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**Do Entrepreneurship Programmes Raise Entrepreneurial Intention of Science and Engineering
Students?**

The Effect of Learning, Inspiration and Resources

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Do Entrepreneurship Programmes Raise Entrepreneurial Intention of Science and Engineering Students?

The Effect of Learning, Inspiration and Resources

Abstract

Drawing on the theory of planned behaviour, this study tests the effect of entrepreneurship programmes on the entrepreneurial attitudes and intentions of science and engineering students. This is necessary in order to confirm (or disconfirm) conventional wisdom that entrepreneurship education increases the intention to start a business. The results show that the programmes raise some attitudes and the overall entrepreneurial intention and that inspiration (a construct with an emotional element) is the programmes' most influential benefit. The findings contribute to the theories of planned behaviour and education and have wider implications for a theory of entrepreneurial emotions and also for the practice of teaching entrepreneurship.

1. Executive Summary

This study tests the effect of entrepreneurship programmes on entrepreneurial attitudes and intention of science and engineering students, in order to confirm (or disconfirm) conventional wisdom that entrepreneurship education increases the intention to start a business. We address two research questions: Do entrepreneurship education programmes raise entrepreneurial attitudes and intention of students? And, which programme-derived benefits raise entrepreneurial attitudes and intention? We test the effect of three proposed programme-derived benefits for students: learning, inspiration and resource-utilisation.

We used a pre-test post-test quasi-experimental design. Data were collected before and after an entrepreneurship programme in two universities (London and Grenoble), from 250 science and engineering students (124 taking the programme and 126 in a control group). The results showed that:

a) Students in the 'programme' group increased their subjective norm and intention towards self-employment, whereas students in the control group did not. Therefore, the programme raised entrepreneurial attitudes and intention.

b) Intention towards self-employment was not related to nascency at the end of the programme (probably due to the time lag between intention and action, especially in the case of young students). Longitudinal studies are the only way to test the intention-action link.

c) Inspiration (and not learning or resource-utilisation) was the programme's benefit related to the increase of subjective norm and intention towards self-employment. The implication for programme developers is that whereas knowledge and resources might increase the likelihood of success for those who are going to start a new venture, it is the inspiration that raises attitudes and intention and increases the chances that students will actually attempt an entrepreneurial career at some point in their lives. Therefore, if the target is to increase the number of entrepreneurs in the student population, then the inspirational part of the programmes has to be designed purposefully and instructors should be trained not only to teach the entrepreneurship curriculum, but also to change 'hearts and minds'.

At a broader level, the study contributes to both the theory of planned behaviour (entrepreneurship programmes had not been empirically linked with change in attitude and intention towards self-employment) and the literature of entrepreneurship education itself, by revealing the effect of specific benefits for the students derived from the entrepreneurship 'programme'. Also, it is an illustration of the role of emotions in entrepreneurship, as inspiration is a construct with an emotional element.

2. Introduction

The purpose of this study is to test the impact of entrepreneurship education on attitudes and intention of science and engineering students, applying empirically the theory of planned behaviour. Although the alleged benefits of entrepreneurship education have been much extolled by researchers and educators, the

impact of entrepreneurship programmes on attitudes and intention remains relatively untested (Krueger & Brazeal, 1994; Gorman, Hanlon & King, 1997; Peterman & Kennedy, 2003).

In the psychology literature, intention proved to be the best predictor of planned behaviour, particularly when that behaviour is rare, hard to observe, or involves unpredictable time lags; entrepreneurship is a typical example of such planned, intentional behaviour (Bird, 1988; Katz & Gartner, 1988; Krueger & Brazeal, 1994). Consequently, employment status choice models that focus on entrepreneurial intention have been the subject of considerable interest in entrepreneurship research (Kolvereid, 1996b). In these models career intention is seen as the immediate antecedent of behaviour. Intentions in turn are determined by attitudes, and attitudes are affected by 'exogenous influences' such as traits and situational variables (Ajzen, 1991; Krueger, Reilly & Carsrud, 2000). This study positions and tests entrepreneurship education as such an 'exogenous influence' on attitudes and intention.

We refer to the entrepreneurship programme, a concept broader than a course, which includes a portfolio of complementary activities. Based on descriptions of entrepreneurship programmes in the literature (e.g. Gartner & Vesper, 1994) and on a search of current offerings in major universities, we suggest that balanced, 'good practice' programmes offer activities grouped under four components: a) A 'taught' component, with one or more modules; b) A 'business-planning' component, which can include business plan competitions and advice on developing a specific business idea; c) An 'interaction with practice' component, which can include talks from practitioners and networking events; d) A 'university support' component, which can include market-research resources, space for meetings, a pool of technology with commercial potential and even seed funding to student-teams.

Our study addresses two research questions: Do entrepreneurship education programmes raise entrepreneurial attitudes and intention of students? And, which programme-derived benefits for students, raise entrepreneurial attitudes and intention? It is important to note that the independent variables are programme-derived benefits 'captured' by each student as opposed to programme activities 'offered' to all students. Captured benefits are measured at the level of the individual (hence can be related with individual

attitudes and intentions) and can vary across a student group that attend the same programme. Our aim at the outset is to contribute both to the theory of planned behaviour (entrepreneurship programmes have not been empirically linked to change in attitude and intention towards self-employment) and to the literature of entrepreneurship education itself, by revealing the effect of specific benefits for the students derived from the entrepreneurship ‘programme’.

The paper proceeds as follows: Initially we present the theory of planned behaviour and develop two hypotheses to confirm its basic predictions in the student context. Afterwards we suggest that entrepreneurship programmes (in general) affect attitudes and intention. Then we propose three specific programme-derived benefits for participants and we hypothesise that each benefit affects entrepreneurial attitudes and intention (the paper’s conceptual model can be viewed in figure 1). Subsequently, we present the methodology and the results. Finally, in the discussion section, we link the findings with the wider entrepreneurship literature and highlight the theoretical contributions and practical implications.

Figure 1 about here

3. Theoretical Background and Hypotheses

3.1 Entrepreneurial Attitudes and Intention

The overall tenet of the psychological theory of planned behaviour (Ajzen, 1991) is that planned behaviours (such as starting a business) are intentional and thus are predicted by intention towards that behaviour. Intention is best predicted by attitudes (attitude towards the behaviour, subjective norms and perceived behavioural control). In turn, exogenous influences (such as traits, demographics, skills and social, cultural and financial support) affect attitudes and indirectly intentions and behaviour (Shapiro and Sohol, 1982). Entrepreneurship researchers empirically tested specific parts of the theory of planned

behaviour using self-employment as the target behaviour¹ (Kolvereid, 1996; Krueger et al., 2000; Luthje & Franke, 2003). In the case of entrepreneurship, the constructs of the theory of planned behaviour are defined as follows: ‘Attitude towards self-employment’ is the difference between perceptions of personal desirability in becoming self-employed and organisationally employed. Therefore, ‘high’ attitude towards self-employment actually indicates that the respondent is more in favour of self-employment than organisational employment (Kolvereid, 1996). ‘Subjective norm’ refers to perceptions of what important people in respondents’ lives think about them becoming self-employed, weighted by the strength of the motivation to comply with them (Krueger et al., 2000). Finally, ‘perceived behavioural control’ reflects the perceived ability to become self-employed (Kolvereid, 1996). The above three are attitudinal constructs and are often referred to collectively as ‘attitudes’ (in the literature and in this paper). In turn, ‘intention’ is defined as a state of mind directing a person’s attention and action towards self-employment as opposed to organisational employment (based on Bird, 1988).

The empirical results in entrepreneurship broadly confirmed the theory’s predictions regarding the relationship between attitudes (attitude towards self-employment, subjective norm and perceived behavioural control) and intention towards self-employment (Kolvereid, 1996; Krueger et al., 2000; Luthje & Franke, 2003). However, Krueger et al. (2000) failed to find a link between subjective norm and intention and called for more studies with more reliable measures. Kolvereid (1996) called for more research to confirm whether his results from a relative small sample of Norwegian undergraduates can be generalisable to other contexts. Therefore, to replicate and confirm early results linking self-employment attitudes with intentions, we suggest:

***Hypothesis 1:** The higher the attitude, the subjective norm and the perceived behavioural control with respect to self-employment, the stronger the students’ intention to become self-employed.*

¹ Strictly speaking there is a difference between the intention to own a business (self-employment) and the intention to start a business (see Shook et al 2003). We preferred self-employment as it is a more encompassing construct.

The relationship between intention and behaviour is less clear as we lack empirical studies that prove it. Kolvereid (1996) called for more empirical research towards proving the intention-action link. Katz (1990) questioned the intention-behaviour link in the entrepreneurship area, whereas Reynolds (1994) noted that there are often significant time lags from intention to action.

Interestingly, the entrepreneurship literature on nascency (e.g. Carter, Gartner & Reynolds, 1996; Alsos & Kolvereid, 1998) focused on the gestation period before venture creation (the time-lag from intention to action). A nascent entrepreneur is an individual with an intention to create an organisation (Katz & Gartner, 1988) who (in the process of starting-up) is going through a series of behavioural activities, such as assembling resources, hiring, incorporating the company etc. Scholars proposed lists of such gestation-process activities (Carter et al., 1996; Alsos and Kolvereid, 1998) and the implicit assumption is that the more activities initiated or completed, the closer the nascent entrepreneur gets to the start-up event. Since it would not be realistic to expect many students with already formed ventures at the end of a programme, we aimed to test whether there was a link between intention towards self-employment and nascency (positioned as an intermediate pre-venture phase). Accordingly:

***Hypothesis 2:** At the end of an entrepreneurship programme, the greater the students' intentions to become self-employed, the higher the propensity of being nascent entrepreneurs and the higher the number of start-up activities that they initiated or completed.*

A number of authors proposed (implicitly or explicitly) a link between entrepreneurship education and entrepreneurial attitudes, intention or action, but with no empirical proof. For example, Dyer (1994) suggested that specialised courses in entrepreneurship, or training of how to start a business, might give some people the confidence they need to start their own business. Robinson et al. (1991) brought the argument closer to the theoretical lens of planned behaviour, claiming that the attitude model of entrepreneurship has ramifications for entrepreneurship education programmes, as attitudes are open to change and can be influenced by educators and practitioners. Krueger and Brazeal (1994) suggested that entrepreneurship education should improve the perceived feasibility for entrepreneurship by increasing the

knowledge of students, building confidence and promoting self-efficacy. It should also improve the perceived desirability for entrepreneurship by showing students that this activity is highly regarded and socially acceptable and that it can be personally rewarding work.

However, we found little empirical evidence supporting these theoretical claims (the literature review by Gorman et al. 1997 confirms that). A promising exception was a recent study by Peterman & Kennedy (2003) who found that exposure to enterprise education affects intention, but surveyed high school rather than university students. Since there is a clear need for empirical studies testing the link between entrepreneurship education and attitudes-intentions, we propose that:

***Hypothesis 3:** At the end of an entrepreneurship programme, students will have higher (average) attitude towards self-employment, subjective norm, perceived behavioural control and intention to become self-employed than at the beginning of the programme.*

3.2 The Benefits from Entrepreneurship Education Programmes

Entrepreneurship education research is still at the exploratory stage (Gorman et al. 1997). The objectives of the existing studies were either to simply describe courses or trends in entrepreneurship education (e.g. Vesper & Gartner, 1997), to debate what should be taught (e.g. Fiet, 2000), or to economically evaluate courses comparing the entrepreneurial activities of takers versus non-takers (Chrisman, 1997). Research designs incorporating such basic controls as pre- and post-testing tended to be the exception rather than the rule. As might be expected in a discipline still at the early stages of development, few studies had preconceived hypotheses and even fewer drew on theory to derive hypotheses (Gorman et al. 1997; Peterman & Kennedy, 2003).

One of our aims is to advance entrepreneurship education theory by revealing specific benefits that students can derive from the programme and testing the impact of each of these benefits on attitudes and intentions. We propose that there are three types of programme benefits to students: learning, inspiration and incubation resources.

Learning. Learning taps the knowledge about entrepreneurship that students acquire during a programme. Johannisson (1991) proposed a conceptual classification with five levels of learning from entrepreneurship education: Why entrepreneurs act (values, motivation), what needs to be done (knowledge), how to do it (abilities, skills), who should we know (social skills, networks) and finally when to act (experience and intuition). Johannisson's classification was used as the conceptual base for our operationalisation of learning from the programme, described in the measurement section later in the paper.

Recent results associated prior knowledge with the identification of a greater number of entrepreneurial opportunities and with ones that are more innovative (Shepherd & DeTienne, 2005). Prior knowledge refers to an individual's distinctive information about a particular subject matter (Venkataraman, 1997) and may be the result of work experience or education (Gimeno et al. 1997). Education-derived knowledge (referred to as human capital) facilitates the integration and accumulation of new knowledge, providing individuals with a larger opportunity set (Gimeno et al. 1997). Since knowledge (and in particular education-derived knowledge) leads to more and better entrepreneurial opportunities, we suggest that specific knowledge about entrepreneurship learned during a programme would also improve the participants' opportunity-identification ability and therefore raise their entrepreneurial attitudes and intentions.

Inspiration. Inspiration was generally defined as "the infusion of some idea or purpose into the mind and the awakening or creation of some feeling of impulse" (Oxford English Dictionary, Simpson & Weiner, 1989). The psychology literature developed a more sophisticated conceptualisation of the construct. In a comprehensive review of the literature, Thrash & Elliot (2003) suggested that:

- a) Inspiration is evoked rather than initiated directly through an act of will or arising without apparent cause. The term 'trigger' was used to refer to the stimulus object (person or idea) that evoke inspiration.
- b) Inspiration implies elicited emotions such as elevation, awe and admiration - a feeling often associated with 'falling in love' (Branzei & Zietsma, 2003). Emotions are defined as personal displays of affected (or

‘moved’) or ‘agitated’ states (Shepherd, 2003). Therefore, inspiration has an emotional element to it; in Falcioni’s (2001) terms, inspiration involves a ‘change of hearts’.

c) Inspiration encompasses motivation directed towards a new ‘target’ (e.g. a behaviour, a personal goal, or a creative product). Isabella (1990) also argued that inspiration implies new thoughts and behaviours. In Falcioni’s (2001) terms, inspiration also involves a ‘change of minds’.

Trash and Elliot (2003) suggested that the trigger and the target should be integral parts of conceptualising inspiration and defined the construct as “a motivational state evoked by a revelation (trigger) and directed towards the conversion of transcendent, revealed knowledge into some concrete form (target).” Pilot interviews with students also revealed that inspiration can be understood and operationalised when it is tied to a trigger (inspiration from what?) and to a target (inspiration to do what?). Therefore, in our context of entrepreneurship education, we operationally defined ‘programme-derived entrepreneurial inspiration’ as “a change of hearts (emotion) and minds (motivation) evoked by events or inputs from the programme and directed towards considering becoming an entrepreneur.” It is worth noting that consideration of entrepreneurship is distinct from our dependent variable of intention; considering an option does not necessarily mean deciding (intending) to pursue it. However, a trigger that makes one consider becoming an entrepreneur could be the first step to a change of attitudes and intentions towards entrepreneurship. Therefore, in the context of an entrepreneurship programme we suggest that programme-derived entrepreneurial inspiration (from now on briefly referred to as just ‘inspiration’) would raise the participants’ entrepreneurial attitudes and intentions.

Incubation resources. The students of entrepreneurship programmes can also benefit from a pool of resources, which can help them to evaluate their business ideas and develop them into a venture. Access to resources can derive from every component of the programme. For example, as part of the taught course, students can relate to a group of entrepreneurial-minded classmates in order to build a team. While carrying out business-planning activities, they can get advice from lecturers, technology transfer officers and classmates and use a business plan competition to test their venture. Additionally, students can utilise

networking events to access practitioners for recruitment or advice and get referrals to investors. Finally, due to their university association students can often get close to technology with commercial potential, access research resources (e.g. proprietary market research reports in the library), use physical space for meetings and at times even access university seed-funding.

Resources were linked to entrepreneurship since the early writings on the subject. Schumpeter (1934) envisioned entrepreneurs as constantly modifying and developing new markets through innovative and unrehearsed combination of resources. More recently, Stevenson & Jarillo (1990) defined entrepreneurship as the pursuit of opportunity without regard to the resources currently controlled. Their entrepreneurs were resource-starved but not deterred - they first committed to an opportunity and then proceeded to a multi-staged commitment and control of the required resources. Since control of scarce resources is an essential hurdle in entrepreneurship, we suggest that the benefit of utilising 'free' resources as part of an entrepreneurship programme would tempt students to start a business and therefore raise their entrepreneurial attitudes and intentions.

Earlier we proposed that the programme as a whole increases the students' entrepreneurial attitudes and intentions. Since firstly it is logical to assume that the programme's effect is due to the benefits that students derive from it and secondly we presented theoretical arguments (in the previous paragraphs) to support the impact of each proposed benefit on entrepreneurial attitudes and intentions, we pose the following three hypotheses:

Hypothesis 4a: *The greater the learning from an entrepreneurship programme, the higher the 'post-programme' increase in the students' attitude towards self employment, subjective norm, perceived behavioural control and intention to become self-employed.*

Hypothesis 4b: *The greater the inspiration from an entrepreneurship programme, the higher the students' 'post-programme' increase in attitude towards self employment, subjective norm, perceived behavioural control and intention to become self-employed.*

Hypothesis 4c: The greater the utilisation of incubation resources offered during an entrepreneurship programme, the higher the student's 'post-programme' increase in attitude towards self employment, subjective norm, perceived behavioural control and intention to become self-employed.

4. METHODS

4.1 Participants and Procedures

The reasons for selecting science and engineering students as the context of our empirical test were twofold: Firstly, their behaviour is inheritably interesting, as their technical training gives them the potential to start high-growth technology ventures. This is illustrated by the increasing amount of resources directed towards entrepreneurship programmes for science and engineering departments (e.g. the UK government-funded 'Science Enterprise Centres') b) The entrepreneurial attitudes and intentions of technical students are unlikely to have been 'contaminated' by prior business courses that touch upon entrepreneurship. However, since the variables employed in our study are not specific to science and engineering students we believe that the results can also be applicable to other sub-sets of students of applied fields that can offer ideas for a venture (e.g. medicine, art, design, law, business).

We conducted the study in two major European universities with excellent reputation for science and engineering studies, in London, UK and Grenoble, France. Since our experiment was set up to capture the variability of individual benefits derived from similar 'good practice' programmes and its effect on individual intention (rather than the variability of programme-offering and its effect on the average intention of the whole class) we selected two programmes that were similar and represented good practice. Both chosen institutions had academic units aimed to embed entrepreneurship among science and engineering students and offered programmes with a wide range of activities across all four components (formal teaching of courses, business planning, interaction with practice and university support). The

selection of two sites in countries with different academic traditions intended to increase the generalisability of our results beyond the context of one university or programme.

We adopted a pre-test-post-test control group design (Cohen & Manion, 1989) to measure the change of attitudes and intentions over a period of approximately five months (January-May 2002). The group who participated in the programmes (232 students, 154 in London and 78 in Grenoble) took entrepreneurship as a compulsory or elective module within their curriculum (a number of classes were taught simultaneously by different academic instructors). The students in the control group (220 students, 148 in London and 72 in Grenoble) did not participate in the programmes. It was clearly explained to the surveyed students that the questionnaires were for research purposes only, participation was voluntary, and their views would not affect their grades. Both time 1 (t1) and time 2 (t2) questionnaires were reviewed by 3 academics and 5 non-participating students to ensure clarity of wording and face validity of the constructs. The questionnaire was translated to French and afterwards back-translated to English by a different translator in order to confirm language compatibility.

Time 1 (t1) questionnaire measured the attitudes, subjective norm, perceived behavioural control and intention towards self-employment at the time of entering the programme. Time 2 (t2) questionnaire measured the attitudes, subjective norm, perceived behavioural control, intention, start-up activities and nascency at the end of the programme, as well as the study's programme-related independent variables, i.e. learning, inspiration and utilisation of resources.

We received matched questionnaires (at both t1 and t2) from 124 students in the programme group (79 in London and 45 in Grenoble) and 126 students in the control group (84 in London and 42 in Grenoble). The overall response rate was 55.3%. No significant differences were found between respondents and non-respondents in terms of gender (sym. $\lambda = 0.01$, $p=0.290$) or age ($t=0.25$, $p=0.400$) (all reported significant tests in the paper are two-tailed). Also, t-tests indicated no significant differences between respondents and 'incomplete' non-respondents (students who filled the t1-questionnaire but failed to respond at t2), in terms

of time 1 attitudes ($t=0.68$, $p=0.250$), subjective norm ($t=0.25$, $p=0.400$), perceived behavioural control ($t=1.05$, $p=0.150$), or intentions ($t=1.21$, $p=0.120$). Therefore, non-response bias was not evident.

4.2 Attitudes

a) Attitude towards self-employment. We adopted a measure proposed by Kolvereid (1996), which includes five reasons in favour of organisational employment and six reasons in favour of self-employment, complemented with indexes for each of the 11 employment choices (a total of 33 items shown on table 1). Our data confirmed the reliability of the scales (Cronbach's $\alpha > 0.70$ – see table 1). Principal component analysis (at t1 and t2) was conducted to verify the number of factors and to check the independence of scales. Eleven factors with eigenvalues > 1 emerged which confirmed the *a priori* dimensions. Following Kolvereid's instruction, an indicator of employment status choice attitude was calculated as the numerical difference between the average of the 6 index scores for self-employment attitude and the average of the 5 index scores for employment attitude. A high score indicated a favourable attitude towards becoming self-employed.

b) Subjective norm. We adopted a 3-item indicator by Kolvereid (1996). The respondents had to answer three questions of the following type: I believe that my closest family think that I should not (1_2_3_4_5_6_7) should pursue a career as self-employed. The two other items concerned the respondents' belief of 'my closest friends' and 'people who are important to me'. Motivation to comply was measured by three items referring to each of the belief questions. The first question was "To what extent do you care about what your closest family think when you are to decide whether or not to pursue a career as a self-employed?" The responses were given on a 7-point scale ranging from 1 (I do not care at all) to 7 (I care very much). The belief items were re-coded into a bipolar scale (1=-3 to 7=+3) then multiplied with the respective motivation to comply item and finally the scores added in order to obtain an overall measure of subjective norm (Cronbach's $\alpha = .84$ for t1 and $.87$ for t2).

c) Perceived behavioural control. We adopted Kolvereid's (1996) 6-item measure (see table 1). Our data confirmed the reliability of the scale ($\alpha = .74$ at t1 and $.70$ at t2). Also, the 6 items were loaded on a single factor.

4.3 Intention to become self-employed

We adopted a 3-item measure of career intention, proposed by Kolvereid (1996), which captures the intention of an individual to start a business as opposed to pursuing a career employed by organisations (see table 1). Our data confirmed the reliability of the scale (Cronbach's alpha = 0.72 at t1 and 0.75 at t2). The differences between attitudes and intentions before and after the programme were calculated by subtracting the t1 from the t2 scores for each variable.

4.4 Nascent entrepreneur status and start-up activities

Based on the study by Carter et al. (1996), we defined as nascent entrepreneurs students that: a) Answered yes to the question "Are you involved in evaluating a new business idea?" b) Answered yes to the question "Are you trying to start a business for real, as opposed to just evaluating an idea out of interest or as part of an academic exercise?" and c) Have initiated or completed at least 2 out of a list of 19 activities associated with starting a new business (adopted from Alsos & Kolvereid, 1998 - see table 1). Apart from nascency, which was a binary yes/no variable, we also recorded the total number of activities initiated or completed (from 1 to 19).

-----**Insert table 1 about here**-----

4.5 Programme benefits

a) Learning from the module. Based on Johannisson's (1991) conceptual classification of learning from an entrepreneurship programme, we developed a perceptual scale to measure learning. We chose a perceptual measure being consistent with the proposition that perceptions of the environment can be stronger predictors of entrepreneurial actions than actual facts (Zahra, 1993). The students were asked the following 5 questions at the end of the course (t2) and had to answer on a seven-point Likert scale (1=not at all 7=to a large extent). To what extent did the entrepreneurship programme: 1) increase your

understanding of the attitudes, values and motivation of entrepreneurs (i.e. why do entrepreneurs act?) 2) increase your understanding of the actions someone has to take in order to start a business (i.e. what needs to be done?). 3) enhance your practical management skills in order to start a business (i.e. how do I start the venture?) 4) enhance your ability to develop networks (i.e. who do I need to know)? 5) enhance your ability to identify an opportunity (i.e. when do I need to act?). The learning scale proved reliable ($\alpha=0.71$) and unidimensional (all five items loaded on a single factor). To validate the measure, we tested the association between the scores on the perceptual scale with the grades for the entrepreneurship courses (a factual 'proxy' for learning). The correlation was positive and significant ($r=0.71$ $p<0.001$) supporting the validity of the learning measure.

b) Inspiration. The students were asked the following question at t2: Do you remember any particular event or input during the entrepreneurship programme that changed drastically your 'heart and mind' and made you to consider becoming an entrepreneur? (yes/no). This categorical construct was named 'perceived trigger'. The students were presented with a list of potential programme-related triggers and they had to tick the ones that applied to them. The trigger-list included the views of a professor, the views of an external speaker, the views of a visiting entrepreneur, the views of classmate(s), the preparation for a business plan competition and the views of judges of the competition. The purpose of this list was to offer a menu of trigger-examples, which would help respondents to relate to the concept (participants in the questionnaire-pilot suggested this). Students who answered no to question 1 did not tick any of the boxes in the trigger-list, confirming the reliability of the 'perceived trigger' measure. The categorical construct was complemented by a measure of degree: "To what extent did such events made you to seriously consider embarking on an entrepreneurial career?" (7-point Likert scale, 1=not at all, 7=to a large extent). The score for 'inspiration' was calculated by multiplying the categorical measure of perceived trigger (0=no, 1=yes) with the measure of the degree of the trigger (1 to 7), so we ended up with a range from 0 to 7.

c) Utilisation of programme-resources. We developed a perceptual measure of resource utilisation, again consistent with the proposition that perceptions can be better predictors of entrepreneurial action than facts (Zahra, 1993). An 11-item list of incubation resources was compiled by visiting the websites of various entrepreneurship programmes and discussing with colleagues in the field. At the end of the course (t2) students were asked to indicate the extent to which they have used each of the 11 resource-items (7 point Likert scale from 1=minimal utilisation to 7=extensive utilisation). To validate the measure, we associated each perceptual item with a more ‘factual’ proxy measures of resource utilisation and the correlations proved positive and significant (see table 2). The final score for resource-utilisation was the average of the perceived utilisation item scores.

-----**Insert table 2 here**-----

To establish the stability of the factor structure among British and French respondents, we performed a factor analysis for each sub-sample separately and compared the emerged factor structures. The coefficients of congruence of the corresponding factors were all well above the usual cut-off point of 0.8, providing evidence of the stability of the factor structure across countries.

4.6 Control variables

We had the following control (dummy) variables. a) The ‘university’ (London versus Grenoble), b) the ‘module’ (categorical variable for the 9 different modules running simultaneously) c) the ‘mode of programme selection’ (self-selected versus compulsory) and d) the t1 values of attitudes and intentions, as students with higher initial values would have less room for increase. Other ‘exogenous’ influences which are often used as control candidates (such as gender, family background and experience) were not considered relevant in our case for two reasons: a) Tkachev and Kolvereid (1999) found that adding them to the theory of planned behaviour did not significantly increase the explanation of the variance in individuals’ self-employment intentions and b) Even if background characteristics do have an effect on attitudes-intentions, this would be a long-term effect on the initial scores at t1, parcelled out by using the attitude/intention difference as the dependent variable.

5. Results

To test our hypotheses, we employed the following tests: a) Correlation (table 3) and regression (table 4) to test the relationship between attitudes and intention at t1 and t2. b) To test the effect of the programme on the change of attitudes and intentions, we used one-way ANOVA on the difference scores (total sample) with the group membership (programme vs. control) as the independent variable (table 5). The ‘difference scores’ method is preferable to split-plot repeated measures ANOVA for pre-test post-test designs with ‘treatment’ and control groups, because it gives equivalent results in a simpler and less confusing way (Girden, 1992) c) To test the relationship between control variables and change of attitudes and intentions in the programme sample, we used correlation for ratio and dummy variables (table 6) and GLM repeated measured ANOVA for categorical ones (table 7). For the programme (treatment) sample analysis, the GLM repeated measures procedure was the preferable ANOVA method, as it reduces the unsystematic variability in the design and so provides great power to detect effects (Field, 2000). d) To test the association between differences in attitudes and intentions (dependent variables) and programme-related predictor variables (learning, inspiration, incubation resources) we used correlation (table 6) and stepwise hierarchical regression (table 8). For the regression models, control and predictor variables entered in consecutive steps and the variables were standardised since we employed a number of different scales. No significant violations of the assumptions for t-test, repeated measured ANOVA, and regression were identified. Specifically, the common problem of multicollinearity was not evident, as the correlations between independent variables were moderate and the tolerance values were all higher than 0.77.

----- **Insert tables 3-8 about here** -----

Control Variables: As expected, for each of the four ‘before-after’ variables, the t1 values had significant negative correlation with the difference values, pre and post the programme (for attitude to self-employment $r = -.48$, $p < .001$, for subjective norm $r = -.43$, $p < .001$, for perceived behavioural control $r = -.52$, $p < .001$ and for intention $r = -.29$, $p < .001$). These results confirmed the expected role of the initial values of attitudes and intentions as control variables. The mode of selection was negatively correlated

with the difference in perceived behavioural control ($r = -.23, p < .05$) meaning that self-selected students increased less their perceived behavioural control after the course. On the contrary, the university did not have significant correlation with the 'difference' values for any of the attitude or intention variables. The GLM procedure (table 7) showed that the only significant differences in attitudes and intentions controlling for the categorical variables (university, module, mode of selection) were for perceived behavioural control, controlling for mode of selection ($F=6.84, p=.010$). Therefore, university and module were dropped from the control variable list. For the regression models (table 8), we controlled for the initial values of the dependent variable at t1 (all the t1 controls proved significant). For perceived behavioural control, the mode of selection was also entered as a control, but its coefficient did not prove significant.

Hypothesis 1: At both t1 and t2, intention to become self-employed was positively and significantly correlated to the attitude towards self employment (t1: $r = .42, p < .001$; t2: $r = .40, p < .001$) to subjective norm (t1: $r = .53, p < .001$; t2: $r = .44, p < .001$) and to perceived behavioural control (t1: $r = .39, p < .001$; t2: $r = .25, p < .001$). The regression models showed significant adjusted regression coefficients (t1: $R^2=.35, p < .001$; t2: $R^2=.32, p < .001$) and significant standardised coefficients for all three predictors (t1: .24, .35, .22 all with $p < .001$; t2: .29, .35, .16, $p < .001$). Therefore, hypothesis 1 was accepted.

Hypothesis 2: There was no significant correlation between intention at t2 and nascency or number of start-up activities at the end of the course (table 6). The GLM procedure showed no difference in the pre- and post-programme values for any of the attitudes or intention variables when we controlled for nascency. Therefore hypothesis 2 was rejected.

Hypothesis 3: For the programme sample t tests (for $p < .05$) showed that we could reject the null hypothesis that students had equal pre- and post-programme means for intentions ($t = 4.87, p = .000$) and subjective norms ($t = 2.29, p = .024$), but not for employment attitudes ($t = .78, p = .440$) and perceived behavioural control ($t = 1.55, p = .123$). The GLM procedure (simple time effects - table 7) confirmed the significant differences between the pre- and post- programme values for subjective norm ($F=5.22, p=.024$)

and intention ($F=23.70$, $p=.000$), but not for attitudes and perceived behavioural control. Instead, for the control sample, the t-tests did not show differences in pre- and post- values of any variable. The ANOVA for the whole sample (table 5) showed a significant association between group (programme vs. control) and difference in the pre-post scores for norms ($F=4.87$, $p=0.028$) and intentions ($F=13.23$, $p<0.001$), but not for attitudes ($F=.34$, $p=.563$) and perceived behavioural control ($F=.16$, $p=.689$). Therefore, hypothesis 3 was partly accepted (for subjective norm and intention towards self-employment). Interestingly, the increase in subjective norm was caused by a small raise in ‘expectations of significant others’ (mean difference = .13: $t=1.36$, $p=0.177$) amplified by a higher and statistically significant raise in the ‘motivation to comply’ (mean difference = 0.29: $t=2.59$, $p=0.011$).

Hypothesis 4a: There was no significant correlation between learning and any of the attitudes and intentions variables. Moreover, learning did not have a significant effect on any of the four regression models. Therefore hypothesis 4a was rejected.

Hypothesis 4b: Inspiration was significantly correlated with subjective norm ($r=.19$, $p<.05$) and intention towards self employment ($r=.20$, $p<.05$). However the correlations with attitudes to self-employment and perceived behavioural control were not significant. The regression results showed a similar pattern. Inspiration was the only predictor variable with significant coefficients in the hierarchical regression models for subjective norm ($.25$, $p<.001$) and intention ($.28$, $p<.001$), leading to a significant ΔR^2 in the second step of the procedure. For attitudes to self-employment and perceived behavioural control, inspiration had insignificant standardised coefficients and ΔR^2 in the second step of the hierarchical procedure was also insignificant. Moreover, the GLM results showed that the categorical measure ‘trigger event’ was associated with subjective norm ($F=6.81$, $p=0.10$) and intention ($F=5.53$, $p=0.20$). Therefore hypothesis 4b was partly accepted (for subjective norm and intention towards self-employment).

Since inspiration proved an important predictor of changes in attitudes and intentions, we checked which events triggered it (using t-tests within the subset of 71 students that actually perceived a trigger).

The mean degree of trigger was significantly raised for individuals who were triggered by two events: The 'views of a professor' ($t=2.63$, $p=0.011$) and the 'views of an external speaker' ($t=2.13$, $p=0.037$).

Hypothesis 4c: There was no significant correlation between utilisation of resources and any of the attitudes and intentions variables. Furthermore, utilisation of resources did not have significant effect in any of the four regression models (for attitudes, subjective norm, perceived behavioural control and intentions). Therefore, hypothesis 4c was rejected.

6. Discussion

We had posed two research questions: Do entrepreneurship education programmes raise entrepreneurial attitudes and intention of students? And, which exact benefits of entrepreneurship education programmes raise entrepreneurial attitudes and intention? To address these questions, we employed a pre-test post-test design, with hypothesis grounded in the theory of planned behaviour. The results showed that the post-programme mean values of subjective norm and intention towards self-employment were increased in relation to the pre-programme ones. However, intentions at the end of the programme were not related to nascency. From the three programme-related benefits (learning, inspiration and resource utilisation), inspiration proved to be associated with the increase in subjective norm and intention. In summary, the study illustrated that entrepreneurship programmes are a source of trigger-events, which inspire students (arouse emotions and change mindsets). Inspiration is the programme-derived benefit that raises entrepreneurial attitudes and intentions.

The insignificant relationship between intention and nascency at the end of the programme could be attributed to the well-documented time-lag between entrepreneurial intention and behaviour, especially concerning undergraduates. Despite the fact that the proportion of students who declared nascency was substantial (27.4%) it is possible that this was the effect of an enthusiasm generated by their business-plan project, which would dissipate soon after, rather than of a serious intention to start a business. Since a very low proportion of graduates start a business immediately after graduation (Luthje & Franke, 2003), we

echo the suggestion that longitudinal studies following the subjects for years after graduation is the only way to prove with accuracy the intention-behaviour link (Kolvereid, 1996).

A possible interpretation of the significant raise of subjective norm after the programme is the following: The small increase in the 'expectations of significant others' could reflect the creation of a new circle of entrepreneurial-minded friends from the programme. The larger increase in the 'motivation to comply' could be due to a realisation that their family and friends were right about this career possibility, or to a feeling that they had to comply with the significant others' expectations after investing time and effort during an entrepreneurship programme. The insignificant effect of the programme on perceived behavioural control is intuitively difficult to explain and disconfirms results by Peterman & Kennedy (2003) who found a positive effect of entrepreneurship programmes on 'perceived feasibility' of high-school students. A possible explanation is that the 'elite-university' students in our sample had high self-confidence generally (the mean perceived behavioural control at t1 was 4.18) and therefore there was less scope for a change attributed to the programme.

6.1 Theoretical contribution and implications

The study contributes at two levels of theoretical development: The core theoretical contributions are to the research streams of planned behaviour and entrepreneurship education, as planned at the outset. In addition, the finding that inspiration was the sole programme-benefit driving entrepreneurial intention has wider theoretical implications regarding the role of emotions in entrepreneurship. In this section, we initially highlight the specific contributions to the theories of planned behaviour and education and then (temporarily detaching the discussion from the specific context of entrepreneurship programmes) we explore some wider implications towards a theory of entrepreneurial emotions.

The study contributes to the theory of planned behaviour by confirming the attitude-intention link and by testing the effect of an 'exogenous influence' (education) on attitudes and intentions towards the behaviour (self-employment). The study also contributes to research on entrepreneurship education, by revealing the effect of specific benefits for the students derived from the entrepreneurship programme. A

possible explanation of why learning and resources did not correlate with an increase in attitudes and intentions, whereas inspiration did, is the following: In the transition to entrepreneurship, a student faces first an attitude/intention-related personal challenge (do I want to be an entrepreneur?) and then a number of 'implementation' challenges such as acquiring knowledge, finding and evaluating an opportunity and assembling the resources. The attitude/intention-related personal challenge of the student can be resolved (triggered) by specific programme-related events such as a casual comment by an entrepreneur guest-speaker or the launch of a company by a group of colleagues. On the contrary, the acquisition of knowledge and the utilisation of resources from the course can help in the implementation challenges faced at a later stage, once the student actually decides to proceed to opportunity search and evaluation.

Our findings also have implications for the emerging literature of entrepreneurial emotions and passion (Cardon, et al. 2005). Weick (1999) argued that despite the fact that theories that recognise emotions move us and resonate with our day-to-day experiences, emotions have not received significant scholarly attention in the management literature. Cardon et al. (2005) noted that we currently lack a theoretical foundation for the processes by which entrepreneurial passion (a mix of emotions) is generated, maintained and regulated. Our study, which illustrated that specific events during entrepreneurship education inspire and therefore trigger emotion, contributes towards answering the emotion/passion-generation question.

At a broader theoretical level, this study introduces an emotional angle to the entrepreneurship literature. In a recent attempt to develop a general theory of entrepreneurship, Shane (2003) suggested that the discovery of opportunities depends on access to information and opportunity-recognition characteristics (e.g. intelligence). The opportunity exploitation decision depends on: a) non-psychological factors such as experience, age, social position and opportunity cost and b) psychological factors grouped under personality (e.g. extraversion), core self-evaluation (e.g. locus of control) and cognitive characteristics (e.g. overconfidence) (Shane, 2003). We argue that these characteristics are obviously valid, but not always sufficient, as they overlook: a) the individuals' emotional preference for the entrepreneurial lifestyle which raises their alertness to opportunities and b) the emotional 'chemistry' between the

individuals and particular opportunities which affects their decision to exploit. Based on our results, which illustrate the importance of inspiration, we propose that often there is something more than information, background, personality or cognition, which is whether the individual 'falls in love' with the entrepreneurial career and/or with an entrepreneurial opportunity driven by emotion and personal preference (love is blind) rather rational evaluation.

6.2 Implications for practice

The main practical implication for entrepreneurship programme developers, is that whereas knowledge and resources could increase the likelihood of success for those who are going to start a new venture (a claim made also by Gorman et al., 1997), it is the inspiration that raises attitude and intention and increases the chances that students will eventually attempt an entrepreneurial career. This implies that if our target is to increase the number of entrepreneurs from the student population, then the inspirational part of the programme has to be designed purposefully.

Since the results showed that inspiration was driven by the views of professors and external practitioners, programme developers should focus on their instructors. We suggest that instructors (academics and practitioners) should receive training not only on how to teach entrepreneurship, but also on how to change 'hearts and minds'. But how exactly can instructors inspire and encourage emotions? If we assume that the instructor plays a leadership role within the student group, we can get practical advice from the vibrant literature on charismatic leadership. Charismatic leadership is characterised (among other factors) by emotional skills such as 'emotional intelligence'; in other words the ability to recognise the meaning of emotions and to reason on the basis of them (Middleton, 2005) and 'emotional expressivity'; for example, more and more intensive smiles and longer and more frequent visual attention of the audience (Cherulnik et al. 2001). Charismatic leaders were found to have a strong influence on followers through 'emotional contagion' (Cherulnik et al. 2001); in brief, the exposure to images of a charismatic leader displaying positive emotions (in our context an instructor) can result in a corresponding change in the emotional state of the observer (the student). Based on the above, we suggest that hiring charismatic

instructors who can communicate their enthusiasm for entrepreneurship through non-verbal expressiveness will result in inspired students with higher entrepreneurial intention.

Since inspiration is important as a driver of attitudes and intention, we propose that it should also be measured. Universities that want to assess the effectiveness of their programmes should capture not only how much their students learn about entrepreneurship or whether they are satisfied with the courses, but also whether they are inspired from the programme. A feedback form measuring inspiration from the programme (as well as satisfaction with the courses) is a practical suggestion.

6.3 Limitations of the study

The study addressed attitudes and intentions, but not actual behaviour (due to the time lag problem). To compensate we included nascency as a 'proxy' of post-programme behaviour, but it was not linked with intentions.

The allocation of students to the programme and control groups was not random (due to the common practical difficulties in educational research), hence the design was quasi-experimental (rather than a true experiment). To compensate, we included the mode of selection as a control. Overall, we have confidence in the validity of our results. Before-after designs with control group offer a good level of internal validity (better than the typical cross-sectional designs) and sampling from two universities in different countries adds to the external validity of the findings.

We chose to use perceptual measures of benefits from the programme, as we believe that perceptions of the environment can be more powerful predictors of intentions and behaviour than actual facts. This choice could be criticised, as perceptions often differ from factual reality and also the use of self-reported measures invite statistical problems of common method variance and response set tendencies. To pre-empt these concerns we validated our perceptual measures with factual proxies and the inter-rater reliability proved satisfactory.

Inspiration from entrepreneurship programmes was a new construct and was measured with a simple single-item measure of degree. To compensate for the unknown reliability, we incorporated simple checks,

which confirmed that respondents understood the question and answered consciously (students that did not perceive a trigger did not tick any of the boxes in the trigger event list and did not answer the trigger-extent question). However, a valid and reliable multi-item scale of the construct would be useful for future empirical tests.

6.4 Implications for further research

Where do our findings lead the planned behaviour, education, emotion and entrepreneurship literatures? By failing to identify a relationship between intention and nascency, our results invite longitudinal testing of the theory of planned behaviour. Regarding the literature on entrepreneurship education, future researchers may productively address such questions as whether there are other potential benefits from an entrepreneurship course apart from learning, inspiration and resources. For example, what could actually change the students' intentions during the programme might not be learning about entrepreneurship per se (which was what we measured), but learning about themselves and what they like (self-realisation). Do learning and incubation resources assist some students at a later stage of their lives when they move from intention to nascency? How and why does learning about entrepreneurship affect inspiration (we found a significant correlation between learning and inspiration)? Why does the programme raise subjective norms but not attitude towards entrepreneurship or perceived behavioural control? Moreover, an interesting avenue for further research would be to investigate the link between the benefits for the "average" student and the programme components offered (i.e. what should programmes offer in order to increase the chances of the average student to derive benefits?). This would require a research design based on a number of programmes with varying levels of offerings.

Our study also opens a number of research avenues for the emerging literature on entrepreneurial emotions. Future researchers can ask, what kinds of emotions are experienced after each of the various trigger-events during an entrepreneurship programme? How are these emotions linked with the construct of entrepreneurial passion? How does the emotional stimulation affect cognitive rationality? (Cardon et al., 2005 suggested that intense emotions may impede cognitive reality. We could argue that this claim is

confirmed by our study in case we consider attitudes/intentions as cognitive characteristics as suggested by Mitchell et al., 2000). For how long do students feel emotions triggered by a programme? Does emotional triggering last up to the opportunity exploitation decision? Current thinking in entrepreneurial emotion highlights the interaction between entrepreneurs and the 'objects' of their emotion (ventures or ideas) (Cardon et al. 2005). Our study reveals an interesting twist which merits further investigation: the emotion towards entrepreneurial lifestyle, before even the 'object' of the entrepreneurial lifestyle (venture or idea) forms.

The entrepreneurship literature has often portrayed the entrepreneur as a heroic figure who overcomes a number of obstacles and goes against all odds in his pursue of an opportunity (e.g. Gartner, 1993). Entrepreneurship is a risky career option, as most entrepreneurs fail. In this sense, our findings that inspiration (a powerful persuasive message) and not 'textbook knowledge' is what raises entrepreneurial intention of engineering students seem intuitively reasonable. In this spirit, we support the idea that entrepreneurship can be also viewed from an emotional lens. The hero, apart from being intelligent and rational, has also to be passionate and emotional. The emotional side of entrepreneurship is an exciting new area with myriad opportunities for scholarship. Our results suggest an outline for addressing at least some of these opportunities.

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TABLES and FIGURES

Figure 1. **Conceptual model and hypothesised relationships**

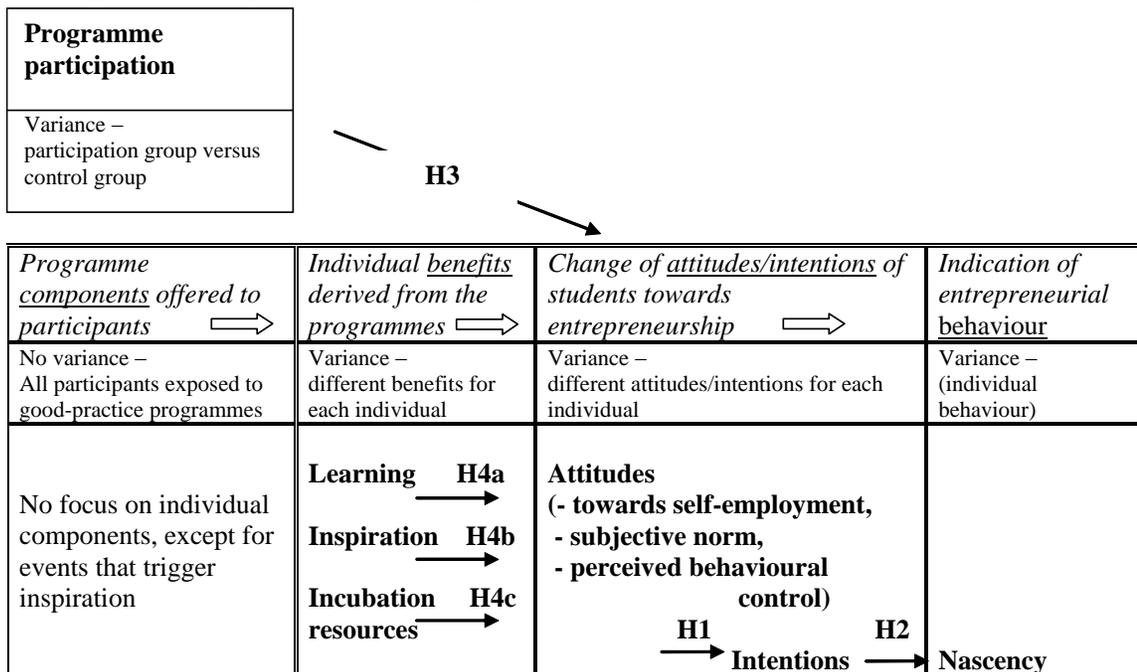


Table 1: Measurement Instruments for attitudes-intentions-nascency

| |
|---|
| Occupational Status Choice Attitude Indexes (33 items adopted from Kolvereid, 1996) |
| A. Reasons for becoming organisationally employed |
| 1. Security (two items): Job security, Job stability (Cronbach's α : $t_1=0.86$, $t_2 = 0.86$) |
| 2. Work load (five items): Not having to work long hours, To have leisure, To have fixed working hours, Not to have a stressful job, Have a simple, not complicated job (Cronbach's α : $t_1=0.72$, $t_2 = 0.74$) |
| 3. Social environment (two items): Participate in a social environment, To be a member of a social "milieu" (Cronbach's α : $t_1=0.76$, $t_2 = 0.78$) |
| 4. Avoid responsibility (three items): Avoid responsibility, Not taking too much responsibility, Avoid commitment (Cronbach's α : $t_1=0.77$, $t_2 = 0.81$) |
| 5. Career (two items): Have opportunity for career progress, Promotion (Cronbach's α : $t_1=0.76$, $t_2 = 0.86$) |
| B. Reasons for becoming self-employed |
| 1. Economic opportunity (three items): Economic opportunity, To receive compensation based on merit, To keep a large proportion of the result (Cronbach's α : $t_1=0.73$, $t_2 = 0.73$) |
| 2. Challenge (four items): To have a challenging job, To have an exciting job, To have an interesting job, To have a motivating job (Cronbach's α : $t_1=0.88$, $t_2 = 0.87$) |
| 3. Autonomy (four items): Freedom, Independence, To be your own boss, Be able to choose your own work tasks (Cronbach's α : $t_1=0.79$, $t_2 = 0.82$) |
| 4. Authority (two items): Have power to make decisions, Have authority (Cronbach's α : $t_1=0.73$, $t_2 = 0.70$) |
| 5. Self-realisation (four items): Self realisation, Realise one's dreams, To create something, To take advantage of your creative needs (Cronbach's α : $t_1=0.81$, $t_2 = 0.79$) |
| 6. Participate in the whole process (two items): To participate in the whole process, To follow work-tasks from a to z (Cronbach's α : $t_1=0.78$, $t_2 = 0.78$) |
| <i>The question asked was as follows: To what extent do you agree or disagree that the following factors are important to consider when you are to decide your future career path? (1=strongly disagree; 7=strongly agree)</i> |
| Perceived behavioural control (6 Items adopted from Kolvereid, 1996 / 7-point scale). |
| (1) For me, being self-employed would be (very easy - very difficult) |
| (2) If I wanted to, I could easily pursue a career as self-employed (strongly agree - strongly disagree) |
| (3) As self-employed, how much control would I have over the situation? (absolutely no control - complete control) |
| (4) The number of events outside my control which could prevent me from being self-employed are (very few - numerous) |
| (5) If I become self-employed the chances of success would be (very low-very high) |
| (6) If I pursue a career as self-employed, the chances of failure would be (very low-very high). |
| Responses to items 1,2,4,6, were reverse-coded (1=7, 2=6 etc) and the scores on the six items were averaged to obtain an overall measure of perceived behavioural control. |
| Occupational status choice intention (3 Items from Kolvereid, 1996 / 7-point scale) |
| (1) "If you were to choose between running your own business and being employed by someone, what would you prefer? (1=Would prefer to be employed by someone; 7=Would prefer to be self-employed); |
| (2) "How likely is it that you will pursue a career as self-employed?" (1=unlikely – 7=likely); |
| (3) "How likely is it that you will pursue a career as employed in an organisation?" (1=unlikely – 7=likely). Item 3 was reversed |
| An index of intention to become self-employed was created by averaging the three item-scores. |
| Start-up activities for nascency (19 items adopted from Alsos & Kolvereid, 1998) |
| <i>Segment 1) 'Business Planning'</i> : Prepared business plan, Organised start-up team, Looked for facilities/equipment, Acquired facilities/equipment, Developed product/service, Conducted market research, Devoted full time to the business. |
| <i>Segment 2) 'Financing the new firm'</i> : Saved money to invest, Invested own money, Applied for bank funding, Received bank funding, Applied for government funding, Received government funding. |
| <i>Segment 3) 'Interaction with the external environment'</i> : Applied for license patent etc., Hired employees, Sales promotion activities, Business registration, Received first payment, Positive net income. |

Table 2: **Resource utilisation** (11 items. Comparison of perceptual scales with ‘factual’ proxy measures)

| <i>Item on the perceptual scale</i> | <i>‘Factual’ proxy for validation</i> | <i>Association</i> |
|---|---|--------------------------|
| A pool of entrepreneurial-minded classmates for building a team | Ratio of classmates to externals in the business competition team (project reports) | $r = .67, p < 0.001$ |
| A pool of university technology | Technology project? (yes/no) (project reports) | Sp. $r = .73, p < 0.001$ |
| Advice from faculty | No of meetings with faculty (diaries) | $r = .70, p < 0.001$ |
| Advice from classmates | No of group-meetings (project reports) | $r = .58, p < 0.001$ |
| Advice from tech-transfer officers | No of meetings with TTO (project reports) | $r = .72, p < 0.001$ |
| Research resources (library /web) | No of hours in the library (self-reported) | $r = .65, p < 0.001$ |
| Networking events | No of networking events attended (records) | $r = .59, p < 0.001$ |
| Physical space for meetings | No of room meeting-room bookings (records) | $r = .45, p < 0.001$ |
| Business plan competitions (testing ground for the idea) | Participation in business plan competition? (yes/no) (records) | Sp. $r = .75, p < 0.001$ |
| Seed funding from university | Seed funding received? (yes/no) (records) | Sp. $r = .77, p < 0.001$ |
| Referrals to investors | No of referrals (recollection of faculty) | $r = .78, p < 0.001$ |

Table 3: Descriptive statistics and Pearson correlations - Attitudes and intentions for total sample ($N=250$)

| Variable | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|
| 1. Attitudes towards self-employment (t1) | 10.20 | 4.98 | 1 | | | | | | | |
| 2. Subjective norm (t1) | 7.71 | 17.10 | .29** | 1 | | | | | | |
| 3. Perceived behavioural control (t1) | 4.12 | .85 | .27** | .38** | 1 | | | | | |
| 4. Intention towards self-employment (t1) | 3.56 | 1.19 | .42** | .53** | .39** | 1 | | | | |
| 5. Attitudes towards self-employment (t2) | 10.80 | 4.56 | .58** | .12 | .24** | .40** | 1 | | | |
| 6. Subjective Norm (t2) | 10.10 | 16.50 | .25** | .51** | .24** | .52** | .30** | 1 | | |
| 7. Perceived Behavioural control (t2) | 4.20 | .69 | .05 | .30** | .52** | .25** | .10 | .26** | 1 | |
| 8. Intention towards self-employment (t2) | 3.88 | 1.01 | .27** | .25** | .30** | .71** | .40** | .44** | .25** | 1 |

* $p < .05$ ** $p < .001$

Table 4: Regression models of attitudes upon intentions at time 1 and time 2 ($N=250$)

| Predictor variables | Intention (Model at time 1) | Intention (Model at time 2) |
|-------------------------------|-----------------------------|-----------------------------|
| | Standardised coefficients | Standardised coefficients |
| Attitude to self employment | .24** | .29** |
| Subjective norm | .35** | .35** |
| Perceived behavioural control | .22** | .16** |
| Adjusted R2 | .35** | .32** |

* $p < .05$ ** $p < .001$

Table 5: One-way ANOVA ($N=250$)- Do mean difference values differ between the programme and control group?

| | F | Sig | η^2 |
|---|--------------|-------------|------------|
| 1. Difference in attitude to self-employment. (t2-t1) | .34 | .563 | .00 |
| 2. Difference in subjective norm (t2-t1) | 4.87 | .028 | .02 |
| 3. Difference in perceived behavioural control (t2-t1) | .16 | .689 | .00 |
| 4. Differ. In intention towards self-employment (t2-t1) | 13.23 | .000 | .05 |

Table 6: Descriptive statistics and Pearson correlations for the analysis of the programme sample (N=124)

| Variable | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|----------------------|-------|------|-------|-------|--------|--------|--------|--------|-------|-------|-------|-------|------|------|------|------|-------|-----|-------|-----|----|
| 1.Uni.(1=INP) | .36 | | 1 | | | | | | | | | | | | | | | | | | |
| 2. Selection | .66 | | .54** | 1 | | | | | | | | | | | | | | | | | |
| 3. Attitude (t1) | 10.90 | 5.06 | .01 | .22* | 1 | | | | | | | | | | | | | | | | |
| 4. Subj. norm (t1) | 7.67 | 17.6 | .07 | .13 | .26** | 1 | | | | | | | | | | | | | | | |
| 5. Per. control (t1) | 4.18 | .80 | .13 | .33** | .28** | .40** | 1 | | | | | | | | | | | | | | |
| 6. Intention (t1) | 3.74 | 1.13 | .21* | .47** | .40** | .50** | .43** | 1 | | | | | | | | | | | | | |
| 7. Attitude (t2) | 11.30 | 4.99 | .07 | .37** | .56** | .14 | .23** | .38** | 1 | | | | | | | | | | | | |
| 8. Subj. norm (t2) | 11.30 | 18.8 | .19* | .28** | .26** | .53** | .23** | .55** | .33** | 1 | | | | | | | | | | | |
| 9. Per. control (t2) | 4.28 | .75 | .10 | .13 | .08 | .31** | .55** | .27** | .14 | .25** | 1 | | | | | | | | | | |
| 10. Intention (t2) | 4.11 | 1.20 | .23* | .42** | .29** | .29** | .34** | .74** | .43** | .48** | .29** | 1 | | | | | | | | | |
| 11. Attitude (t2-t1) | .33 | 4.72 | .06 | .14 | -.48** | -.13 | -.06 | -.02 | .46** | .07 | .06 | .13 | 1 | | | | | | | | |
| 12.S. norm (t2-t1) | 3.62 | 17.6 | .13 | .17 | .01 | -.43** | -.15 | .09 | .21* | .54** | -.04 | .23* | .21* | 1 | | | | | | | |
| 13.Per.contr (t2-t1) | .10 | .74 | -.03 | -.23* | -.22* | -.12 | -.52** | -.19* | -.11 | -.08 | .36** | -.09 | .13 | .12 | 1 | | | | | | |
| 14. Intent (t2-t1) | .37 | .84 | .03 | -.02 | -.12 | -.26** | -.09 | -.29** | .09 | -.05 | .05 | .43** | .22 | .20* | .15 | 1 | | | | | |
| 15.Start-up active. | 3.22 | 3.48 | .34** | -.05 | -.09 | .09 | .03 | -.08 | -.05 | -.04 | .10 | -.12 | .04 | -.14 | .06 | -.06 | 1 | | | | |
| 16.Nascency | .27 | | .36** | .17 | .07 | .15 | .06 | .11 | .23* | .14 | .12 | .09 | .17 | .00 | .05 | -.02 | .53** | 1 | | | |
| 17. Learning | 4.96 | .86 | -.07 | .06 | .02 | .19* | .00 | .09 | .14 | .12 | .03 | .13 | .13 | -.06 | .02 | .06 | -.08 | .07 | 1 | | |
| 18. Inspiration | 3.60 | 2.28 | -.08 | .06 | .01 | .05 | .01 | .20* | .14 | .23* | .06 | .34** | .14 | .19* | .05 | .20* | -.10 | .03 | .40** | 1 | |
| 19.Resource utilis. | 4.14 | 1.22 | .05 | -.05 | -.01 | .08 | .01 | -.03 | .08 | .13 | -.02 | .04 | .10 | .06 | -.04 | .10 | .08 | .07 | .31** | .13 | 1 |

* p<.05 ** p<.001

Table 7: The effect of categorical variables on attitudes and intentions: GLM repeated measures ANOVA for the programme sample (N=124).

| | Attitude to self – employment | | | Subjective norm | | | Perceived behavioural control | | | Intention towards self-employment | | |
|----------------------------|-------------------------------|------|----------|-----------------|-------------|------------|-------------------------------|-------------|------------|-----------------------------------|-------------|------------|
| | F | p | η^2 | F | p | η^2 | F | p | η^2 | F | p | η^2 |
| Time | .60 | .440 | .01 | 5.22 | .024 | .04 | 2.41 | .123 | .02 | 23.70 | .000 | .16 |
| Interaction effects | | | | | | | | | | | | |
| Time x University | .52 | .472 | .00 | 2.15 | .145 | .02 | .14 | .709 | .00 | .15 | .698 | .00 |
| Time x Module | 1.61 | .130 | .10 | 1.69 | .109 | .11 | 1.50 | .165 | .09 | .16 | .996 | .01 |
| Time x Mode of selection | 2.63 | .108 | .02 | 3.62 | .059 | .03 | 6.84 | .010 | .05 | .07 | .788 | .00 |
| Time x Nascency | 3.46 | .065 | .03 | .00 | .974 | .00 | .34 | .562 | .00 | .04 | .839 | .00 |
| Time x Trigger event | .93 | .337 | .01 | 6.81 | .010 | .05 | .18 | .670 | .00 | 5.54 | .020 | .04 |

Table 8: Hierarchical regression models for the difference in attitudes and intentions before and after the programme (N=124)

| Independent variables | Difference in attitude to self –employment (t2-t1) | | Difference in subjective norm (t2-t1) | | Difference in perc. behavioural control (t2-t1) | | Difference in Intention to self-employment (t2-t1) | |
|---|--|----------------|---------------------------------------|----------------|---|----------------|--|----------------|
| | Step 1 | Step2 | Step 1 | Step 2 | Step 1 | Step 2 | Step 1 | Step 2 |
| Step 1: Control variables | | | | | | | | |
| Time 1 values of the dependent variable | -.483** | -.484** | -.430** | -.430** | -.499** | -.496** | -.290** | -.341** |
| Mode of selection | | | | | -.063 | -.072 | | |
| Step 2: Predictor variables | | | | | | | | |
| Learning | | .077 | | -.111 | | .023 | | -.038 |
| Inspiration | | .107 | | .247** | | .053 | | .281** |
| Resource utilisation | | .056 | | .095 | | -.048 | | .066 |
| Overall R ² | | .233** | | .264** | | .274** | | .279** |
| ΔR^2 | | | | .031 | | .060* | | .005 |
| F | | 37.04** | | 10.68** | | 27.68** | | 9.63** |
| ΔF | | | | 1.69 | | 3.14* | | .280 |

* p<.05 ** p<.001