Creativity among entrepreneurship students: comparing engineering and business education

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Abstract: As creativity is increasingly recognised as a vital component of entrepreneurship, researchers and educators struggle to reform enterprise pedagogy. To help in this effort, we use a personality test and open-ended interviews to explore creativity between two groups of entrepreneurship masters' students: one at a business school and one at an engineering school. The findings indicate that both groups had high creative potential, but that engineering students channelled this into practical and incremental efforts whereas the business students were more speculative and had a clearer market focus. The findings are drawn on to make some suggestions for entrepreneurship education.

Keywords: entrepreneurship education; creativity; engineering students.

Reference to this paper should be as follows: Berglund, H. and Wennberg, K. (2006) 'Creativity among entrepreneurship students: comparing engineering and business education', *Int. J. Continuing Engineering Education and Lifelong Learning*, Vol. 16, No. 5, pp.366–379.

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1 Introduction

Creativity is a highly ambiguous concept that tends to be given different meanings depending on the discipline or practice to which it is related (Runco, 2004). This diversity becomes evident not least in the discourse on enterprise and entrepreneurship. Writers like Schumpeter and Kirzner emphasise the abstract economic function embodied in the creative and alert actions of daring entrepreneurs, whereas management-oriented writers often treat creativity in a hands on manner emphasising the creative behaviours and thought styles apparent in opportunity search, business model development, social networking, etc. (Drucker, 1985; Fiet, 2002; Sarasvathy, 2001).

In entrepreneurship education, an additional tension is added as entrepreneurial demands for creativity, novelty and synthesis often clash with the traditional academic focus on rigour and analysis. This tension is increasingly becoming clear as researchers now tend to distinguish between small firm management and entrepreneurship through concepts such as emergence, evolution and variation (Gartner, 1993). This issue also transcends academic discourse, as poor pedagogy and course content risks doing more harm than good to prospective entrepreneurs (Gibb, 1996).

Preliminary psychometric creativity testing indicated greater differences between students with different disciplinary backgrounds, than between entrepreneurship students and non-entrepreneurship students (Wennberg et al., 2004). This pointed to a need for more detailed examinations of creativity in the context of entrepreneurship education.

In this study, we use a mixed methods approach, something that has been suggested as an appropriate way of exploring domain-specific creativity (e.g. Amabile, 1996; Cropley, 2000). Specifically, we use a combination of established personality tests and open-ended interviews to explore creativity in two entrepreneurship master programmes, one at an engineering school and other at a business school. Such a broad investigation on how entrepreneurship students think and act creatively will hopefully aid educators trying to foster creativity, improve teaching and general pedagogy.

Some tentative implications may be drawn. For instance, the divergence of creative styles including different 'lay theories' of creativity, points to the problems of a 'one-size-fits-all' approach to entrepreneurship education and the need to be sensitive to individual differences (cf. Hytti and Kuopusjärvi, 2004). Still, the main purpose of this study is to conduct a broad and exploratory description of creativity among entrepreneurship students.

This paper is structured as follows. In Section 2, we present a literature review of creativity and its relationship to entrepreneurship. In Section 3, we discuss a sample selection and describe the two methods used, including testing procedures and analyses. This is followed by Section 4, where a structured results presentation is given before the findings are discussed in Section 5 in relation to entrepreneurship education. Finally, conclusion is given in Section 6.

2 Theoretical framework

2.1 Entrepreneurship education

Entrepreneurship is becoming more and more acknowledged as an important driver of growth, innovation and job creation (e.g. Audretsch, 2002; Birch, 1979). A consequence

of this is that policymakers are becoming increasingly interested in ways of enhancing entrepreneurship (Lundström and Stevenson, 2001) in different ways not least through entrepreneurship education (cf. European Commission, 2004). The last two decades have also seen an explosion in the number of universities offering entrepreneurship courses and programmes, in the USA (Vesper and Gartner, 1997) as well as in Europe (Garavan and O'Cinneide, 1994; Johannisson et al., 1998). One reason for this increase is that the structure and teaching style of traditional business education has been accused of impairing entrepreneurship (Gibb, 1996). More explicitly, traditional business education tends to focus on disseminating information and training of analytical abilities, whereas the vital skills for entrepreneurs are less about information processing and analysis and more about creativity and action (Gibb, 1996).

There is still a lack of knowledge regarding the effect of different educational programmes on students' behaviour and subsequent performance as entrepreneurs (Kolvereid and Moen, 1997; Krueger and Brazeal, 1994; Peterman and Kennedy, 2003). Specifically, it is indicated that the most or researches assume a causal relationship between the entrepreneurship education and entrepreneurial behaviour (Gorman et al., 1997). Although research investigating alumni from entrepreneurship education programmes in the USA (Webb et al., 1982), Norway (Kolvereid and Moen, 1997) and Sweden (Johannisson et al., 1998) all show that graduates from entrepreneurship programmes more often become self-employed by starting new businesses compared to business graduates with a general business degree, it is unclear whether this is attributable to selection and self-selection to these programmes of students with entrepreneurial potential, or if the programmes actually foster entrepreneurship.

2.2 Creativity

Creativity is a highly diverse concept that has been studied in disciplines such as economics, cognitive science, development research, pedagogy and history (Runco, 2004). While precise operationalisations differ between disciplines, creativity is usually defined as a combination of novelty and appropriateness and has been associated with problem-solving and novelty generation as well as with reactive and adaptive behaviour that allows people to cope up with turbulent environments. Even if psychological perspectives are most common, research on creativity is highly dispersed and multidisciplinary. One common way of structuring creativity research is to divide it into *person, process, product* and *press* (Rhodes, 1987), where the person approach includes research on personal characteristics and traits; process research is more behavioural and involves creative thinking and techniques; research on creative products assumes that products can be investigated through measures of their quality and quantity and press refers to factors within and especially outside individuals which affect the creativity.

Csikszentmihalyi (1988), Amabile (1996) and others also emphasise the importance of relevant social systems in both defining and shaping creativity. Combining sociological and psychological perspectives on creativity, Ford (1996) suggested that intentional action and social situations constitute an evolutionary framework where an individual's creative and routine actions are selected or rejected by social constituencies forming an evolutionary process that guides individual creative action.

2.3 Entrepreneurship and creativity

Entrepreneurship and innovative business behaviour have long been associated with creativity (Amabile, 1996; Nyström, 1979; Walton, 2003) and the two are often used interchangeably. In the business context creative novelty and appropriateness is often translated into idea development (Ward, 2004), new product innovations (Amabile, 1996) and adapting or improving existing innovations (Kirton, 1987). Methodologically, creativity in entrepreneurship and innovation has been explained through cognitive processes, attitudes, motivation, existing knowledge, work environment and personality traits (Amabile, 1996; Walton, 2003; Ward, 2004).

Much research also addresses the question of different kinds of creativity. Sternberg and Lubart (1995) distinguish between uppercase 'C' or genius creativity, and lowercase 'c' or mundane creativity. On this concept, Fletcher noticed management of the stubborn, rebellious or perfectionist sides of highly creative people as a key management issue: 'the art of managing a creative group is to ensure that the conditions are as conducive to good work as they can be, and only then to apply the rules of efficiency' (Fletcher, 1990, p.37). Boutaiba takes the other approach: 'we need to recognize that entrepreneurial (read: creative) activity is an inherent part of everyday life, and even the seemingly trivial activities of everyday life have great capacity to move us in new and unexpected directions' (Boutaiba, 2004, p.24). What is perceived to be creativity in entrepreneurship is also strongly influenced and legitimised by business people, social groups and other institutional and contextual factors (Hjorth and Steyaert, 2004).

Csikszentmihalyi (1996) and Nyström (1979) point to another creative tension, namely the need for different foci during various phases of innovative processes; early stages tend to require more of divergent, holistic and intuitive thinking, whereas later stages will benefit from convergent thinking, reductionism and cognitive closure. Both parts in tandem are however seen as vital to the overall process of creative entrepreneurship. In a similar vein, Walton (2003) speculates that during early phases, entrepreneurs' creative goals may be highly private, only to become more geared towards organisational benefits as an organisation is established and developed.

3 Method

3.1 Measuring creativity

There are many ways to assess creativity. These include experiments (Ward, 2004), assessment of creative tasks based on observations (Amabile, 1996) and various types of psychometric tests (Sternberg, 1988). While psychometric tests are perhaps the most established branch of creativity assessment (Amabile, 1996), they have been criticised for not adequately capturing domain-specific qualities (Wallach, 1976; Kaufman and Baer, 2002) or that the artificial nature of the test situation does not reflect the natural creativity or real life (Plucker and Runco, 1998; Wallach, 1976). In an evaluation of creativity test methods, Cropley (2000) found that personality and behavioural tests generally had the most valid results but recommended a mixed methods' approach. Thus, while psychometric tests are regarded as somewhat blunt instruments for measuring creativity they are still useful as indicators of general creative potential and may be useful in combination with more specific instruments (Cropley, 2000). Most creativity

researchers advocate a mixed approach when investigating creativity, for instance combining personality tests with examinations of previous creative output (Runco, 2004). In this investigation, the personality test, 16 personality factors (16PF) (Russel et al., 1997), was therefore complemented with semi-structured interviews, where students described creative experiences (cf. Hocevar and Bachelor, 1989).

3.2 Sampling

As mentioned the present investigation is part of a larger project investigating how to promote creativity in entrepreneurship education. In this project, a psychometric investigation of four different entrepreneurship master programmes showed that an educational background was a dominant indicator of creativity (Wennberg et al., 2004). To go beyond indicators of general creativity, we selected the two programmes for further study based on the fact that they are specialised on engineering students, and business students, respectively, and are two of the most established entrepreneurship masters programmes in Sweden.[1]

Specifically, the sample consists of two groups of students: 13 from a business school and 18 from a technical (engineering) university. The total population of students was 15 in the business school programme and 20 in the engineering school. Individual participation was determined in conjunction with the administration of the 16PF test. No regularities were found among the absent students.

It should be noted that the students are actively selected by the research and teaching faculties based on a combination of grades, personal essays and interviews with the focus being on identifying individuals with high potential. This may have introduced a bias compared with other programmes or courses.

3.3 Test procedures

To get good results in psychometric testing, it is important that subjects sense comfortable and have a positive and frank attitude. Students were therefore instructed that there were no correct answers and they were urged to be honest. Also, it was stressed that findings would only be used for research purposes, presented on a group level and that no one outside the research group would be allowed to handle results. Random post hoc interviews confirmed that the students did find the test interesting and meaningful.

After three months, the students were individually interviewed for about 30 min in their school offices. The gap in time between tests and interview minimised the risk that students would remember certain questions and answers from the 16PF tests in the interview session. The interviews were semi-structured and students were asked to freely recall and describe, with as much detail as possible, different episodes of their own choosing where they had felt creative. Focus was on concrete examples since asking for general descriptions tends to yield socially desirable answers or reiterations of popular concepts (Edwards, 1990).

3.4 Interview analysis

The interviews were transcribed and then read jointly by two of the researchers to get a feel for what was said. After this, the transcripts were read again with an eye to identify

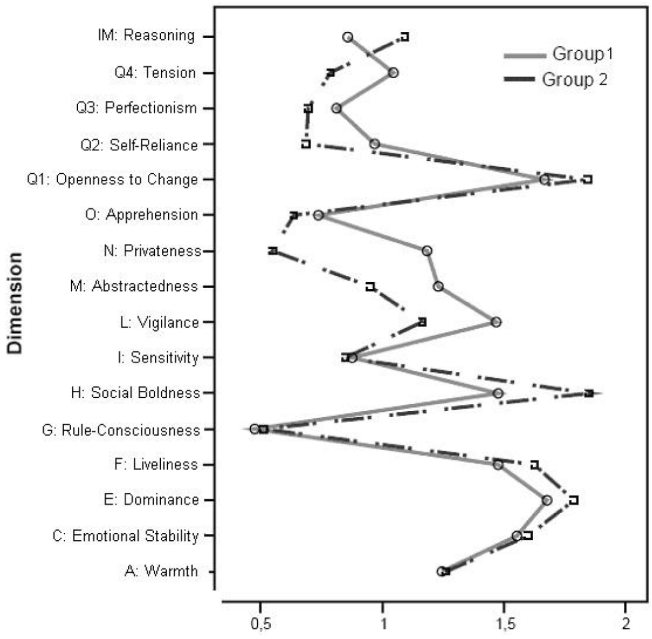
common categories, which captured the essential dimensions of what the respondents had said. This process produced six categories, which were found to capture creativity as expressed by the interviewees (see Table 1). This process took no notice of the group to which interviewees belonged. Cross tabulations indicated that the categories were quite independent, with only one category (*Origin of Creativity*) relating somewhat to three other categories.

4 Results

4.1 Results from 16PF

Earlier investigations of the 16PF test have found that the five factors 'Openness to change', 'Dominance', 'Social boldness', 'Perfectionism' and 'Abstractedness' strongly correlate with other measures of creativity (Rieke et al., 1994). This was partly reflected in the findings as the average scores for both student groups were highest for the factors 'Openness to change', 'Social boldness' and 'Dominance'. Among the engineering students, these three categories were the highest whereas the business students scored somewhat lower on Social boldness (see Figure 1).

Figure 1 Average results for the two groups (scale 0-2). Group 1 are the business school students and group 2 are the engineering school students



According to the 16PF manual (Russel et al., 1997), people scoring high on Openness to change (Q1) tend to think of ways to improve things and they enjoy experimenting with the status quo. If things are unsatisfactory or dull, they seek change. These people find

individuals with differing viewpoints exciting and interesting. People scoring high on Social boldness (H) are adventurous in social groups and show little fear of social situations. They are not shy to initiate social contacts and may have a need to self-exhibitionism. They seem to fit in easily to a new social situation. People scoring high on 'Dominance' (E) tend to be dominating and aggressive in imposing their will onto other people. They are forceful, vocal and pushy in obtaining what they want. They offer their opinions even when not asked and they feel free to criticise others. Extreme levels can alienate people who do not wish to be dominated.

On average, the entrepreneurship student also scored high on 'Liveliness' and 'Emotional stability'. These factors have not previously been associated with creativity in 16PF, but the traits are not difficult to relate to creativity. Again the 16PF manual (Russel et al., 1997) states that Liveliness (F) measures exuberance and the natural self-expression exhibited by children before they learn self-control. People scoring high on Liveliness are enthusiastic, spontaneous and seek attention. They are drawn to stimulating social situations. Emotional stability (C) measures feelings about coping up with day-to-day life and its challenges. People scoring high on Emotional stability feel more in control of their life and surroundings. They take a proactive approach in dealing with strains of daily life and are good at managing their emotional life. They recover from upset easily and usually feel satisfied with their day's accomplishments.

The lowest scores were found on the factors 'Rule consciousness', 'Apprehension' and 'Perfectionism'. This is a bit surprising as Rieke et al. (1994) found Perfectionism to be associated with creativity. This category addresses one's tendency towards perfectionism versus tolerance of disorder. People scoring low on perfectionism leave more things to chance and tend to be comfortable in a disorganised setting. They may be perceived as lackadaisical, unorganised, or unprepared and they may not be able to muster a clear motivation for behaving in planning or organised ways, especially if these behaviours are unimportant to them.

The only factor where the two groups differ significantly[2] is Privateness (N), where the business students scored considerably lower than the engineering students. People with high scores on privateness tend to 'put all the cards on the table' and talk about themselves readily and openly (Russel et al., 1997). They are genuine, self-revealing and forthright. Extreme scorers may get into trouble by putting too much on the line about themselves when it is not be in their best interests. People with low scores are non-disclosing and private about themselves. They are hesitant to new social contacts, and maintain their privacy at the expense of establishing and maintaining quality relationships. People find them hard to get close to.

4.2 Results from interviews

After reading and discussing the interview protocols, they were found to converge on six general creativity categories that described: 1) origin of a creativity as insight or the result of a process, 2) which aspect of the creative process was emphasised, idea generation or implementation, 3) whether the preferred mode of idea enactment was theoretical or practical, 4) if the respondent saw him/herself or the group as the source of creative ideas, 5) whether ideas were incremental developmnts or departed radically from the context in which they emerged, and 6) the driving force as personal involvement or more external rewards. These six categories are summarised in Table 1 and also elaborated briefly using illustrating quotes.

Table 1 Creativity categories from interviews

1) Origin of creativity	Flash of insight	⟷	Creative process
2) Focus in the creative process	Openness	⟷	Closure
3) Enactment of creative process	Planning	⟷	Doing
4) Locus of creativity	Group	⟷	Alone
5) Type of creative outcomes	Stand-alone	⟷	Incremental
6) Driving force	Involved ego	⟷	Extrinsic motivation

1a *Flash of insight* refers to individuals' descriptions of creative ideas that seem to come instantly. *Example*: "It was a spur of the moment. I felt when I wrote that 'now it feels right' and I got a better grip of the situation."

1b *Creative process* refers to individuals' descriptions of creativity as the result of a continuous process of testing and experimenting. *Example*: "It happens, I think, sometimes when I have been sitting and thinking for a while. When I have immersed myself in thinking about a solution, then the ideas emerge."

2a *Openness* refers to individuals describing creative achievements that focus on expansion of the problem space up, for example, initiating a process or generating ideas and/or products. *Example*: "Now lately we have been talking about business models. It feels like there is a lot of freedom to think wide and broad. We've had lots of brainstorming activities and lots of fun ideas pop up in all possible directions."

2b *Closure* refers to individual's describing creative achievements that emphasise implementation activities and reaching results. *Example*: "I think I was creative last week when we were finalizing this marketing report. Because you knew exactly what to do, we clearly divided the work among ourselves and I felt that I didn't need help from anyone else or from external sources."

3a *Planning* refers to individuals describing their creative processes in terms of mental planning and preparation. *Example*: "I felt creative when I was thinking about visions and concepts; what the company will be like in ten years so that you build on an overall concept."

3b *Doing* refers to individuals describing creative processes in terms of concrete actions and outputs. *Example*: "To organize the work process. What should the rest be like, should there be workspaces for those who work? What about ergonomics, how heavy will it be for the workers? Then try to construct a worktable and imagine how all the moving parts should fit together, how should it move, what the weights should be for it to be balanced."

4a *Group* refers to individuals emphasising the group as the locus of creativity. *Example*: "Sometimes you do not know who actually came up with something when you have talked for a while. But that's how it should be."

4b *Alone* refers to individuals who clearly refer to themselves as the locus of creativity, regardless of whether they are part of a group acting alone. *Example*: "I think much more clearly when I am by myself than in groups. There you get impressions from everywhere and you keep a though for no more than 20 seconds, then you have a new thought. It is difficult to be creative then. Really creative."

5a *Stand-alone* refers to descriptions of ideas which seem independent of or loosely coupled to the previous situation or context. *Example*: "Like, when you think 'Darn, I don't want to do it the same way I always have, or like everyone else does'. And you think of something else. […] Sometimes it pays to experiment with the craziest ideas you can come up with. That's how I've come up with many of the tricks that I've used as a salesman for example."

5b *Incremental* refers to ideas that extend, modify or react to things given in the current situation. *Example*: "I think creative people […] do those little things, or add those small changes, in a way that other people don't. […] It can be in a business plan as well as in a painting."

6a *Involved ego* refers to individuals who emphasise personal involvement when describing creativity. *Example*: "Often I would get an impulse that I want to follow even if it wrong or forbidden. If it doesn't work, or someone tells me not to, I might change, but I get annoyed. When I only act on instinct, then it is me."

6b *Extrinsic motivation* refers to individuals who emphasise creativity in terms of it usefulness or meaning in relation to extra-personal situations such as technical feasibility or making profits. *Example*: "A real entrepreneur would run an ice-cream parlour if it was possible to make a profit."

5 Discussion

In this section, the results are discussed both in relation to previous literature and in terms of differences in and between the groups of students. It is readily admitted that the sample does not allow for any general conclusions to be drawn. However, by conducting a discussion that relates to previous theory, we are tentatively sketching the theoretical contours of creativity as it may be conceptualised in the specific domain of entrepreneurship education

5.1 16PF

It seems that all subjects, especially engineering students, fit well with the received 16PF creativity profile. Three of five creativity factors were among the highest for both groups. While saying little about domain-specific creativity practices and thought styles, this result indicates a high potential for creativity, which may be channelled in different ways (Cropley, 2000).

In contrast to the generally high scores, the factor 'perfectionism' that is also associated with creativity, produced one of the lowest results. There are many potential explanations for this. One may speculate that as students, the subjects have not yet learnt

to appreciate the importance of focus in creative work. In addition, entrepreneurship students, perhaps as opposed to entrepreneurs, may be drawn to the relatively unmonitored and perhaps easy-going life of entrepreneurship programmes.[3] If we look at differences between the two groups, the business students tended to score somewhat higher on Perfectionism and Abstractedness, two of the five factors associated with creativity, whereas engineering students were higher on Openness to change, Social boldness and Dominance. None of these differences are however statistically significant.

The results also show that the two groups of entrepreneurship students were remarkably similar in their general personality profiles. Many results such as 'Rule consciousness', 'Warmth', 'Emotional stability' and 'Sensitivity' were almost identical for both groups, something which points to a certain consistency within the whole cohort of entrepreneurship students. One should note that this similarity concerns average scores and that there is considerable variation between individual students. This is in line with overwhelming evidence from previous personality-oriented research on entrepreneurs, where entrepreneurs have been found to be a very disparate group (e.g. Gartner, 1988).

5.2 Interviews

The 16PF test indicated a similar and generally high creative potential in both groups. As mentioned, these results, which on average were quite similar, in fact contained considerable internal variation. This variation was echoed in the interviews, where the high creative potential was clarified and broken down into six generic categories. These categories can be seen as theories-in-use or personal constructs (Kelly, 1963), which reflect the different dimensions along which entrepreneurship students seem to differ with regard to creativity.

Origin of creativity, for instance, discriminates between styles of creativity based on whether ideas pop up discretely or as part of a longer process. This should not be confused with the category *type of creative outcomes*. While the first concept deals with the context of discovery and the latter with the context of justification, both in different ways relate to the degree of radicalness (Sternberg and Lubart, 1995). The category *focus in the creative process* has a rather straightforward correlate in the theories of Nyström (1979) and Csikszentmihalyi (1996), where initial openness, followed by increased focus and closure, are seen as natural components of any innovative process. Our results, however, suggested that the different styles were more or less salient in different individuals. The category *enactment of creative process* does not concern actual planning and doing per se. Rather it distinguishes between individuals who are creative in terms of imagining alternative futures and engaging in scenario planning types of activities on the one hand, and those who connect creativity with hands on activities such as finding practical solutions, tinkering with tools or fine-tuning machinery. Both activities can be completely cognitive; the important difference is whether focus is on planning or doing. *Locus of creativity* refers to a propensity to harness group dynamics. Some individuals seem to thrive in group situations such as brainstorming sessions, where they can pitch original suggestions and allow new ideas to evolve (cf. Ford, 1996). Others seem to feel constrained by social obligations and prefer to create and develop ideas in isolation. The final category refers to the entrepreneurship students *driving force*, which

distinguishes between a need for personal expression and more instrumental and pecuniary gains. This difference may signify different types of creative entrepreneurship. It also seems related to Walton's (2003) temporal distinction where personal interests are gradually replaced by extra-personal ones as a venture develops.

These categories or creativity dimensions also make it possible to discuss differences between engineering and business students. Because of the limited number of students in each group, it would be misleading to focus on quantitative differences along individual categories. However, by reexamining the student's stories along with the creativity categories in Table 1, a pattern begins to emerge. The engineering students tended to stress the role of action and practical work whether this related to ideas or actual products. The business students were more focused on thinking and reflecting in their creative processes. Engineering students also related creativity much more to problem solving, spotting different defects and making incremental but often important improvements in what they were currently occupied with. The business students often had a clear focus on business ideas in a market context, and reported feeling creative when coming up with radical ideas with big commercial potential.

During the interviews, we noted that some students sought to come across as highly creative in their stories and examples. It is hard to say whether this was the result of students seeking to provide socially desirable answers, or reflective of something more substantial. Regardless of which, such 'lay theories' are important as popular creativity concepts and other discourses tend to influence entrepreneurs' thoughts and legitimise certain actions (Hjorth and Steyaert, 2004). Investigating lay theories and how these migrate into individuals' underlying personalities and motivational structures, has been pointed out as an important area for future creativity research (Plucker and Runco, 1998).

6 Conclusions

As indicated above both engineering and business school students got high creativity scores on the personality test, something that indicates high creative potential. When broken down into more specific categories, this creative potential emerged as more nuanced. On the basis of the interview study, we could tentatively sketch the contours of creativity as conceived and enacted by entrepreneurship students. The results are very much preliminary and more explorative research is needed before more definitive statements can be made. As part of these results, we found that engineering students tended to emphasise incremental development and solving existing problems, while business students tended to focus on the radically new and generally were more market-oriented in their creative styles.

These findings can be drawn on to make a number of suggestions for engineering entrepreneurship education. For one, it may be advisable to include more elements that emphasise market orientation and a focus on the bigger commercial picture. Engineering students generally had higher creative potential and if these energies can also be geared towards more commercial pursuits, students should end up better prepared for the realities of entrepreneurial life. One way of accomplishing such learning could be to actively mix engineering students with students from business schools. This would lead to a pooling of creative strengths as well as induce learning between individuals.

Another finding, which receives a lot of support in the literature, if that entrepreneurs are a very heterogeneous group (Gartner, 1988). This should also be reflected in the pedagogy, which should allow for both extremely creative individuals and others to thrive and develop (cf. Fletcher, 1990). A suggestion is to implement flexible educational structures, which can cater to both group and individual needs.

It is also interesting to note that the groups, on average, had remarkably similar personality structures. This stands in contrast to the overwhelming evidence that entrepreneurs are not a homogeneous group with respect to personality (Gartner, 1988). One might speculate whether this similarity is grounded either in self-selection of individuals who for some reason want to study entrepreneurship, or if it is the effect of active selection of students by faculty and teachers who still look for an ideal type entrepreneur. This is an important question that requires careful study.

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Notes

[1]A few students in each programme had other disciplinary backgrounds such as law or joint business/engineering degrees.

[2]The difference is significant $t(1) = -2.19$, $p < 0.05$ although this difference should be seen as tentative, given the limited size of the both student groups.

[3]Both programmes emphasise autonomous work on innovation projects as equally or even more important than regular classes.