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ABSTRACT

Enhancing levels of innovation and entrepreneurship to grow a more competitive economy is the focus of much government effort. Attention is paid to changing a culture seen as antagonistic to entrepreneurship through initiatives designed to promote an entrepreneurial spirit. Universities, aware of the importance of developing entrepreneurial potential, are focusing on equipping students with the skills and abilities to contribute to innovation within organisations they join upon graduation, while also providing opportunities for the development of student aspirations. Cambridge-MIT Institute (CMI) has developed a one week event designed to influence deep personal values and the underlying motivations of potential entrepreneurs. This paper reports on the Connections course content as it was offered at the University of Strathclyde in 2003, content premised on the belief that students are motivated to start new enterprises through enhancement of self-confidence in their entrepreneurial skills. Measures of entrepreneurial self-efficacy and other outcomes are offered, followed by a report of the results found at the end of the event and then six months later. The programme is found to have created enduring improvements in entrepreneurial self-efficacy, and a related strengthening of pre-entrepreneurial awareness and exploration of ideas for starting companies. Other assessment results are presented suggesting the need to include explicit course content on entrepreneurial career paths. The implications of the Connections findings for entrepreneurship teaching in general are discussed.

Introduction

The last 40 years have seen increasing attention paid to investigation of factors relating to entrepreneurship and new venture creation (Cooper 1970, 1973; Roberts 1991; Bygrave 1997; Oakey 1995; Timmons 1999). Much of this work has been stimulated by the desire to identify methods of encouraging entrepreneurship as a means of increasing new firm formation rates and enhancing regional and national economic development (Oakey 1984; Oakey *et al.* 1988, 1990; Storey 1994; Oakey 1995; Oakey and Pearson 1995). This paper reports on one such method, the testing of a Cambridge-MIT Institute (CMI) model programme at the University of Strathclyde.

The Global Entrepreneurship Monitor (GEM) suggests there are marked international differences in the incidence of entrepreneurial activity (Reynolds *et al*. 2004) and regional variations within countries (Levie *et al*. 2004). Factors such as differences in local market opportunities, skill levels for new venture creation and management, unemployment levels (Goldsmith *et al.* 1997), availability of grants and loans for start-up, variations in entrepreneurial culture and the presence of entrepreneurial role models (Cooper 1973; Anderson *et al.* 2003) influence sub-national patterns. The UK government has been among those that have sought to improve national and regional conditions for new venture creation, reducing market barriers and strengthening incentives for entrepreneurship. There is growing recognition in the UK, however, that improving economic conditions alone is not sufficient, and that at least part of the solution requires changing national culture or, more precisely, finding ways to strengthen the entrepreneurial values, perceptions and motivations of prospective entrepreneurs (Tomes 2003).

Entrepreneurship education has the potential to develop knowledge and skills for enterprise but also, importantly, increase the willingness of individuals to consider entrepreneurship as a career option. Education is believed to be able to ameliorate negative student perceptions of the

probability and costs of failure, and help dispel cultural stereotypes that entrepreneurship is less than ethical. Consequently, a number of current government-funded initiatives are wholly or partly focused on enhancing university-level enterprise education. Science Enterprise Challenge addresses a perceived lack of enterprise skills in science and engineering graduates through education and commercialisation interventions, while CMI, with its remit of enhancing UK competitiveness, is targeting resources at undergraduate education in entrepreneurship.

Founded in 2000 with funds from the UK government, CMI's goals include contributing to entrepreneurship in Britain through the identification and study of model programmes. A successful one-week intensive event held annually at MIT that fosters undergraduate leadership skills was adapted for this purpose. The curriculum was reorganised, retaining a pedagogical approach focusing on leadership motivation, teaming and work skills in groups, but narrowed to stress entrepreneurship rather than leadership in general. A premise was the belief that students can be motivated to start new enterprises by enhancing self-confidence in their entrepreneurial skills. Called Connections, the programme was piloted at MIT, offered in the UK at the University of Durham in January 2003, and repeated at the University of Strathclyde in August 2003. This paper presents the theory and methods behind the programme design, reports on Connections programme goals and content, and explores the results of the Connections assessment at the University of Strathclyde.

Economic change and entrepreneurial career paths

The economic environment in many developed nations is undergoing long term and significant change that shows every sign of continuing well into the future. Decline in traditional sectors, such as coal-mining and steel making, causes dramatic reductions in manpower requirements while other sectors have reduced labour needs owing to widespread application of new technology. Even within robust industry sectors many large corporations created during the 1960s and 1970s experienced downsizing and restructuring to increase efficiency. Opportunities have been created for firms, many of them small organisations, which now perform contract work undertaking the activities once performed by the displaced employees. Developments in new technology fields have opened up markets ideally suited to exploitation by dynamic, flexible and innovative small firms. If the broader economy is to benefit from restructuring and the emergence of new business models, it requires entrepreneurial individuals and teams able to recognise and exploit effectively the opportunities created. Both established and newly created firms require employees with the knowledge, skills and attitudes that enable them to develop innovative, leading edge products and services which underpin venture creation, growth and sustainable development in the face of increasing competition.

Traditionally, many graduates joined large corporations, benefiting from in-house training and development opportunities, and spent the majority of their entire career with the same organisation. The large firm proved a good environment for personal development, but tended not to contribute significantly to an individual's capabilities and competences for venture creation unless individuals worked in divisions with a project rather than a functional focus (Cooper 1973). Perhaps in part for this reason, those who did leave their first employer usually worked for other established organisations, while a minority established their own enterprises. Most new ventures are established by those who have worked for other, often large, established organisations prior to starting their own business, not by recent graduates (Oakey *et al.* 1990; Cooper 1996; Lindholm Dahlstrand 1999; Harrison *et al.* 2004).

The same economic trends that create a greater need for new generations of entrepreneurs contribute to general cost reductions that mean there are fewer training opportunities to prepare them. While in the past early employers have provided a substantial training ground where employees developed and honed their knowledge, skills, attitudes and networks that are an invaluable foundation for entrepreneurship (Harrison *et al.* 2004), today training channels in large

companies are less readily available. Few graduates have the choice of joining a large employer for life and participating in such long-term personnel development programmes they might offer. Portfolio careers are becoming the norm, as individuals are likely to work for a number of employers during their career (Bridges 1995) and career change is common (Henderson and Robertson 2000) as people switch to pursue more attractive opportunities. Increasingly, small and medium sized firms are offering opportunities for graduates, although few offer formal structured training programmes as most lack sizeable training budgets. Individuals with entrepreneurial aspirations still have the opportunity to learn first hand about business processes as employees, from basic management practices to identifying and exploiting opportunities. In some cases they may gain experience with managing a venture for growth (Timmons 1999), but with portfolio careers the identification of a career path that best leads to entrepreneurship is left to the individual. The most common exceptions are provided by the cadres of successful entrepreneurs who choose to mentor young professionals with career advice and encouragement, often choosing to help individuals who worked effectively in the companies they have started.

In this environment the role of university or other programmes that promote entrepreneurship goes beyond the teaching of business skills. Prospective entrepreneurs need to know how to make good decisions about paths that have a high likelihood of leading to the type of entrepreneurship they wish to pursue. If their goal is to lead a high growth start-up company, tomorrow's graduates should be taught to identify the comparative advantages of joining established or newly formed small companies, trying to start their own firm alone or with a start-up team and other options. As they consider their career goals, they need to understand what steps to take to achieve them, and how to capitalise upon their experience (Cooper *et al.* 2004). They need to understand entrepreneurship as a career that they must manage themselves, and they must be enabled to assess and act on opportunities when they occur.

The role of entrepreneurship education in the development of self-efficacy

Important in the decision to start a venture is the confidence and self-belief that an individual or group of potential founders has in their ability to undertake successfully the many sub-actions/activities that are required. Self-efficacy is central to the willingness to act in an entrepreneurial way, to identify and seize opportunities. First postulated by Bandura (1997) self-efficacy beliefs are "people's judgement of their capabilities to organise and execute courses of action required to produce given attainments" and have the consequence that "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true". High and low levels of self-efficacy have serious consequences for an individual's belief in their ability to perform in a range of situations. High levels of self-efficacy have been linked to various behaviours such as innovation and opportunity recognition in entrepreneurship (Ardichvili *et al.* 2003) and career persistence (Mau 2003).

A person's willingness to act is influenced by their perceived abilities and skills with respect to that area of activity. Individuals require an accurate sense of self-image to prevent malign outcomes; for example, someone with an inflated view of their own abilities may put him/herself into a position in which they are bound to fail, which will have a negative impact on self-confidence and self-efficacy. Similarly, a person who underestimates their abilities will not strive to achieve to their potential. A degree of stretch, where an individual strives beyond their known competence level, can contribute to the development of enhanced self-efficacy. In the context of sources of self-efficacy, authentic mastery, failure, vicarious experience, the success of others and the appraisal of an individual's skills are all key elements (Bandura 1997). Learning through the failure of others, and modest levels of personal failure, has the capability to feed authentic mastery.

To increase levels of entrepreneurial motivation it is proposed that it is essential that programmes influence self-efficacy and confidence of individuals so that they will try, learn and persist in the pursuit of entrepreneurship. Education programmes are thus needed that contain the pedagogical

elements shown to develop particular skills and competences, linked to enhanced self-efficacy. From this perspective one comes to see that the forms of teaching may be as important as the curriculum content. Experiential and reflective methods are known to promote deep learning (Barclay 1996; Cope and Watts 2000; Krebner 2001; Loo and Thorpe 2002), and are also relevant in the development of self-belief and self-efficacy (Ndoye 2003). Self-efficacy can be developed through vicarious experience, and self-efficacy for entrepreneurship can thus be conceptualised as being enhanced through pedagogical approaches which encourage the student to learn through the experience of others, as well as through their own experience (Rae and Carswell 2000). At the passive end of the spectrum students learn through the integration of brief examples into the theoretical or concept-based lecture. The student takes a slightly more active role in his/her learning during the analysis of written case studies which explore the entrepreneurial event or some other aspect of the venture creation process (Krebner 2001). Guest entrepreneurs as speakers enable students to learn directly from those who have first-hand experience of the innovation and venture creation process (Cooper *et al.* 2004). Where an entrepreneur cannot be present in the classroom the use of video profiles can prove an effective tool for teaching and learning (Roberston and Collins 2003).

The incorporation of individual, small and large group activities offers the potential to develop other aspects of self-efficacy and skills important in enterprise creation, such as teaming, while blending those from different backgrounds and cultures is also important in developing understanding of different perspectives and subject mastery (Driver 2003; Gear *et al.* 2003; Poell and Van der Krogt 2003). Evidence from the fields of training and development regarding assessment and feedback points to their role in influencing the development of self-efficacy (Humphreys *et al.* 1997); increased regularity of assessment and feedback provides tangible evidence of changes in performance which can be influential in enhancing self-efficacy (Orpen 1999). Critical thinking and reflection have been linked to the achievement of deep learning and practices such as journaling and the use of learning logs may be used to support such activities (Barclay 1996; Jack and Anderson 1999; Loo and Thorpe 2002; Van Woerkom *et al.* 2002).

The Connections programme continues to evolve as the community growing up around it gains experience and learns from continuing assessment. One result has been a growing appreciation for the importance of entrepreneurial self-efficacy and the value of this literature that informs us how best to strengthen it.

The Connections Programme

CMI Connections (recently renamed CMI Enterprisers, www.Enterprisers.org.uk) brings together undergraduate students from UK universities and MIT for a highly interactive and participative, week-long, residential programme. It is designed to develop entrepreneurial skills, build confidence and create meaningful relationships among participants from diverse cultural backgrounds and disciplines. During the programme participants learn about entrepreneurship and how to pursue their passions, acquiring the tools and developing/enhancing their skills for pursuing projects and building new organisations. The curriculum content and delivery have been conceived to equip participants with entrepreneurial project/venture skills, for example, networking, team building and creativity. Participants learn about the resources required to realise new activities, develop a network of like-minded students across different countries and universities and establish contacts with a variety of university faculty members and links to resources within their own institutions. The emphasis is on helping participants to unlock their entrepreneurial spirit, instil a “can do” attitude and encourage them to acquire the skills, confidence and contacts to realise ambitions within a “safe” environment, with support from faculty and those in the entrepreneurial community.

To date there have been four programmes: Boston 2002, Durham 2003, Strathclyde 2003 and Durham 2004. Each programme has involved roughly ten students and two facilitators from each of six universities, and two to three lead facilitators. Programmes have also drawn from the

enterprise community to bring in guest speakers and other entrepreneurial participants to acts as role models and provide the opportunity for students to network with and learn from those who have created their own ventures. This paper reports on the assessment of the Strathclyde 2003 programme, which involved 55 students and 12 facilitators from the Universities of Edinburgh, Lancaster and Strathclyde, Queen's University Belfast, The Robert Gordon University and MIT. Students were drawn from a wide range of disciplinary backgrounds, from politics, history, and physics to Scottish studies and product design. Facilitators from each institution generally were involved in small business and enterprise teaching or had a personal interest or involvement in entrepreneurship, and were given two days of training before the event.

Programme curriculum and delivery

The programme focused on four key themes, originally incorporated into the curriculum by Shai Vyakaram of the Centre for Entrepreneurial Learning at the University of Cambridge, which underpinned the project/venture development process and supported students in the development of ideas/opportunities from new business ventures to not-for-profit initiatives. Each theme was the focus for a day of the programme:

The entrepreneur within each of us: defining and understanding entrepreneurship and understanding one's self and personal motivations, values, ethics and goals;

Launching a great idea: understanding what an entrepreneur is, the process of creativity and idea generation and developing the first elements in the project plan;

What it will take to succeed: leadership and teams, the identification and acquisition of resources and the value and use of networks in resource acquisition and project execution (the Strathclyde programme placed much more emphasis on networking than that in Durham);

Keeping the dream alive: maintaining motivation and commitment, celebrating progress and sustaining projects.

The curriculum was delivered using a range of pedagogical techniques to create contrasting learning environments through which students would gain perspectives on the new venture/ project creation process. While large group sessions were employed to deliver elements of the core curriculum, such as ethics, creativity, presentations/pitching and networking, frequently within such sessions students were broken into smaller, tutor-facilitated groups to engage in highly participative, interactive exercises; occasionally, students worked independently, for example, to develop their own project idea and pitch. Presentations from guest entrepreneurs, representing a range of backgrounds, ages, markets and experiences, enabled participants to learn vicariously from practising entrepreneurs, and to appreciate the positive and negative aspects of new project genesis and implementation. It was expected that the students would appreciate the different career paths the speakers had taken, and draw personal lessons on how they might think about work opportunities as steps in a career. Other sessions focused on topics such as project planning, resources and networking. Participants engaged in exercises to develop skills in presentation and pitching (abilities to describe project concepts orally), and learned the importance of feedback and constructive criticism. Students were encouraged to engage in reflection on the learning process and record their reflections in a daily journal or learning log.

Assessment methodology

The Strathclyde Connections event offered in Glasgow in August 2003 was assessed with a pre- and post-test design. Data were collected on two proximate measures of the event's effectiveness, and a third "trajectory metric" that would provide evidence that the event had caused changes that are likely to lead to participants starting new companies at a rate higher than what would have otherwise been expected.

Because the participants were self-selected and not representative of university students in general, the assessment used a pre-test before the event and two post-tests, one immediately after the event and one six months later. Applicants from different universities competed for the opportunity to join the Connections event based in part on the strength of their entrepreneurial interest, and some had already explored entrepreneurial possibilities. As a consequence it was difficult to define an appropriate control group. Benchmark data are being collected on some of these universities and will be available in the future to establish the extent of these differences, but it remains that a pre- and post-test design was required to measure change. An abbreviated post-test was administered immediately after the week-long event to determine the amount of change that could be immediately attributed to the Connections event; and a second post-test conducted after six months measured what enduring change remained after the enthusiasm generated by the event had waned.

The assessment measures concentrated heavily on estimating the student sense of personal competency in both general skills and in their understanding of and capacity to undertake entrepreneurship; asked questions about their envisioned career; and sought the frequency of behaviours believed to be precursors of entrepreneurship.

Measuring sense of task efficacy. Gecas (1989) reports that self-efficacy is measured in a variety of ways, but suggests that the two dominant forms are task and domain specific. Bandura, whose early work focused on the mastery of phobias (Bandura *et. al.* 1982), consistently stresses that self-efficacy is based on the performance of quite specific tasks and his work is widely followed. The early study of career self-efficacy and interests represents an extreme domain approach, with Lent *et al*. (1986) asking students about their confidence performing the work of an occupation based on the career title, without any detailing of specific tasks. Some fields see both approaches used, such as work on mathematics self-efficacy, a critical predictor of persistent pursuit of science and engineering careers. On one hand, Pajares (1996) asks students to examine specific problems and then asks a series of separate judgments about their confidence that they could solve each one. Conversely, Betz and Hackett (1983) use a domain approach asking for the individual's confidence that they can get an A, then a B, and then a C grade for each of a variety of maths courses. The present research tries a mid-range approach, asking about their capabilities in types of skill areas like the ability to "design something novel", "apply an abstract idea to a real problem" and "recognise an opportunity". Specific to entrepreneurship, participating students were also asked about their "understanding about what it takes to start a company" and whether they could "start a company if you chose to".

Another difference in approaches to self-efficacy measurement is found in how one addresses the frame of reference used. Bandura (1986) holds the position that while students might use other students as a standard of comparison to judge some self-concept measures, judgments of their abilities on specific tasks are not relative and not influenced by an external frame of reference. In a useful review, Marsh *et al*. (1997) suggest that while Bandura may well be correct that judgments about specific tasks are generally less influenced by peer capabilities, but when the tasks are not familiar and the subject has no prior experience with performance, frame of reference effects may not be avoidable. In such cases, the dilemma is whether one makes the frame of reference explicit (e.g., comparing oneself with "other students"), allowing it to influence judgments although in a consistent manner; or risk that individuals might be drawing on unknown and different frames of reference (each thinking of "friends" with widely differing skill levels). It was thought that the Connections students might have difficulty answering questions about their ability to perform tasks they had never encountered without some referent, particularly at the pre-test when entrepreneurial activities had as yet not been experienced or even described to many of the participants. Consequently the research drew on a general skills-based self-ranking approach suggested by Susan Blake, a consultant on the Cambridge-MIT undergraduate exchange, asking the Strathclyde Connections students to rank their ability relative to other university students on a six point scale from poor to excellent.

Envisioned career paths and high growth entrepreneurship. Many individuals interested in entrepreneurship have relatively modest ambitions. While the idea of a start-up for some evokes an image of great wealth and global corporations, for others a new company may be simply a source of personal income. This might be a life-style company whose primary purpose is to provide individuals with a secure income stream and relative autonomy with such benefits that a small company structure and legal status might provide. They might alternatively prefer to be self-employed, minimizing the need to take any responsibility for others. For Connections the intention is to encourage participants to consider high growth entrepreneurship, and the emphasis on teams, networking and other skills is designed with a view to encouraging the skills appropriate to high technology or other ambitious ventures.

To assess whether the Connections experience influences the image that participants have of entrepreneurship, they were asked when, if ever, they think it likely that they might be an employee in a start-up, a business owner with employees, or self-employed. The form of the question was when (immediately, within 5 years, in 5 to 10 years, longer than 10 years, or never) did the respondents envision being in the work situation of each type. The first question sought to capture whether the participants had taken the lesson that one valuable path to entrepreneurship is by learning the appropriate skills as a start-up employee, anticipating that the Connections experience would cause participants to move the time forward for that work situation. Another expectation was students who see themselves as self-employed would tend to push that possibility later with an increase in the "never" response; and that those wanting to own a company with employees would shift to a concentration in earlier time frames, but not so early that they could not first gain experience in other companies.

Pre-entrepreneurial behaviour: awareness and exploration. Connections was created by CMI with funding from the UK government that carries an obligation to assess the programme for both its immediate or proximate effects, and for its contribution to competitiveness, productivity and entrepreneurship. While two individuals attending the Strathclyde event have already started companies, an encouraging early outcome, systematic data on entrepreneurial efforts across all the participants on such things as annual turnover and job creation will not be available for 10 or 20 years. Given that entrepreneurship peaks when founders are in their mid-thirties, and continues into their forties and beyond, a complete picture cannot be compiled for 30 years. Faced with that time scale, yet still needing metrics to gauge progress, CMI has developed "trajectory metrics," in this case a measure that shows that a programme does or does not demonstrate progress on a trajectory or path to eventual entrepreneurship.

For Connections that metric is provided by three questions considered to be pre-entrepreneurial behaviours expected of those who continue to be alert to opportunities and evaluate chances that appear. They ask the frequency that individuals talk about ideas for starting companies, whether they return to those ideas to talk about them again, and whether they take steps to look into markets, technology or some other aspect to assess the idea. For each question the respondent had the choice of responding with a frequency range from "Almost never" to "Very often," with the latter defined as over 10 times a month. The assumption is that if individuals are actively engaged in these behaviours, they are demonstrating an awareness of opportunities that might occur, and investing some amount of time in their evaluation. Certainly some individuals will engage in these activities and never start companies, but in the aggregate, if a programme generates a heightened level of awareness and testing of start-up ideas, it is likely to be setting individuals on a path to achieving the economic gains sought by the UK government.

Assessment Results

Results from the programme indicate that the Connections educational interventions have a substantial impact. First, the results of the post-event test are reviewed to show that there is a strong proximal impact of the event that can only be attributed to the programme, suggesting a strong causal link with the programme content and changes in leadership and entrepreneurial self-

efficacy. Second, the results of the surveys conducted six months later show that the effects were not transient results of post-event enthusiasm.

Immediate post-event results: Self-efficacy. The purpose of the second survey given immediately at the conclusion of the Connections event was to determine whether the event

Table 1: Pre- to Post Event Change in Levels of Self-Efficacy

A. Self-efficacy: Current skill levels compared to university students	Percent ranking their skill "Good" to "Excellent"		Response changes from pre- to post event survey and sign test			
N = 55 students	Pre-event	Post event	N	Number increase	Total change	Z value
Design something novel	57.4%	85.5%	55	27	35	3.212**
Solve an unstructured problem	74.1%	85.5%	55	23	31	2.694**
Clearly describe a problem orally	51.9%	72.7%	54	27	37	2.795**
Clearly describe a problem in writing	63.0%	72.2%	53	24	33	2.611*
Ask probing questions that clarify facts	51.9%	83.6%	54	28	32	4.243***
Recognise a good opportunity	66.7%	83.6%	54	24	32	2.828**
Motivate others to work together	59.3%	70.9%	54	25	37	2.137*
Understand what it takes to start your own business	24.1%	72.7%	54	44	47	5.980***
Start a successful business if you want	20.4%	67.3%	54	42	44	6.030***
B. Envisioned work situations by Time Periods (Immediately, Within 5 years, 5 to 10 years, more than 10, or Never)	Percent seeing themselves in situation within 5 years		Response changes from pre- to post event survey and sign test			
In new venture (owned by others)	70.8%	64.6%	48	14 shift later	24	0.816
As business owner (employing others)	27.6%	44.7%	47	16 shift earlier	23	-1.877
Self-employed (working for self)	29.2%	41.7%	48	15 shift earlier	22	-1.706

* p<.05; ** p<.01; *** p<.001. The Sign Test was used to estimate statistical strength of significance because t-test or other methods using difference of means are inappropriate for the pre- and post-test of the same group (Cliff 1991). Given a nul hypothesis that any change found will be random and equally probable in either direction, the sign test calculates the probability that the number of changes is disproportionately in the hypothesized direction (one-tail test). A two-tail test was used for envisioned work.

had an effect on the participants, and to demonstrate that changes found later could be reasonably assumed to have been caused by the event. To save time and to preserve goodwill for the subsequent post-test, a subset limited to nine of the self-efficacy items were on the immediate post-event instrument (see Table 1A).

The results show that after the one-week course there were gains in reported self-efficacy across all areas, with changes ranging from small to massive gains. Comparing the number of increases relative to total changes provides what is called a sign test, and in each case the size of the changes for the responding students is more than can be expected by chance (p<.05 or higher). The smallest increase in self-efficacy found is seen in the change in the percent of participants that say they are "good," "very good" or "excellent" at solving unstructured problems, increasing

from 74.1% to 85.5%. Another result is that there was also only a modest increase in the sense that the participants could recognise an opportunity (66.7% to 83.6%). This small increase is due in part to the fact that the levels of self-efficacy for this item are quite high before the event started. This suggests that one of the distinguishing characteristics of individuals attracted to Connections, and perhaps to other entrepreneurial programmes as well, is a sense that they already have these core skills for entrepreneurship.

The highest levels of improvement are found in participant self-confidence in the ability to start a new company. The proportion of those saying they have "good" or better understanding of what it takes to start a business rose from 24.1% to 72.7%. The percent that felt they had the ability to start a business if they wanted to tripled, rising from 20.4% to 67.3%.

Post-event results for work envisioning. Turning to students' views of when they might see themselves in different work situations (Table 1B), the results indicate that their views were generally unaffected by Connections. The evidence strongly suggests that before coming to Connections the participants had already taken the lesson that work as an employee in the new ventures is an important stepping stone, with 70.8% of them seeing themselves working in a new venture in the next five years. At the end of the week, this result was statistically unchanged at 64.6%. There are suggestive but not quite statistically significant shifts in expectations about the other work situations, with both being a business owner (27.8% increasing to 44.7%) and being self-employed (29.2% increasing to 41.7%) being imagined within the next five years. The conservative conclusion is that work envisioning was not changed meaningfully by Connections, but together these results do suggest that the participants might feel they will be ready for some form of entrepreneurship somewhat earlier than they had been before the event.

Because the Connections event content led students to talk frequently and repeatedly about start-up ideas, it seemed self-evident that any report of the frequency of this behaviour would see an increase, so these questions were not asked until the six month post-test.

The self-efficacy results leave little doubt that the Connections programme at Strathclyde had some effect on the participants. The breadth of the increases in their confidence in their skills suggests the possibility that the relatively intense nature of the experience had created a general enthusiasm that might well dissipate over time. Whether the changes in their views were transient or enduring becomes the next question to be answered.

Self-efficacy on the six month post-test. In late February 2004, six months after the Strathclyde event, the Connections programme contacted the students who had participated in August 2003, asking them to complete another survey that included a full set of the pre-test survey items. Repeated inquiries requesting cooperation continued until 28 responses, or over 50%, had responded, with one or two individuals not responding to some questions. Here we present the pre-test and 6 month post-test results for just those 28 participants.

There was some drop off in the levels of self-efficacy; for example, those saying that they are comparatively confident that they can solve an unstructured problem dropped from 85.5% in August 2003 to 77.8% by February 2004 (Table 2A). Similarly, a small decrease is found in self-ranking of abilities to recognise an opportunity (83.6% to 74.1%). As a result of that decay, and the fact that the number of participants that are in this six-month panel is half the size, several of the six-month increases are no longer statistically significant.

Nonetheless, a general conclusion is that the results from the post-test show that the Strathclyde programme had a strong and enduring impact on the participants' continuing sense of efficacy, particularly for skills related to leadership, entrepreneurship, and other abilities central to the curriculum content. Leadership gains are found in the percent of those ranking their ability as good to excellent at motivating others to work together, which rose from 59.3% to 74.1%. The same percentages for their ability to lead a group whose members disagree rose from 37.0% to

Table 2
Levels of Self-efficacy, Envisioned Work Situations, and Entrepreneurial Awareness at the Universities of Strathclyde

A. Self-efficacy: Current skill levels compared to university students	Percent ranking their skill "Good" to "Excellent"		Response changes from pre- to post event survey and sign test			
Response rate at post-test, 50.9%, for N=28	Pre-Event	After 6 months	N	Number increase	Total change	Z value
Design something novel and innovative.	44.4%	66.7%	27	13	18	1.886*
Solve an unstructured problem.	74.1%	77.8%	27	12	19	1.147
Evaluate arguments and evidence so competing alternatives can be judged.	73.1%	92.3%	26	10	18	0.471
Apply an abstract idea or concept to a real problem or situation.	48.1%	81.5%	27	17	21	2.837**
Clearly describe a problem orally.	51.9%	85.2%	27	17	21	2.837**
Clearly describe a problem in writing.	66.7%	77.8%	27	17	21	2.837**
Develop several methods that might be used to solve an unstructured problem.	53.8%	69.2%	26	13	17	2.183*
Work on collaborative projects as a member of a team.	85.2%	85.2%	27	9	14	1.069
Ask probing questions that clarify facts.	61.5%	80.8%	27	11	15	1.807*
Recognise a good opportunity.	70.4%	74.1%	27	15	19	2.524*
Motivate others to work together.	59.3%	74.1%	27	15	17	3.153***
Lead a group whose members disagree.	37.0%	63.0%	27	15	16	3.500***
Put a detailed plan into action.	59.3%	74.1%	27	13	19	1.606
Deliver on a job you have agreed to do.	88.9%	92.6%	27	11	17	1.213
Understand what it takes to start your own business.	19.2%	76.9%	26	21	22	4.264***
Start a successful business if you want.	22.2%	59.3%	27	18	20	3.578***
B. Envisioned work situations by Time Periods (Immediately, Within 5 years, 5 to 10 years, more than 10, or Never)	Percent seeing themselves in situation in 5 years		Response changes 6 months after the event and sign test			
In new venture (owned by others).	63.0%	40.7%	27	14	20	1.789
As business owner (employing others).	17.9%	28.6%	28	9	16	0.509
Self-employed (working for self).	17.9%	21.4%	28	8	15	0.258
C. Entrepreneurial Awareness: Frequency (Almost never to activity regarding start-up company ideas.	Percent saying they do activity "Often" (6+ times a month)		Response changes 6 months after the event and sign test			
Talked about an idea for starting a Company.	28.6%	39.3%	28	11	19	0.688
Pursued an idea for starting a company talking about it more than once.	14.3%	28.6%	28	12	18	1.414*
Took steps (e.g., looked into markets or technology) to follow up on an idea.	7.1%	25.0%	28	10	13	1.941*

* p<.05; **p<.01; ***p<.001. One-tail tests were used to estimate significance of self-efficacy and entrepreneurial awareness since change is hypothesised only to increase. A two-tail test was used for envisioned work.

63.0%. Self-ranked understanding of what it takes to start a company rose from 19.2% to 76.9%, and their confidence in being able to start a company if they wanted to went from 22.2% to 59.3% saying they had good to excellent abilities for that purpose. These differences are significant at $p<.001$, which is to say that they could have only occurred one time in a thousand or less often by chance.

Other results are less dramatic, but still meaningful. The participants have increased their confidence in their oral and written communications skills for problem solving ($p<.01$). The percentage that say they are good to excellent at recognising opportunities again does not appear to change (70.4% and 74.1%), but there are substantial changes within those combined categories with 15 changes in increased confidence and only two declines, explaining why those results prove to be statistically significant ($p<.01$). The data suggest that Connections has an enduring effect on participant beliefs in abilities central to entrepreneurship.

Envisioned work situations. Given there was little change at the post-event survey, it comes as no surprise that after six months there is again little evidence that Connections was effective in promoting increased interest in high growth career paths. As shown in Table 2B, attitudes towards working as an employee shift further into the future. Those seeing themselves using this form of work as an early stepping stone within five years fell from 63.0% to 40.7%. For the other two questions about the timing of self-employment or being a business owner, there is no meaningful change. The direction of the shift is towards a slight increase in those thinking they might take on that role within the next five years, but the results are far from being statistically significant and the most appropriate judgment would be to say there are no meaningful changes in the desired directions. These results are generally consistent with those found at the post-event survey that the participants were not influenced by Connections in directions believed valuable for high growth entrepreneurship.

Entrepreneurial awareness and exploration. The results for our metric for heightened entrepreneurial behaviour from the six-month follow-up are more positive (see Table 2C). While the frequency of talking about ideas for starting a venture has increased, with those reporting that they talk about such ideas a half dozen times a month or more increasing from 28.6% to 39.3%, this change is within a range that could have occurred by chance. The results for those who take such discussions further are more consequential. Six months after the Connections event, 28.6% pursue such ideas six times a month or more, doubling the 14.3% found at the pre-test. Going beyond talking, those who take active steps to investigate an idea are at the cusp of entrepreneurship, engaging in exploring possibilities and developing their skills to evaluate opportunities. Comparing their pre-test reports with their behaviour six months later, the respondents have more than tripled their activity levels, with 25.0% reporting that they engage in these behaviours six times a month or more, compared with only 7.1% at the pre-test.

Discussion

The Connections event can be said to have succeeded in its primary purpose, to strengthen the participants' entrepreneurial motivation through a programme that builds their confidence in their ability to perform the tasks related to entrepreneurship. The offering in August 2003 was a six-day, intensive experience with the student fully engaged and in residence for most of each day. The week began with the administration of the pre-test, and on the last day an abbreviated post-test designed to establish with confidence that the programme had measurable short-term effects. Given the relative isolation of the students, that 5 out of 6 were away from their home institutions, and the diversity of backgrounds, it would seem reasonable to attribute any change to the Connections experience.

Relative to the size of the investment, an intervention of only six days duration, the enduring impact after six months seems quite remarkable. Certainly one reason for the success was that the participants were self-selected and quite ready to be persuaded that they had leadership and entrepreneurial talent. Another seems likely to be the nature of self-efficacy itself, a psychological characteristic known for its ability to have an enduring influence on related behaviour and interests (Mau 2003). Self-efficacy is known for its spiralling effect that, once well established, leads individuals to make choices and attempt tasks that reinforce and further increase the sense of confidence in one's capabilities.

The assessment results are disappointing in that Connections was not successful in shaping the interests of the participants in work situations that are on the path to high growth entrepreneurship. On reflection, it appears that the linkages and logical stepping stones believed to lead to high technology or other wealth-generating ventures were not a sufficiently explicit part of the curriculum, and the participants were left to draw inferences from the experience of speakers and examples. As formative research, research intended to identify the strengths and weaknesses of a programme for the future, this finding suggests a need to revisit the curriculum and make career planning a stronger component of the event.

Conclusion

Research tells us that individuals setting up companies typically have worked within the sector before. They have experience of and familiarity with the commercial/voluntary environment in which they set up their venture. They have a toolkit and knowledge base from which to draw and against which to make reference at key decision points. They have established networks through which to access resources, financial (start-up or development capital), intellectual (intellectual property or expert technical advice), human (identifying prospective members of the start-up team or early employees) and physical (borrowing plant and equipment or gaining access to premises). With declining training opportunities in business and industry but a heightened need for entrepreneurial professionals, universities have a substantial responsibility to teach both content and performance skills.

If self-efficacy is a key to the broader acceptance and practice of entrepreneurship, then the measured opportunities to learn about one's capacity to perform needs to be a central part of practice. That implies that when the opportunities are available, pedagogical approaches which enable students to work on company-based projects, or as interns on placement programmes, provide opportunities to learn by working alongside entrepreneurs (Cooper *et al.* 2004), and build efficacy by having a chance to perform tasks and measure their own performance. Such approaches assist students by demystifying the entrepreneurial process and building self-belief that they too might have what it takes to be entrepreneurial, now or at some point in the future.

That said, this research suggests that it is also possible to foster entrepreneurial confidence through education without direct experience, and that this sense of confidence or mastery of entrepreneurial skills may have an unappreciated importance. Education programmes of all kinds that focus on entrepreneurship have the potential to provide students with an experience which builds on current self-efficacy beliefs, enhances awareness of and understanding of innovation and the new venture process and leaves them feeling enabled for entrepreneurship (Cooper *et al*. 2004). It is argued that education programmes which focus on the development of knowledge and skills for creativity, innovation and venture creation, and are targeted at university students, have the potential to contribute to economic development in a number of ways. Self-efficacy is a key requirement for entrepreneurial action, and findings from the Connections Programme point to the potential for enhancing self-efficacy through structured interventions. The minority of graduates who start businesses straight after university will possess greater knowledge and more appropriate skills to help build successful and sustainable businesses; those who have no aspirations to start their own business will understand better the enterprise environment and be in a position to make more positive, innovative contributions to the organisations that they join; while those who aspire,

in the longer term, to entrepreneurship will have a framework for enterprise development within which to conceptualise their opportunity and have a better understanding of the skills and resources required to take it to the market. Enterprisers, as it is now named, should enable them to adopt a more strategic and planned approach to developing their personal capabilities and networks to facilitate resource (intellectual, human, physical and financial) acquisition for venture creation.

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