This paper received the best paper award of IntEnt 2003 Conference.

IntEnt 2003 Internationalising Entrepreneurship Education and Training
September, 8th – 10th 2003 in Grenoble/France

Helping engineers to become entrepreneurs.

Attitudes, behaviours, beliefs, skills:

what are the educational factors in their entrepreneurial spirit?

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Résumé: the aim of this article is to present the stage of progress of our research about the making up of an entrepreneurial spirit and of an enterprising intention. Our objective is not only to understand the mechanisms of the making up of an enterprising spirit, but mainly to identify the variables within teaching actions that may make their contribution to it. The aim of our paper is to present the model that has enabled us to tackle the experimental phase of our research through the working out of a questionnaire.

Key-words: enterprising spirit, teaching factors, behaviours, identity, enterprising intention, skills.

Our research is carried out within the framework of « Pôle Régional de Recherche sur l'Entrepreneuriat » set up by Conseil Régional du Nord Pas de Calais.

The problem: to develop an enterprising spirit among engineering college students.

Although engineers are often associated to innovation, they tend to create far fewer businesses than management schools' former students (*Fayolle 2001*). As a matter of fact, the engineer career prevailing model is rather oriented towards technical or managerial functions within large companies (*Bouffartigue 94*).

Considering the importance of the stakes, the question is to find out the way to favour the emergence of an enterprising spirit among new engineers. What are the factors that can be acted on?

The family background holds a demonstrated part in the probability to create one's business but many entrepreneurs do not have this background, and another advanced approach based on the identification of entrepreneurial fitness and skills (*Gartner88, Carter, Gartner et Reynolds 95, Loraine, Belley, Dussault 98*), does not make it possible to predict the occurrence of the phenomenon or the actor's identity. A certain number of authors emphasize the part to be played by the educational system in the promotion of an "enterprising spirit" prior to a business setting up intention (*Albert & Marion 97, Fayolle 00*).

Our own experience at Ecole Centrale de Lille shows that only few students choose to join the business setting up master course (for third year students). When they do, it is after a certain maturation (*Verzat, Quenehen, Bachelet, Frugier, Giry 02*). Within this phase, which we may probably call – as Fayolle does – the « awakening of an entrepreneurial spirit » a part is

played, among other things, by they are made aware of the importance, for them, to have had a significant part in the managing of an innovating project as a two-year long team work.

The purpose of this article is to further the exploration of what can be called the « entrepreneurial spirit », these words, although largely used, have not yet been properly defined in the relevant literature as to how it builds up, and what precise aspects can be acted on through teaching activities. It is a matter of suggesting hypotheses in order to build up a model of how an enterprising spirit builds up among newly trained engineers.

Our paper is based on 4 questions: 1) What can be called entrepreneurial or enterprising spirit? 2) How does an entrepreneurial spirit arise prior to the decision to set up a business? 3) How can the components of an enterprising spirit be defined? 4) What are the possible teaching method variables within the engineering college training? As a conclusion, we will present the perspectives and the stage of progress of our research.

I. Enterprising spirit: a notion that has not yet been properly defined. A suggestion of a dynamic model.

How should enterprising spirit or entrepreneurial spirit be defined? Although this notion has been largely used, it still is to be properly defined.

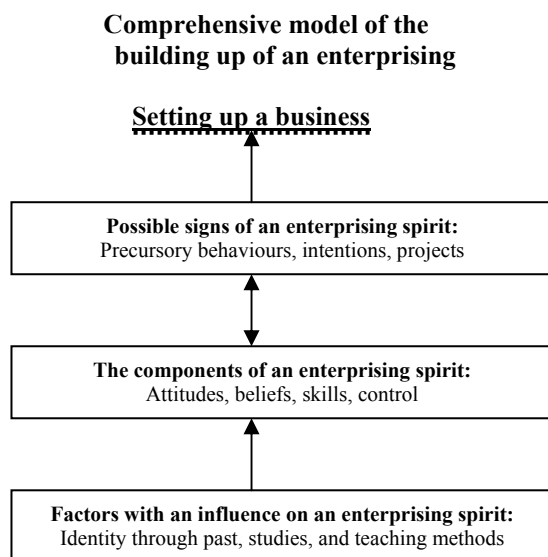
According to *Albert et Marion 01*: "the enterprising spirit consists – for business as well as for all human activities – in identifying opportunities, in gathering resources of various natures, in order to create a wealth that meets a solvable demand". Other authors

define the enterprising spirit as a set of positive attitudes as regards the notion of “enterprise” or of “starting a business”, or as regards the entrepreneurial spirit which involves taking initiatives and action (Léger-Jarniou 01). The entrepreneurial spirit also defines on the basis of characteristics belonging to the entrepreneur, who is different from the manager or the inventor (Fayolle 02), regarding the activating of mental images allowing an organisation to develop (Fonrouge 02). A set of personality features, of abilities, values and attitudes which reveal entrepreneurial behaviours are to be found in these models.

Thus, there is no clear consensus as for the definition of an « enterprising spirit », and the definitions that can be found in the literature seem to be closer to the consequences of an « enterprising spirit » than to the concept itself. Besides, the act of setting up a business and the creator’s attributes seem to be more focused on than the enterprising spirit training and the factors contributing to its building up .

There are two aspects in the question, which makes it possible to spot a dynamics of evolution: on the one hand, what are the components of such a state of mind, in other words, what does it account for in terms of the person’s abilities, skills, behaviours, beliefs and values? On the other hand, through what actions or intentions – close or not to the decision of starting a business – does it show? They can all appear at various moments, early before the actual creation, and the various factors related to identity or teaching methods may act upon those various elements.

The model we suggest can be presented roughly as follows:



II. How does an enterprising spirit show prior to the setting up decision?

The time before the relevant behaviour can be interpreted according to the planned behaviour psychological theory (Ajzen 02). According to Ajzen, any behaviour finds expression in an intention to adopt this behaviour. This intention springs from positive attitudes as regards this behaviour, normative beliefs and a control feeling regarding this behaviour, which results in a “control locus” on the one hand, and in the perception of a “self efficacy” (Bandura 82) on the other hand. This is the way, for instance, he analyses the intention to give up smoking. The expression of an enterprising spirit can then be brought down to the intention to create a business. This is the first hypothesis, which some entrepreneurship researchers are starting to adopt (Audet 02, Krueger, Reilly & Carsrud 00, Shepherd & Krueger 02).

But is this model fully relevant? Can the stages prior to the decision to set up a business be brought down to an intention to create? That intention may well express itself very late whereas other deeper or earlier manifestation may exist. For instance, Fayolle (Fayolle 01) notes that many business setting up engineers had taken responsibilities in associations when at school. As far as we are concerned, we noted in our exploratory research that most newly trained engineers embarking on the setting up of a business had had a decisive leader position for two years within their innovation project team. (Verzat, Quenehen, Bachelet, Frugier, Giry 02). We can thus get to the hypothesis that the stages before the business setting up decision can show through precursory behaviours, beyond the intention to create.

Besides, we have noted, through our exploratory interviews, the importance of a projection of an identity and/or professional type which shows through some assertions, such as: “I have known for a long time that I have an entrepreneur profile” or “I don’t feel myself as a classical technology or large business minded engineer” or else “ there are many business creators in my family, and I am interested in it too”. How can we give an account of those implicit professional models? All the more so as, for some authors such as Gottfredson 81 (quoted by Gichard & Huteau 01), the professional and career choices are first an attempt for the person to realise a “social self” , and, secondarily, the realisation of a “psychological self”. Using the related story of life, Ray and Carswell (00) enlight the importance of the building up of a meaning for oneself in front of other people in the entrepreneur’s learning process: becoming an entrepreneur is building up values/incentives with precise objectives, so as to, once they have been achieved, the successful realisations feed a self confidence, the ability to be successful, which is close to Bandura’s « self efficacy » concept.

Becoming an entrepreneur may be approached on the basis of the double transaction identity building up theory (Dubar, 91). In fact, we can identify here:

- a. On the one hand, a biographic transaction in which the engineering college student sees a possible future continuing or breaking up with his/her former experience (family experiences, the choice for an engineering college, activities with associations, projects ... etc).
- b. On the other hand, a relational transaction in which the engineering college student has his/her the legitimacy of his/her pretensions (career and life projects) recognized by a favourable environment (parents, relatives, friends, other students ready to get involved, outside potential partners, lecturers helping to build up a business plan or confirming the feasibility of a creation idea) among which the college's culture plays an important part.

For many of them, the professional projects build up slowly, through explorations, trial and error where some encouragement can occur to explore the trail and then the confirmation of the feasibility of a business setting-up project by the lecturers.

In that respect, the way some career guidance psychologist analyse the building up of a professional project is interesting. For Ginzberg et al 51, (quoted by Gichard & Huteau 01) building up one's professional project is a process including « realistic choices » as soon as the first year spent at university. This process goes through three stages: an exploratory phase, along which first year students carry out an active search for information, taking part in discussions with well informed people – such as lecturers or career advisers – in order to elaborate a professional choice. The second phase is a crystallisation phase, in which students – generally fourth-year students – crystallise their choices and experience, which then enable them to draw up a hierarchy of their choices and to identify their tendencies. The last phase of the process is called “specification” and corresponds to the expression of the “professional tendency”; last-year students choose a profession and devote many hours of work to the project they are interested in.

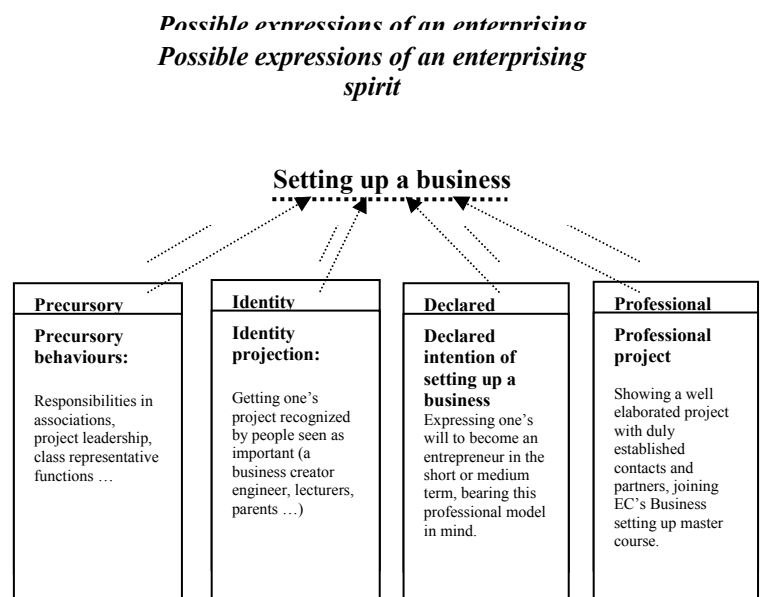
To sum up, several hypotheses can be set out about the way to define the manifestations of an enterprising spirit prior to the decision to set up a business.

- H1. An enterprising spirit expresses itself through an intention to set up a business.
- H2. An enterprising spirit expresses itself, during the studies at college, through precursory behaviours such as: taking responsibilities in associations or taking the leadership of a project team.
- H3. An enterprising spirit expresses itself through an identity projection which can be spotted through claims to other people of what one is

or wants to be, as opposed to the technology-minded engineer model.

- H4. An enterprising spirit expresses itself through a professional project gradually built up around the setting up of a business: with first-year students, it expresses itself in an information search exploratory phase. With second-year students, it finds expression in a search for opportunities, advice, training related to the project. As soon as they get to the third year, the students have roughly completed their project work (contacts have been established with banks or partners; they have turned towards the Business-setting up Master Course

The following diagram sums up the hypotheses which our questionnaire will aim at testing:



On the basis of this diagram, we will deal with the components of an enterprising spirit in the following section.

III. The components of an enterprising spirit

Using the planned behaviour theory (Ajzen 02), various components of the intention to be an entrepreneur can be brought out: 1) favourable attitudes as regards entrepreneurship 2) Interiorised social standards related to an entrepreneurial behaviour 3) the feeling of having entrepreneurial skills, self control, and abilities to get to success. The following diagram presents a more detailed model of the components of an enterprising spirit.

In the following section, the various components of Ajzen's model will be detailed, being each time related to the subject of our study, i.e. the entrepreneurial behaviour.

III. 1 Attitudes:

In order to estimate someone's attitude as regards an entrepreneurial behaviour, we have selected eight attitudes so as to be able to figure out the students' attitudes regarding an entrepreneurial behaviour.

For each attitude, a series of questions are asked, evoking precise situations, on the basis of the Biodata technique (*Mael 91*), which makes it possible to ask factual questions about real facts, involving opinions, attitudes and values in an historical perspective.

Attitude estimating variables	References	A few situations evoked in the questionnaire
Autonomy	Craid 90, Cromie 87	Working on one's own or with a group, preferring to be « framed » when working on a project.
Need for fulfilment	McClelland 61, Koh 96	Setting up personal challenges, working more than required to.
Dynamism	Craid 90	Extra curricular activities, with associations ...
Risk taking	Koh 96	Aversion or not to risk
Initiative taking	Cromie 00	Initiatives within a class, a group, the family ...
Responsibility	McClelland 61	Responsibilities within an association, class representative functions ...
Innovation	Koh 96, Craid 91	Favourable to changes, to new working methods
Will, determination	Cromie 00	Achieving one's objectives at all costs

Entrepreneurs' skills	References	A few situations evoked in the questionnaire
Seizing and making up opportunities	Herron 90, Vesper 89, Baum 95	Opportunity of a placement or employment, vacancy opportunity ...
Working with a team	Chandler & Jensen 92, Lorrain & Belley 98	Working on one's own or with a team, dealing with tensions within a group.
Developing and maintaining a network	Aldrich et all 87, Herron 90	Relationships with friends, school mates ; developing further acquaintances
Technological skills	Baum 95, Herron 90, Chandler & Jensen 92	Solving technical problems (computers ...)
Working intensely	Chandler & Jensen 92	Working so as to comply with deadlines, physical efforts ...
Organisational skills	Lorrain & Belley 98, Deeks 76	Organizing events at school or with a group of friends
Self projection into the future	Hambrik & Crozier 85, Milton 89	Having a personal idea of a professional project after college, anticipating difficulties pertaining to the project activity ...
Making decisions	Deeks 76, Hefer & Sandberg 87	Making a decision with little information

III. 2 Normative beliefs:

The normative beliefs concept in Ajzen's intention model refers to social models and referents, to the people who are important to the person ("the person's relevant others") as regards career and professional projections, but also to a favourable environment supporting the person in his/her project.

The questions we ask in our questionnaire aim at identifying the professional reference models and the favourable environment towards the student's building-up of a project (parents, relatives, close friends, lecturers, former students, banks, school mates ...) on the one hand, and, on the other hand, finding out whether these reference models support the student's entrepreneurial project.

III. 3 The feeling of being skilled:

The estimation of this aspect goes through two sub aspects:

III 3.1 Self-efficacy: within the scope of our study, we have defined self-efficacy in relation to entrepreneurs' key-skills as identified in the relevant literature. Our purpose is to identify the potential existence of those entrepreneurial skills among students, through our questionnaire.

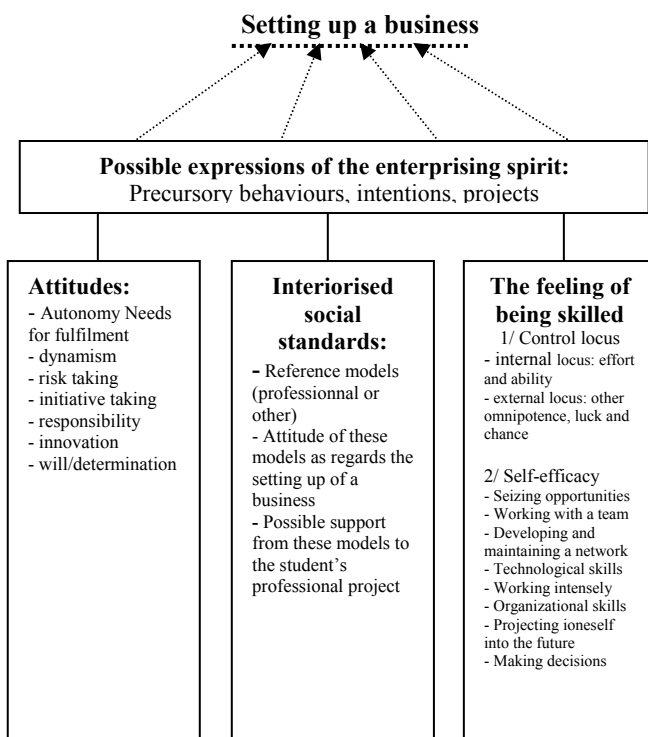
III. 3.2 The locus of control: this notion refers to the feeling of controlling the causes and running of an event, or taking them for granted (*Brockhaus 82*).

The purpose of our questionnaire is to test this aspects at two levels:

- The internal locus of control: this aspect is tested through questions helping to find out whether the person makes his/her own of the control of some events (his/her ability, efforts...)
- The external locus of control: The questions asked to estimate this aspect help to find out whether the person sees the running of some events as due to external causes (chance, luck, omnipotence of others).

The components of the enterprising spirit are summed up in the following diagram:

The components of an enterprising spirit



IV. Enterprising spirit influential factors: identity building past and teaching methods

IV. 1 The identity-building past

In Ajzen's intention model, the identity and dynamics only partly appears through the normative beliefs aspect. With the model we suggest, the identity building dynamics is to be considered at two levels: On the one hand, the identity displayed (self definition, particularly as a would-be engineer, and projections into the future) which builds up interactively with other people (see above). On the other hand, the identity building past which is related to legacy and identification models drawn from the social and family backgrounds: parents being - or not - entrepreneurs, parents' career as experienced by themselves and their child, enterprising - or not - social background.

These aspects are spotted as model entry variables: they may have an influence upon an enterprising spirit, but we do not see them as determining factors. Our hypothesis is that, with some students, the past may constitute a kind of predisposition which will develop during their studies. With others, there may be a deliberate break-up with this past, which may also be seen as some sort of determination. With even others, we admit the hypothesis that university education can provide the opportunity to develop an enterprising spirit in a student who has not had an enterprising spirit background. This hypothesis is supported by a few examples of trajectories followed by students we have met in the course of the qualitative phase of our research. Now let us see how university education can be of some influence upon this original compost, whereas it be favourable or not, related to the development of an enterprising spirit.

IV. 2 The influence of training

There is a rich literature about the construction of an educational and enterprising paradigm (Sexton & Bowman 84, MacMullan & Long 83, Leicht & Harrison 99). There are also a great deal of reports, syntheses and evaluations of educational experiments in the field of university enterprising training (Garavan, O'Conneide 94, Gorman, Hanlon & wayne 97). It is remarkable that the reported experiments mainly concern management training at a university level, even though an awareness of entrepreneurial attitudes involving initiative taking and an approach of changes can - and should - be done very early (Neunreuther 79).

About entrepreneurship teaching objectives, many authors insist on the necessity to avoid any mechanistic type of teaching that would bring entrepreneurship down to a set of techniques and ignore the students' incentives (Hynes 96). With Gibb (93), teaching methods should not just transfer knowledge, but aim at developing the building-up of skills and attitudes in favour of entrepreneurship. They are different from other career objectives because they are multiple and because of a necessary pluridisciplinarity. they represent a specific challenge, particularly for engineering college students whom we are dealing with, as the point is to forget risk aversion attitudes induced by analytic approaches and approaches consisting in searching for a unique solution to cope with a well defined problem. Actually, we have noticed in the course of our qualitative study, that the students interested in entrepreneurship are less focused on technology and more widely open to a selection of the courses they wish to attend.

In the relevant literature, learning entrepreneurial skills and attitudes can be carried out through a teaching method that sets the student in a real problem solving position. Numerous recent empirical researches show that certain types of teaching are more favourable than others to the training of entrepreneurs: « action learning », « learning by doing », , learning through

experience, learning from one's own mistakes, learning from other people ... (T.N.Garavan & B.O'Conneide, 94, Leicht & Harrison 99, Harshorn & Hannon 02). Reviewing various works about learning styles, Gibb (93) suggest to see entrepreneurs as characterised by a learning style that would rather be focused on true life experience and either on action (pragmatic/intuitive mode) or thinking (reflexive/intuitive mode). This learning style can be tested by means of a grid set up for university students (such as *grille ISALEM 94*). In their life story telling approach, Rae and Carswell (00) mention that the entrepreneurs interviewed are typically fond of learning, quick and keen on applying the knowledge and skills acquired. They even build up their own theory about their way to learn and to make their decisions.

Our first qualitative research has enabled us to notice the actual links between an active teaching method and the training to an entrepreneurial spirit. The project activity at EC Lille is a central activity in the curriculum (300 hours per student). The students' interviews have shown that this teaching method, which applies to groups, was seen, by the students, as best to favour an entrepreneurial spirit. The intention to become an entrepreneur, when the time has come for the person to act or not, has appeared to be influenced by two major experiences: 1) It is in the course of the project activity that the student discovers his/her ability to behave as the leader of a group, which is an essential asset for a would-be entrepreneur. 2) It is with the project activity that the student discovers product, market, and custom opportunities which drive him/her to reveal – and confirm to him/herself – his/her abilities to create, decide and develop a social network.

In the light of these theoretical elements and of our first qualitative research, we produce several hypotheses regarding the selection of courses and the learning style which are typical to the students with an enterprising spirit.

- H5. The students with an enterprising spirit reveal more varied choices regarding the available courses than others. They'd rather choose non-technological courses.
- H6. They'd rather choose active teaching activities, such as project or placements, as opposed to lectures.
- H7. Their learning style will rather be reflexive intuitive or pragmatic intuitive.

Beyond the learning styles which rely on variables of a socio-cognitive type, A. Gibb supposes that an enterprising spirit builds up within a specific environment. More precisely, he evokes a culture with which all actors (lecturers, students, career advisers, various partners) support the setting-up of businesses and entrepreneurs. Likewise, in his study about enterprising engineers, Fayolle (01) also mentions that the college's own culture is a factor to be taken into

account when considering the decision to set up a business. A study carried out among Quebec management college students estimates the impact of the choice of courses (business plan or field study) on the desirability and feasibility of an entrepreneurial career (Audet, 02). In our preliminary research, the students who have decided to join the business setting-up master course appear to see the college's culture as rather favourable to entrepreneurship.

In a similar field, Curran & Stanworth (89) put forward an aspect which we feel of some importance in the training leading to the choice of a career: the "affective socialization element" conditioning "the inculcation of attitudes, values, psychological mind sets and strategies necessary for the subsequent taking on of the occupational role in question". In our qualitative research, we have been able to observe the influence of a group on the decision to go into the business setting-up process. Some students who had not revealed any predisposition at first sight, eventually turned towards the setting-up of a business, following the leader of their project work team.

Relying on these two results and of our first research, we provide several hypotheses regarding the part played by the students' environments in the building-up of an enterprising spirit:

- H8. The students with an enterprising spirit see the college's culture as favourable to entrepreneurship.
- H9. The students with an enterprising spirit belong to a group of close friends who are favourable to entrepreneurship.

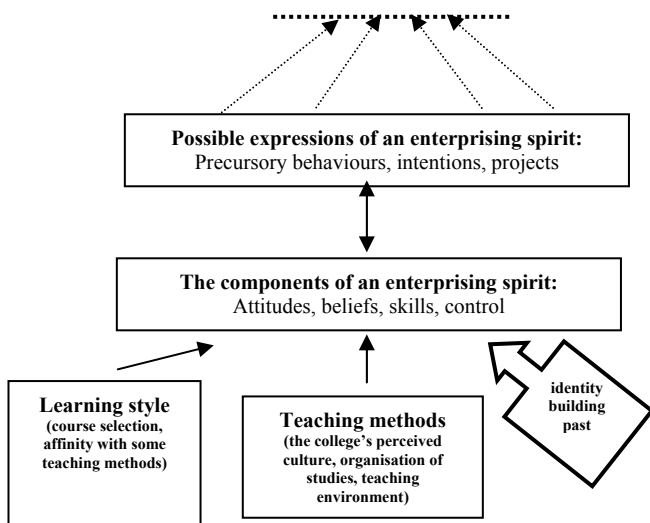
Thus, the part played by teaching methods is an action variable which our questionnaire will test at two levels:

- a. On the one hand, it will test the students' perception of the interest and contribution of the various teaching methods provided by the college.
- b. On the other hand, the updating of the questionnaire every three years will make it possible to identify the impact of the various types of teaching provided by the college as regards entrepreneurial projections, skills and attitudes. It is then possible to put forward the hypothesis of an evolution of the management of the college curriculum that would be more or less favourable to the development of an entrepreneurial model interiorised by students.

To sum it up, the following diagram presents the teaching method factors that influence the building-up of an enterprising spirit:

Influential factors in the building-up of an enterprising spirit

The setting-up of a business



The perspectives of our study:

The model we have presented should be operationalised according to three directions:

1. The results of the test we have launched will make it possible to hone our questionnaire, which will be launched among all three years' students of the college, no later than next November. Thanks to the installation of the "Sphinx" software, the questionnaire will be launched through the web and the data will be collected more easily.
2. The questionnaire will be renewed for three years in order to estimate the dynamics of the various aspects and, particularly, the impact of teaching methods on attitudes, beliefs and control feeling, as well as on other aspects of the model up to the entrepreneurial intention. A series of semi-directive interviews are also planned no later than next year, so as to reinforce the statistical analysis.
3. As soon as next year, we intend to widen our field to include other engineering and business colleges, on a national and European scale. We have established contacts with ECS Lille, and the university of Eindhoven (Netherlands), who seem to be interested in our research; and we will keep open to further collaborations.

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