

Investigating the Motivation for Enterprise Education: A CaRBS based Exposition

Purpose

This study investigates student motivations for undertaking an EU funded entrepreneurship education programme in the Objective One areas of Wales and the relationships between motivation characteristics and their ultimate employment and self-employment aspirations. For both statistical and explanatory reasons a novel data mining technique (CaRBS) is used to undertake the equivalent of classification analysis. The study considers what relationships certain motivation characteristics have to students' aspirations, specifically in terms of their intention to be self-employed or employed.

Design/methodology/approach

The study examined enrolment data of 720 students on an entrepreneurial education programme called E-College Wales, and have known aspirations to either employment or self-employment. The Classification and Ranking Belief Simplex (CaRBS) technique is employed in the classification analyses undertaken, which offers an uncertain reasoning based visual approach to the exposition of findings, and which has particular relevance when the data is non-parametric and the considered potential relationships are non-linear.

Findings

The classification findings demonstrate the level of “contribution” of the different motivation characteristics to the discernment of students between self-employed and employed aspirations. The most strongly contributing characteristics were, motivations to undertake a business start-up, interest in the subject matter and intent to achieve the qualification. For these characteristics, further understanding is provided with respect to the student demographics of gender and student age (in terms of the association with aspirations towards being self-employed or employed). For example, with respect to start-up, the older the student, the increasing association with employment rather than self-employment career aspirations.

Research limitations/implications

The study identifies candidate motivation characteristics and the demographic profile for student's undertaking an entrepreneurial education programme. Knowing applicant aspirations should inform course design, pedagogy and its inherent flexibility, and recognise the specific needs of certain student types.

Originality/value

The study contributes to the literature examining the motivations for undertaking entrepreneurship education and categorising motivating factors. These findings will be of value to both education providers and researchers.

Key words: Aspirations, CaRBS, Entrepreneurship Education, Employment, Motivations, Self-employment.

Article Classification: Research paper

Introduction: Entrepreneurial Education

The small and medium enterprise (SME) sector plays a key role in contributing to innovation and wealth creation, employment and economic growth in all industrialised and developing countries (Robson and Bennett, 2000). Within the UK context, specifically, the SME community accounts for 52.4% of employment (Pickernell *et al.*, 2011). Thus, reality suggests most current Higher Education (HE) students are likely to be employed within the SME sector at some time, and therefore, must be equipped with the appropriate knowledge and skills to prosper (Anderson and Jack, 2008).

Harrison and Leitch (2010) also suggest that researchers, governments and policy makers, are increasingly recognising the significant role that HE in particular, must play in economic development. Consequently, over the past decade there has been a significant global increase in entrepreneurship programmes aimed at augmenting entrepreneurial activity at all levels (Fayolle *et al.*, 2006; Hamidi *et al.*, 2008).

This increased demand has been fuelled by four key drivers of change, namely, global, societal, organisation and individual levels (Henry *et al.*, 2005). Globally, the reduction in, trade barriers, information technology and telecommunications progression and enhancement of transportation infrastructure, have offered new opportunities and increased business uncertainty and complexity (Jones *et al.*, 2013). At a societal level, factors such as privatisation, deregulation, increasing environmental impacts and catering for the rights of minority groups of the individual, have compounded business process complexity. At an organisational level, decentralisation, downsizing, business process re-engineering, increased strategic alliances and mergers and workplace flexibility, have impacted to increase business uncertainty. The outcome of such change is that the individual is faced with an increased variety of employment opportunities and having to undertake a diversity of job roles during their employment career including self-employment opportunities (Henry *et al.*, 2005).

This suggests that entrepreneurship education, to the extent it may be useful, needs to account for the lifelong learning aspects of potential entrepreneurship students. Much of the debate on interventionism has centred on developing an environment in which entrepreneurship can be encouraged and sustained (Gilbert *et al.*, 2004). Jack and Anderson (1999) and Matlay (2006) noted entrepreneurship education has climbed the political agenda, within industrialised and developing economies, as a means of encouraging both business growth and employment within a challenging economic environment.

Within this discussion, the role of education and training has taken prominence (Pittaway and Cope, 2007). Previously, Watson *et al.* (1998) suggest motivation for business start-up is a key factor towards successful entrepreneurship activity. This is based on the premise whereby it is possible to provide individuals with the requisite skills and knowledge required to start-up and develop a new venture (Gorman *et al.*, 1997; Kuratko, 2005). Whilst many individuals already possess distinct attributes and competencies which lend themselves to an entrepreneurial career, recent studies suggest entrepreneurship can also be encouraged through education and training (Hytti and O’Gorman, 2004; Harris and Gibson, 2008).

Zeithaml and Rice (1987), Hills (1988) and Solomon *et al.* (2002), in the USA and Johannisson *et al.* (1998) within Europe, suggested the primary goal of such programmes was to increase student awareness of entrepreneurship as a process, and thereafter, increase awareness of the attainability of an entrepreneurial career. Clark *et al.* (1984) and Cho (1998) claim entrepreneurship education could provide motivation for venture creation. Several studies have associated successful completion of entrepreneurial education with individuals undertaking business start-up activities (Kolvereid and Moen, 1997; Osborne *et al.*, 2000; Dumas, 2001; McLarty, 2005; Dickson *et al.*, 2008). Studies by Robinson and Sexton (1994), Basu and Goswami (1999), Delmar and Davidsson (2000), Brooksbank and Jones-Evans

(2005) and Wennekers *et al.* (2005), indicated prior educational attainment was positively correlated to entrepreneurial activity.

This evidence has provided the impetus for a dramatic increase in the number of entrepreneurship courses being offered by HE institutions globally (Katz, 2003; Fayolle, 2005). Von Graevenitz *et al.* (2010) however, notes that the research on the effects of entrepreneurship education still has significant omissions, and further studies are required to consider the understanding of entrepreneurial perceptions and intentions (McMullan *et al.*, 2008). Several recent studies have explored the short terms impact of entrepreneurial education upon attitude and intent, for example Levie *et al.* (2009), Packham *et al.* (2010) and Lange *et al.* (2011).

Many courses have been criticised, for example, as only providing a traditional, corporatist approach to entrepreneurship education. This has been perceived as often having failed to prepare nascent entrepreneurs for successful business start-up (Gibb, 1993; 1997; 2005; Henry *et al.*, 2005). Much of the prior research, therefore, focuses on establishing an association between education and entrepreneurship. These studies have been successful in establishing a link between education attainment, entrepreneurial activity and advocating the role education plays in promoting entrepreneurship as a viable career option (Rosa, 2003; Kuratko, 2005; Souitaris *et al.*, 2007). Creating and sustaining a new business start-up, however, also requires sufficient motivation to surmount the hardships and frustrations involved (Hisrich and Peters, 1998; Stewart *et al.*, 1999; Kuratko and Hodgetts, 2001; Shane *et al.*, 2003). Hence, the motivation to engage in entrepreneurial activity is a profound issue which can influence the business chances of success (Watson *et al.*, 1998; Shane *et al.*, 2003).

Research examining the underpinning motivations of students to enrol and complete formal enterprise education, however, remains limited (Segal *et al.*, 2005). As entrepreneurship education courses are also not homogeneous in content, level, student

characteristics (e.g. age, gender balance, background etc.), or funding (e.g. student funded, university funded or EU programme funded for example), this suggests a need to build a research base utilising case study type approaches to identify underlying factors and motivations which can also be used to develop future research.

This study, therefore, investigates these underlying factors or motivational characteristics of a specific non-traditional (in terms of age) group of students for undertaking a specific EU funded undergraduate entrepreneurial HE (full degree) programme, utilising a novel non-parametric data mining technique (Classification and Ranking Belief Simplex - CaRBS). Reasons for the utilisation of CaRBS are many-fold, including being linked both to the non-parametric nature of the data, but also to the often non-linear nature of the relationships (which lend themselves to a data mining approach from which more detailed future study might follow), and the ability to more clearly explain the relationships through a visual exposition of findings.

The overriding research aim considered here is what relationships certain motivational characteristics have to the students' ultimate entrepreneurship career aspirations, in terms of their intention to be self-employed or employed. Moreover, how levels of influence of student motivation characteristics (for example desire to undertake a business start-up post programme) vary in the prescribed relationship when certain student demographics were also considered. The paper will contribute to knowledge in providing greater understanding of why students choose to undertake an entrepreneurship related degree and therefore positively inform programme design and construction.

The structure of the paper is as follows: in section two, the salient literature on student motivation for entrepreneurship is discussed, after which section three analyses students' motivations for enterprise education. In section four, the methodology is presented. The technical explanation of the CARBS technique is included within the appendices. The results

of the CaRBS-based analysis of the student motivation data set are thereafter presented, including the influence of the considered motivation characteristics. Thereafter, further exposition of the relevance of the motivation characteristics is undertaken, taking into consideration certain demographics (gender and age) of the students. Finally, conclusions are drawn and directions for future research proposed.

Literature: Student Motivation and Entrepreneurship

Sprinthall *et al.* (1994) and Hytti *et al.* (2010) suggest motivation drives an individual to act in a certain manner. McClelland (1961) and Miner (1993) identified entrepreneurs have a high need for achievement characterised by a desire to succeed and excel, which is more attainable within an entrepreneurial career choice. Contrastingly, McClelland and Winter (1969) found managers had a tendency to be higher in need for power and lower in need for achievement. Watson *et al.* (1998) argued the motivation to start-up a small business was influenced by characteristics such as work experience, personality, family environment and societal norms. Jayawarna *et al.* (2013) summarised entrepreneurial motivations as economic gain, desire for achievement, independence and control, personal development, improved social status, opportunity to innovate and create new products, emulation of role models, and contribution to community welfare (Birley and Westhead, 1994; Carter *et al.*, 2003; Shane *et al.*, 2003; Cassar, 2007; Wu *et al.*, 2007).

Porter and Lawler (1968) therefore proposed a model of entrepreneurial motivation within which the four main factors which influenced the decision of an individual to start-up a business were personal values, characteristics, situation and the status of the business environment itself. Gilad and Levine (1986) proposed several ‘push’ and ‘pull’ characteristics which could be utilised to classify the motivations underpinning small business start-up. Push characteristics related to negative forces such as: difficulties in

finding employment, job dissatisfaction, and inadequate remuneration. Conversely, pull characteristics included independence; wealth and personal fulfilment were considered positive motivational influences (Hisrich and Peters, 1998; Chell, 2001).

Importantly, there are both regional and national differences with respect to these perceived motivations (Linan *et al.*, 2011). In high-income countries, four times more adults engaged in entrepreneurial activities through opportunity than necessity (Bosma and Harding, 2006). Moreover, Watson *et al.* (1998) concluded pull characteristics such as independence, being one's own boss, using creative skills, doing enjoyable work and wealth creation, were more important than the push characteristics such as redundancy, frustration with employers and need to earn a reasonable living. Segal *et al.* (2005) however, mooted that displaced workers did not necessarily pursue an entrepreneurial option unless other influences were evident. Roberts (1991), examining nascent entrepreneurship in the high technology sector, found the majority of respondents did not consider personal wealth creation as a primary motivator for self-employment. Entrepreneurial drivers including a need to achieve, a desire for independence and dissatisfaction with current employment, were often cited as the primary reasons associated with small business start-up.

In terms of HE as a source of entrepreneurs, Segal *et al.* (2005) determined that motivations of undergraduate business students to embark on entrepreneurial careers were related to an individual's tolerance for risk, whilst Chell (2001) argued entrepreneurial activity was underpinned by the need for achievement, independence and power. Galloway and Brown (2002) found the rate of immediate start-ups by graduates was, however, relatively low and suggested the lack of motivation was likely to be due to personal debt, lack of collateral, limited industrial experience and alternative priorities. Segal *et al.* (2005) argued graduates were less influenced by push characteristics due to limited employment experience.

Student Motivations for undertaking Entrepreneurship Education

Young (1997) outlined several reasons as to why university students were motivated to study entrepreneurship. These motivational characteristics included: independence, the acquisition of skills and knowledge to enhance career progression and gaining an adjunct competitive advantage in an independent professional career (e.g. dentist, accountant). Galloway and Brown (2002) found that some students regarded such skills and knowledge as a buffer against possible threats to an intended career path.

Therefore, it is important to explore the motivational characteristics which underpinned students' decision to undertake an entrepreneurial education programme and their career aspirations thereafter. Entrepreneurial attitude is recognised as an accurate predictor of planned behaviour and has been considered in several prior studies (Peterman and Kennedy, 2003; Souitaris *et al.*, 2007). Several studies have examined motivations for undertaking an entrepreneurial career (Roberts, 1991; Galloway and Brown, 2002; Segal *et al.*, 2005; Taormina and Lao, 2007). Contrastingly, only a limited literature exists considering the student motivations related to undertaking formal entrepreneurial education (Young, 1997; Galloway and Brown, 2002). Even fewer, have looked at non-traditional students and their motivations for studying entrepreneurial education.

The examination of the extent literature enables the identification of the following potential motivational characteristics underpinning the decision to undertake formal entrepreneurial education: -

- i)* Desire to undertake a business start-up (Start-Up)
- ii)* Desire to acquire management competencies (Management)
- iii)* Desire to achieve business growth (Business Growth)
- iv)* Desire to increase confidence in the option of an entrepreneurial career (Confidence)
- v)* Desire to develop interest in the subject matter (Interests)

vi) Desire to acquire entrepreneurial education related qualifications (Qualifications).

These characteristics, however, differ in terms of the degree to which they are likely to be related to the desire for self-employment, as opposed to employment. For example, Confidence, Start Up and Business Growth based motivational characteristics can be seen as more likely to be related to self-employment aspirations than Management, Interests and Qualifications. Each of these motivational characteristics is considered in turn, and subsequently used in the CARBS analyses using the code identified:

Start-Up (StrtUp): Garavan and O'Cinneide (1994), Young (1997), Petridou *et al.* (2009) and Peterson and Limbu (2010) suggested students undertake entrepreneurial related programmes to provide the knowledge required for the business start-up process. Galloway and Brown (2002) proposed students undertook entrepreneurial education to enhance their prospects of undertaking an entrepreneurial start-up at some future point. Specifically, their study noted 78% of students identified intent to start a business, of which 19% would enable this process within five years, 38% between five and ten years and 43% after ten years. Furthermore, it was apparent entrepreneurship education students were prepared to delay their proposed business start-up for a significant time period, a trend noted previously in Hayward and Sundes (1997).

Management (Mngmnt): Ineffective managerial competencies have long been associated with small business failure (Walker *et al.*, 2007). Anderson and Jack (2008) identified individuals are attracted to the discipline of entrepreneurial education by the opportunity of personal development and an adaptable skills base. Specifically, Cooper *et al.* (2004) and Galloway *et al.* (2005) noted students seek education which provides them with transferable skills including managerial competencies. Chrisman and McMullan (2004) and Bhandari (2006) also noted that entrepreneurial education study enabled improved managerial competency in areas such as sales and management of employees.

Business Growth (Grwth): The prior literature suggests entrepreneurship activity enhances business growth (Acs and Audretsch, 2003; Audretsch and Keilbach, 2006; Praag and Versloot, 2007). However, van Stel and Storey (2004) note entrepreneurial activity does not necessarily stimulate business growth for several reasons (see also Hessels *et al.*, 2008), although Edelman *et al.* (2010) suggests that firm growth is widely considered to be a measure of success for an entrepreneurial businesses.

Firstly, high growth enterprises contributed more to economic growth than micro enterprises in the start-up phase (Wong *et al.*, 2005). Secondly, a large proportion of Owner/Managers undertaking business start-up had no growth aspirations. Hay and Kamshad (1994) noted such enterprises often remained constant in size as their existence provided lifestyle advantages for Owner/Managers. Such enterprises typically had minimal ambition beyond maintaining their current operations and providing their products and services within existing markets (Levy *et al.*, 2005).

Thirdly, Hessels *et al.* (2008) noted a deficiency of research exploring the diversity of entrepreneurs with a growth perspective. Therefore, it is essential entrepreneurial education enables existing and nascent entrepreneurs to pursue an entrepreneurial career with a growth perspective. Failure to enable this could mean graduate start-up with non-growth aspirations and limited potential.

Confidence (Cnfdnc): The current interest in entrepreneurship is apparent by its high visibility within the UK media, through programmes such as “Dragons Den” and the “Apprentice” and government policies to encourage entrepreneurial activity (Levie *et al.*, 2010). In the UK, increased provision and focus upon entrepreneurial education within the primary, secondary, further and HE sectors increases individual entrepreneurial orientation (Frank *et al.*, 2005) and the confidence on the attainability of such a career (Han and Lee, 1998; Russell *et al.*, 2008). Higher entrepreneurial competency has been associated with self-

confidence and an illusion of control (Koellinger *et al.*, 2007). Thus, entrepreneurial education must encourage new entrepreneurial careers and increase the confidence of the existing entrepreneurial population to further develop their activities.

Interests (Intrst): Jaafar and Abdul Aziz (2008) noted nascent entrepreneurs and Owner/Managers pursue an entrepreneurial career to develop an idea or pursue a hobby. An entrepreneurial education programme should therefore provide the student with the ability to generate new enterprise ideas (DeTienne and Chandler, 2004) and refine and develop existing proposals (Politis, 2005).

Qualifications (Qlftns): Prior research informs us that SME Owner/Managers have lower formal educational levels in comparison to their counterparts within larger businesses, and participate in fewer training activities (OECD, 2002; Bartram, 2005). In contrast, Robinson and Sexton (1994) suggest SME Owner/Managers are more highly educated than the general public, a statistic supported by Muir *et al.* (2001) based on a study of female entrepreneurs.

Schwarz *et al.* (2009) noted highly educated entrepreneurs were more likely to grow their enterprises than lesser qualified counterparts. Moreover, the importance of highly educated Owner/Managers for the survival and growth of business start-ups is well established (Cooper *et al.*, 1994; Kennedy and Drennan, 2001). Therefore, an educated and skilled labour force is considered essential for the growth of the SME sector within the global economy (Walker *et al.*, 2007). Thus, it is important to assess the importance the individual student places on the attainment of an entrepreneurial related qualification as a mechanism to develop their entrepreneurial competencies.

In addition to motivational characteristics for undertaking entrepreneurial education, it is also important, however, to examine how these are related to students' future career aspirations for both self-employment and employment opportunities post programme of study.

Levesque *et al.* (2002) recognised the significant differences between self-employment and employment careers in terms of income, work required, risk and independence. McMullen *et al.* (2008) identified the motivation to become an entrepreneur is closely associated with levels of government related economic freedom.

As a consequence, it is possible to identify opportunity motivated entrepreneurship (OME) and necessity motivated entrepreneurial (NME) activity. The authors recognise OME as when individual/s undertake a business start-up having recognised a business opportunity and are compelled into the career move by the attractiveness of the opportunity. NME by contrast, is a last resort, whereby individuals are driven towards an entrepreneurial career choice through lack of an alternative option (McMullen *et al.*, 2008). The significance of these aspirations is now considered: -

Self-employed (SE): Several studies have recognised entrepreneurship education can promote entrepreneurship as a potential alternative career option for graduates post-graduation and encourage favourable attitudes towards entrepreneurship (Katz, 1991; Kolvereid and Moen, 1997; Young, 1997; Alvarez and Jung, 2003; Jones *et al.*, 2008). There remains an on-going challenge, however, to inform and convince undergraduate students regarding the viability and sustainability of self-employment through a business start-up as an alternative career to employment (Carayannis *et al.*, 2003; von Graevenitz *et al.*, 2010).

Schwarz *et al.* (2009) identifies three underlying drivers for self-employment, namely:

- i) Educated entrepreneurs are expected to create business start-ups which grow more effectively than their lesser educated equivalents.
- ii) Increased global competition has reduced the attractiveness and opportunities for wage employment in larger organisations.
- iii) Increase in graduate unemployment.

They further note it is not known whether environment or individual motivational characteristics drive students' career decisions toward self-employment. Therefore, this study explores the relationships between motivational characteristics for entrepreneurship education and career aspirations towards self-employment of undergraduate students pursuing a degree in entrepreneurship.

Employed (E): Seeking appropriate waged employment has long been regarded as the optimum graduate ambition post study (Nyaribo *et al.*, 2012; Teichler, 2012). Tan *et al.* (1995) proposed, however, that students may be attracted to entrepreneurial learning as a vehicle towards an alternative career opportunity in times of economic recession and high graduate unemployment. Thus, intention to undertake both entrepreneurial activity and entrepreneurial education could be heavily influenced by economic climate, which is particularly relevant in the current global climate (Rae, 2007; Schwarz *et al.*, 2009). Alternatively, waged employment can also be a pre-cursor to future entrepreneurial activity to acquire the relevant qualities, skills, experience and knowledge for future success. Moreover, Carter (1998: 233) found in her study of alumni perceptions of entrepreneurship education in HE that many:

'...believed it was important to gain some work experience prior to start-up as it not only gave them detailed sectoral knowledge, it also provided a network of business contacts and the appropriate finance to start-up.'

Young (1997), also noted, however, that students might study entrepreneurship if they wish to acquire knowledge beneficial to their career in a larger organisation. Holden *et al.* (2007) suggest that there remain serious deficiencies regarding information about the SME graduate labour market. Henley (2007) therefore stressed the importance for enterprise education providers to prepare aspiring entrepreneurs for undertaking new business start-ups. Thus, it seems the motivations of students to achieve employment having studied

entrepreneurial education varies significantly and warrants further investigation. Following, from this discussion, the Figure 1 conceptualises the analysis approach undertaken in this study.

See Figure 1 here

Following on from investigation of the relationship of certain motivation characteristics towards future career aspirations, three specific research questions are constructed, upon which the study will undertake its analysis.

RQ1 - Evaluate the different levels of relevance between the motivation characteristics of students, and their future career aspirations to employment or self-employment (within 12 months after completion).

RQ2 - Evaluate the relative evidence of the considered different levels of importance of the motivation characteristics to the different future career aspirations?

RQ3 - Evaluate how gender and age of a candidate student may contribute to the ways the different motivation characteristics impact on their future career aspirations?

Design/methodology/approach

The research utilised a multi-method approach to data collection for the purposes of triangulation and to take advantage of the respective qualities of quantitative research instrumentation (Mingers, 2001). The first stage involved the analysis of student enrolment data to identify age, gender and background characteristics such as employment status and qualifications to enable respondents profiling. The second stage involved structured interviews using a questionnaire with all the students undertaking the course to discover why they had chosen to embark on an undergraduate enterprise degree. The sample reflected the age and gender differences identified in the enrolment data.

The rationale for analysing these differences was based on the findings of previous studies. For example, it is widely acknowledged that gender has a significant effect upon

nascent entrepreneurship (Brush, 1992, Minniti *et al.*, 2005) and there is considerable variation in entrepreneurial activity between different age groups (Davidsson and Honig, 2003; Reynolds *et al.*, 2003).

For example, Allen *et al.* (2007) identified levels of female entrepreneurial activity in the UK (10.73%) were found to be inferior (-7.72%) in both early stage (male 11.98%, female 7.25%, -3.73%) and established enterprises (male 6.47%, female 3.48%, -2.99%) to male business-owners (18.45%). For the purposes of this study, GEM age groupings were utilised (Bosma and Harding, 2006). Prior to the interview, students were provided with an interview guide asking them to consider why they had selected the course and what they considered to be the primary motivations behind the decision to study the undergraduate enterprise programme. Interviews were either conducted in person or by telephone. The average length of an interview was 30 minutes.

During the interview, students were asked to complete a structured research instrument employing five-point Likert arrays to enable statistical and comparative analysis (see Table 1).

See Table 1 here

The Likert arrays were designed to assess the importance of each of the motivational characteristics identified previously underpinning their desire to undertake an entrepreneurship programme. The scale runs from one as “Not Important” to five as “Most Important” motivational characteristic. In addition, students were asked to identify whether they wished to pursue a career in employment or self-employment post-graduation. All students taking the course had to complete the interview process as part of their application process with no exemptions allowed.

Because of the nature of the data, non-parametric techniques were deemed to be a pertinent choice of analysis approach in this study. As mentioned previously, certain

advantages of the use of a non-parametric approach include the relaxing of the need for Gaussian distributed data values, as well as the ability in this case to investigate non-linear relationships between the motivational characteristics and future employment aspirations.

The non-parametric technique utilised in this study is the CaRBS technique, introduced in Beynon (2005a; 2005b), see Appendix A for a technical description of the technique. Since its introduction the CaRBS technique has been applied in the areas of: public administration (Beynon and Kitchener, 2005), medicine (Beynon *et al.*, 2006a, Beynon *et al.* 2006b), animal biology (Beynon and Buchanan, 2004), E-learning (Jones and Beynon, 2007) and strategy (Beynon *et al.*, 2010). In the CaRBS technique there is the allowance for an a priori considered non-certainty of the association of motivational characteristics to the student aspiration problem considered. Given this non-certainty, CaRBS also allows a visual exposition of the relationships between the “dependent” and potential “contributory” variables in order to allow identification of whether the relationships were linear or non-linear in nature. Further, using CaRBS, there is a direct understanding of the quality of the Likert scale based information with respect to each considered motivational characteristic, in terms of whether there was no information present in Likert scores, or whether there was evidence pertaining to their future career more aspirations to employment or self-employment (see figures presented later).

Participants

A total of 720 students enrolled onto the EU funded undergraduate enterprise degree programme in the Objective One areas of Wales including north, mid, east, west and south Wales during the period of investigation, of which 383 (53%) were female and 337 male (47%), with an age range from 19 to 64 years old. The programme was managed by the University of Glamorgan and delivered through a Further Education network throughout

Wales. The mean age for the cohort was 37.37 with a marginal difference in the gender mean ages (see Table 2). The profile of such students can be considered as non-traditional to typical HE undergraduate students in terms of age range, and also provides a student population that also differs in terms of age with those traditionally analysed with regards to enterprise education. The purpose of the programme was to develop entrepreneurial knowledge and skills, and thereafter business start-up, development and growth activity.

See Table 2 here

Further, using the age ranges, 18-24 (later labelled 1), 25-34 (2), 35-44 (3), 45-54 (4) and 55-64 (5), Figure 2 presents a breakdown of the percentage of students (from the 720), in each of these age groups.

See Figure 2 here

CaRBS Analysis of Student Motivation Data Set

As highlighted earlier, the contention in this study is the use of the CaRBS technique offers a number of advantages over the employment of alternative traditional techniques, such as logistic regression. First, by drawing on all the available information to model student aspirations, evidence-based approaches can accommodate outliers within datasets without needing to fit them to a Gaussian distribution by weighting them or excluding them from the analysis altogether.

Second, because evidence-based approaches are data-driven they are also able to reveal the full range of linear and non-linear relationships which might be present within a dataset. Throughout the study, there is emphasis on the visual representation of results, and relevance and contribution of the motivational characteristics describing the students and how they may evident their future career aspirations (employment or self-employment).

The disadvantage of CaRBS is that it does not allow a statistical significance equivalent to be calculated and thus the research design is not able to meet the usual conditions necessary to establish broad statistical representativeness as identified, for example, by Storey (2002). Standard hypotheses are also, therefore, not applicable to this study, which therefore positions this study as an initial exploration of a case study utilising key research questions. This also limits the generalizability of the specific results beyond the population of students undertaking the enterprise programme used in the study. Because the purpose of the research was to begin to identify relationships between motivations for entrepreneurship education and aspiration to self employment, however, this is not seen as a disadvantage, given that the study itself can be seen to be a case study (partly because of the non-traditional age range of the students) and because of the other advantages of the CaRBS technique.

The CaRBS based analysis undertaken here is the modelling of the students' motivational characteristics in re-creating their expressed aspirations, labelled here as either, employment (E defined here the hypothesis x - see Appendix A) or self-employment (SE defined not-the-hypothesis $\neg x$). The configured CaRBS system produces a final aspiration body of evidence (BOE) for each student, represented as a simplex coordinate in a simplex plot (the standard classification domain employed with CaRBS), made up of an equilateral triangle, whose base vertices in this case are the two aspirations {SE} and {E}, and the top vertex represents ignorance (termed here as {E, SE}).

Analysis and Results

The emphasis here is on the relevance and contribution of the individual motivational characteristics in this modelling process (configuring a CaRBS system). Furthermore, how “discerning” were the individual Likert scale based responses from the students to the

respective motivation questions, when they were employed to segment the known aspirations of the students, see Figure 3 (With a grey shaded sub-region of the simplex plot domain shown - see the small full simplex plot domain for reference). In other words, to what extent were the motivations to undertake the course related to their future employment or self-employment aspirations

See Figure 3 here

In Figure 3, for each of the known aspirations, SE (self-employed) and E (employed), the simplex coordinate forms of the respective average motivation BOEs are presented (see Appendix A), representing evidence from the motivational characteristics, to the students' predicted positions in terms of the employment, self-employment and ignorance domain. The lines joining the pairs of SE and E simplex coordinates are to enable comparisons between the segmenting strengths of the individual motivational characteristics. There are two positional issues to consider when viewing the results in Figure 3 (and considered in conjunction with each other);

- i)* Vertical distance from the {E, SE} vertex: The further distance away (down) from the {E, SE} vertex the less "ignorance" there is associated with the evidence from the motivational characteristic in the overall segmentation of students' aspirations (i.e. the motivational characteristic is more relevant to the aspiration).
- ii)* Horizontal distance between SE (Self-employment) and E (Employment) labelled simplex coordinates associated with a motivational characteristic: the horizontal distance between the two points considers the level of "ambiguity" of the responses made between the groups of differently aspiring students (more distance between them infers less ambiguity, and a stronger power of the motivational characteristics to "explain" differences between the employment or self-employment aspirations). Based on these two positional

aspirations, there are three groups, in contribution terms, of motivational characteristics shown (based on distance down the simplex plot sub-domain).

The most relevant are the group of motivational characteristics, Start-Up (StrtUp), Confidence (Cnfdnc) and Qualifications (Qlfcnts). This is followed by the group Management (Mngmnt) and Interest (Intrst). Finally, nearest the {E, SE} vertex is Growth (Grwth), which exhibits the least relevance in this analysis.

In terms of the level of ambiguity in the evidence from these motivational characteristics, Qualifications, with the greatest distance between SE and E simplex coordinates has the least ambiguity in its evidence. In more “Traditional” terms, the interpretation is that the most influential motivational characteristics underpinning the application to study entrepreneurship education and related to the employment or self-employment aspirations, were the urge to achieve a qualification, desire to undertake a business start-up and increase self-confidence.

Less influence was awarded to the acquisition of managerial experience and to increase interest in the subject matter. Least influence was awarded to the issue of achieving business growth. Thus, it was apparent that student responses related to employment or self-employment aspirations were focused on the shorter term obtainable motivations with the completion and attainment of the qualification, increasing subject knowledge and confidence and thereafter the immediate prospect of business start-up. There was however, minimal consideration of the concept of business growth to the entrepreneurship student which might have been considered as a longer term and hence more unobtainable objective of entrepreneurship study.

Beyond the identification of the most or least relevant motivational characteristics, further identification of the type of influence (e.g. positive or negative, linear or non linear) of the individual motivational characteristic responses to the employment or self-employment

aspiration question is next given by demonstrating the direct association of the response given and the evidence it contributes to the classification of the students (item response to motivation BOE), see Figure 4 (these graphs are made up of a combination of the graphs A1a and A1b in Figure A1). That is, for an individual motivational characteristics, was their relevance, as the importance of a motivational characteristics increases for a student (from ‘Not’ to ‘Most’), because the students had aspirations towards either employment or self-employment (that which could be discerned in the CaRBS analysis of course).

See Figure 4 here

In Figure 4, each graph shows ‘up to’ three mass values which make up a motivation BOE, which offer belief-termed evidence to a student’s aspirations being employment ($m_{j, \text{StartUP}}(\{E\})$ for example in Figure 4a for Start-Up motivational characteristic) or self-employment ($m_{j, \text{StartUP}}(\{SE\})$) and between these ignorance ($m_{j, \text{StartUP}}(\{E, SE\})$). These mass value lines are a direct consequence from merging the first two graphs in Figure A1 in Appendix A, which exposit the stages of the construction of motivation BOEs, prior to their representation in a simplex plot. Moreover, the points are the actual BOE mass values associated with the Likert scale (‘Not’ - 1 to ‘Most’ - 5) values employed in this study, with the lines joining them showing the general structure of the mass values in each motivation BOE (over a continuous domain from ‘Not’ to ‘Most’).

Interpreted more qualitatively, for example referring to the Start-Up motivational characteristic (in Figure 4a), the CaRBS analysis suggests that a response from ‘Not’ up to ‘Contributory’ levels of motivation shows constant evidence towards the respondent having aspirations to being employed ($m_{j, \text{StartUP}}(\{E\})$), whereas, from ‘Important’ to ‘Most’ the evidence towards employment aspirations reduces, with an initial increase in ignorance ($m_{j, \text{StartUP}}(\{E, SE\})$) then evidence towards the respondent having aspirations to being self-employed ($m_{j, \text{StartUP}}(\{SE\})$).

In summary, there appears to be a positive, ‘non-linear’ relationship with increasing importance of the Start-Up motivational characteristic and an increasing association to their future career aspiration of self-employment (and so away from employment). Students with a self-employment aspiration were thus positively related to the business Start-Up motivational characteristic. Referring back to Figure 3, demonstrates also that this motivational characteristic is one of the three most relevant considered. Whilst self-explanatory, this provides supporting evidence of the positive relationship between an immediate entrepreneurial aspiration, via self-employment and a business start-up motivation for taking the course.

Considering the other two most relevant motivation characteristics, Confidence (Cnfdnc - Figure 4d) and Qualifications (Qlfcns - Figure 4f), in Figure 4d, a similar positive relationship is also shown between the increasing level of importance of responses to the contribution of the Confidence motivational characteristic and a student’s associated aspiration towards self-employment (increased contribution resulting is reduced evidence towards employment and/or increased evidence towards self-employment). Similarly, in Figure 4f, there is a positive relationship shown for the responses to the contribution of the Qualification motivation to a student’s aspiration to being in self-employment.

These results also, however, demonstrate the non-linear facet of the analysis undertaken when using the CaRBS technique. While a linear set of values were initially attached to the linguistic response values ‘Not’ to ‘Most’, the graphs in Figure 4 show the non-linear set of evidences they offer in this problem, for each motivational characteristic. The CaRBS analysis can go further than elucidating potential non-linear relationships. A unique feature of the employment of CaRBS, is there can also exist only total ignorance in the evidence from some responses. For example, in Figure 4c (Grwth motivation), for the responses ‘Not’ to ‘Contributory’ there is only ignorant evidence from these response levels,

meaning the responses at these levels were too ambiguous to both student self-employment and employment aspirations to enable any specific relational evidence from them. At the higher levels of motivation, however, there is some evidence that the growth motivation is positively related to self-employment.

For the other motivational characteristics, the evidence is also of potential non-linear relationships regarding the importance of them towards future career aspirations of employment or self-employment. For example, for Management, as its contribution importance begins to increase then this is related to a fall in the aspiration towards employment, with no relationship (ambiguity) at the point where the response value 'Contributory', and then, as this motivation's importance increases towards its highest value of 'Most' becomes a positive relationship with the self-employment aspiration.

Conversely, for the motivational characteristic of Interest in the subject, as the motivation importance increases, the self-employment aspiration falls, with no relationship at the point where the motivation become 'Contributory', and then as the motivation importance increases towards its highest value becomes a positive relationship with the employment aspiration. This was the only motivational characteristic where there was more contributory evidence towards an employment aspiration. This result suggests that interest in the entrepreneurship subject matter does not contribute to a self-employment career choice as an initial student motivator towards programme choice.

Influence of Motivation Characteristics with other Demographics

This section considers the exposition of the relevancies of the considered motivational characteristics in the aspirations of students to self-employment or employment with regard to their relevance when taking into account gender and age demographics. The prior literature has suggested demographics, such as gender and age, impact significantly upon

entrepreneurial motivations and different career aspirations including employment or self-employment. Therefore, it is a logical progression to investigate the relevance of such demographics against motivational characteristics of the desire to undertake entrepreneurial education. This analysis will inform the construction and provision of effective entrepreneurship education programmes based on understanding learning requirements of specific student types. The emphasis on the graphical elucidation of the demographic based relevancies continues here, in each of the following presented subsections. Further, analysis is only undertaken on the three most relevant motivation characteristics (see Figure 3), namely Start-Up, Confidence and Qualifications.

Gender: This section examines the impact of gender on student entrepreneurial motivational characteristics contrasted against future career aspirations towards employment or self-employment. The prior literature has clearly highlighted variances in entrepreneurial uptake by gender (Minniti *et al.*, 2005; Allen *et al.*, 2007). Therefore, it is important to assess the variances in gender attitudes towards entrepreneurial education. Considering this gender demographic, Figure 5 provides a constellation breakdown of certain motivational characteristics.

See Figure 5 here

The details presented in Figure 5, are described with reference to the Confidence (Cnfdnc) motivation characteristic. Near the base of the simplex plot sub-domain shown (to the left), the constellation breakdown is made up of the original solid line connecting the average motivation BOEs for students with employment (E) and self-employment (SE) aspirations (shown with small circles). From these small circles, there are four dashed lines, with respective 'end' circles representing the average motivation BOEs for all male/female employment/self-employment aspiring respondents (labelled M and F appropriately). The

consideration here is, in what directions are the respective end circles (labelled M or F), in relation to the respective E or SE circle. For ease of explanation, the terms SE-M, SE-F, E-M and E-F represents these paths, for example, SE-M are male students with aspirations to self-employment, etc.

For the Confidence motivational characteristic, in the case of those students with known employment aspirations, the female students (E-F), based on their motivational characteristic responses, were more associated with the employment aspiration than their male counterparts (the E-F path is nearer the {E} vertex than the E-M path).

Similarly, those students with self-employment aspirations, the female students, based on their motivational characteristic responses, are more associated with the self-employment aspiration than their male counterparts (the SE-F path is nearer the {SE} vertex than the SE-M path). With respect to both aspiration intentions, employment and self-employment, it was apparent female students, whether aspiring for employment, or self-employment, were more discerning in their responses to the respective motivational characteristic question. In the case of those aspiring for self-employment, this would take the form of them indicating more confidence in the option of an entrepreneurial career than their male counterparts. This reinforces the need to provide female students with appropriate female entrepreneurial role models to encourage them to consider an entrepreneurial career option.

This is perhaps unsurprising as the literature suggested males have more confidence to undertake a business start-up than their female counterparts (Allen *et al.*, 2007). In the case of the Qualifications and Start-Up motivational characteristics, the differences of the E-F and E-M paths (and SE-F and SE-M) are less apart than in the case with the Confidence motivation characteristic, indicating not as noticeable differences between the genders on these motivational characteristics. However, even though to a lesser extent than the confidence motivational characteristic, while the females with aspirations towards employment were

most consistent in their responses to the Qualifications and Start-Up motivation questions, it was the males who were more consistent in the responses when having aspirations towards employment.

Age: The annual GEM studies (e.g. Allen *et al.*, 2007) identified differing levels of entrepreneurial aspiration by age, with aspiration more prevalent in the 25-34 and 35-44 age groups, but less significant in the 18-24 grouping. It is essential entrepreneurship education providers effectively target the 18-24 grouping to encourage further uptake of entrepreneurship education and thereafter business start-up activity. Considering this age demographic, Figure 6 shows a constellation breakdown of certain motivation characteristics.

See Figure 6 here

From Figure 6, considering the confidence motivation (Cnfdnc), for those students with self-employment aspirations, there is a general trend of the older the student (in age groups 3, 4 and 5 - described in Figure 2), being more associated with the self-employment aspiration than the younger aged students (in age groups 1 and 2). That is, for Cnfdnc, the simplex coordinates SE-3, SE-4 and SE5 are nearer the {SE} vertex than the SE-1 and SE-2. The argument regarding this evidence is that the older age groupings, students over the age of 35, might require greater self-confidence to realise the opportunity offered by self-employment based on their prior working and life experiences. Thus undertaking an entrepreneurship education course offers the opportunity for students to build confidence in a safe environment. Similar, inference can be gauged from inspection of the other constellations presented in Figure 6.

Discussion and Conclusions

This study has presented a unique evaluation of student motivations to undertake an entrepreneurship education programme using the novel CaRBS data mining technique, generating a number of contributions to the literature. The study confirmed RQ1 in that it is possible to discern different levels of relevance between motivation characteristics of students and their future aspirations towards employment or self-employment. The analysis also revealed the key motivators to entrepreneurship education in this instance were (in the discerning of students with employment and self-employment aspirations):

- i)* Desire to achieve a qualification.
- ii)* Desire to undertake a business start-up.
- iii)* Desire to increase confidence in the option of an entrepreneurial career.

These results are consistent with the findings of Young (1997) and Galloway and Brown (2002), suggesting students pursue entrepreneurial education programmes to acquire additional skills and knowledge, independence and increased confidence through an entrepreneurial career. Less prevalence was awarded, however, to the desire to develop interest in the subject matter or the need to acquire managerial experience. This result conflicts somewhat with the views posited by DeTienne and Chandler (2004) and Politis (2005), which suggested entrepreneurial education programmes provide the opportunity to develop subject knowledge. The least relevant motivational characteristic was identified as the desire to undertake an entrepreneurial education programme to achieve business growth. This result may suggest that the students surveyed either did not value or did not understand the significance of business growth, as proposed by Acs and Audretsch (2003), Audretsch and Keilbach (2006) and Praag and Versloot (2007) as an important consideration when contemplating an entrepreneurial qualification.

From these results, it could be interpreted, therefore, that the entrepreneurial education students surveyed give greater significance to issues of immediate importance to them like achieving the qualification, building confidence and thereafter considering self-employment. If such motivational attitudes were to be maintained for those undertaking a business start-up then there may be a danger that these Owner/Managers may not pursue a growth strategy and simply operate as lifestyle non-growth enterprises, as previously recognised by Levy *et al.* (2005). It is essential such a mindset be avoided and young nascent Owner/Managers informed regarding the importance of a more strategic mindset and greater growth orientation.

This also suggests that enterprise education providers may need to give consideration to informing and educating students regarding the importance of business growth from the outset of the programme. Beyond the general results of the relevance of particular motivational characteristics, the CaRBS technique has also allowed some inference to be gauged on different cohorts of students, namely using their gender and age demographics. For example, in the case of the gender demographic, in particular with regard to confidence, levels of difference were noticed in the relationships between the importance levels of motivations of male and female students and the self-employment or employment aspirations.

The motivations for entrepreneurial activity previously identified by Roberts (1991), Galloway and Brown (2002), Segal *et al.* (2005) and Taormina and Lao (2007) as need to achieve, desire for independence, dissatisfaction with current employment bear direct comparison with the motivations for entrepreneurial education, for example, desire for independence and self-improvement with the obvious exception of desire to achieve qualifications.

With regard to RQ2, the study found it was possible to discern the relative evidence of the considered different levels of importance of the motivation characteristics to the different

future career aspirations. Students with a self-employment aspiration were positively related to the business Start-Up motivational characteristic. This finding confirms the ability and accuracy of CaRBS to associate motivational characteristics to career aspiration.

Finally, with regard to RQ3, the study confirmed how the gender and age of a candidate student impacted upon the different motivation characteristics towards future career aspirations. The study found that female students were more discerning in their responses regarding motivational characteristics than their male counterparts. This suggests that it is possible using techniques as CaRBS to understand the learning requirements of students prior to the course and provide customised learning programmes which could be gender specific. Furthermore, the analysis suggested that older students were more associated with self-employment aspirations although this required enhanced confidence from their programme to enable this to occur. This evidence again informs the extant knowledge in that the learning requirements of mature students differ from their younger counterparts and thus require different support and instruction with greater focus on operationalising the process.

This study also contributes to methodology. First, it investigates motivations for undertaking entrepreneurship education using a novel data analysis technique (CaRBS) allowing a fuller analysis of the dataset than more traditional techniques (though within the statistical restrictions also imposed by CaRBS in terms of the lack of tests for statistical representativeness). The CaRBS method enables inclusion of data outliers not permitted with standard regression data analysis techniques thus providing a more accurate representation of student motivations towards entrepreneurship programmes. Secondly, it provides new insights into motivations for undertaking an entrepreneurship education programme with regard to self-employment or employment aspirations. Finally, the study considers non-traditional learners which have not been previously represented within the extant literature,

illustrating the strength of CaRBS within a case study context in which a data mining approach is deemed most appropriate.

In terms of the future utilisation of the employed CaRBS technique, in the area of entrepreneurial education, it could potentially provide an ability to generate enhanced understanding of the pedagogical requirements and course content of individual students. The CaRBS technique could specifically offer an alternative to other statistical analysis techniques within the entrepreneurship discipline, where the data is non parametric, the dataset can be seen as a case study comprising the population under investigation, and the issue being researched requires a data mining type approach. Finally, the study generates knowledge which may fit the definition of having practical implications and informing the effectiveness of programme design and increase OME within the student group (McMullen *et al.*, 2008) for educators, programme providers and policy makers. As such it could make a contribution to practice in a number of ways.

As way of an example, customized programmes of studies could be constructed, which may offer more specialised focuses, such as on Confidence and/or Start-Up (two motivational characteristics found here to be particularly relevant in discerning those students with self-employment and employment aspirations). Entrepreneurial personality exercises could also be used to further assess the student's personality and current skills set. Thereafter, this information could be used to identify strengths and weaknesses and a development plan for personal improvement identified to build confidence and entrepreneurial competency.

Moreover, the findings suggest the need for dedicated programme modules which would enable a business start-up, preferably providing seed-corn funding to assist this process. For entrepreneurship education providers and policy makers, it could potentially influence the selection of more entrepreneurially oriented individuals with specific

orientation towards business start-up and enable the construction of more student focused programmes of study.

Appendix A

This appendix outlines the rudiments of the CaRBS technique used in this study (Author, 2005a; 2005b). When used as a classification tool, it undertakes the predicted classification of objects (students here) based on a number of characteristics (Likert based question responses student's motivation of entrepreneurship education). The rudiments of CaRBS are based on Dempster-Shafer theory (Dempster, 1968; Shafer, 1976), the evidence from a characteristic value is quantified in a body of evidence (BOE), denoted by $m(\cdot)$, where all assigned mass values sum to unity.

Moreover, for a student o_j ($1 \leq j \leq n_o$) and their i^{th} motivational characteristic value c_i ($1 \leq i \leq n_c$), a *motivation* BOE defined $m_{j,i}(\cdot)$, has mass values $m_{j,i}(\{x\})$ and $m_{j,i}(\{-x\})$, which denote levels of exact belief in the classification of a student to a *hypothesis* x (employment aspiration) and *not-the-hypothesis* $\neg x$ (self-employment aspiration), and $m_{j,i}(\{x, \neg x\})$ the level of concomitant ignorance, given by:

$$m_{j,i}(\{x\}) = \max(0, \frac{B_i}{1-A_i}cf_i(v) - \frac{A_i B_i}{1-A_i}), \quad m_{j,i}(\{-x\}) = \max(0, \frac{-B_i}{1-A_i}cf_i(v) + B_i)$$

$$\text{and } m_{j,i}(\{x, \neg x\}) = 1 - m_{j,i}(\{x\}) - m_{j,i}(\{-x\}),$$

where $cf_i(v) = \frac{1}{1 + e^{-k_i(v-\theta_i)}}$, and k_i , θ_i , A_i and B_i are incumbent control variables. Figure A1 presents the progression from a value v to a motivation BOE and its representation as a simplex coordinate in a simplex plot.

See Figure A1 here

In Figure A1, a question response value v is first transformed into a confidence value (A1a), from which it is de-constructed into its motivation BOE (A1b), made up of a triplet of mass values $m_{j,i}(\{x\})$, $m_{j,i}(\{-x\})$ and $m_{j,i}(\{x, \neg x\})$. Stage (A1c) shows a BOE $m_{j,i}(\cdot)$; $m_{j,i}(\{x\}) = v_{j,i,1}$, $m_{j,i}(\{-x\}) = v_{j,i,2}$ and $m_{j,i}(\{x, \neg x\}) = v_{j,i,3}$ can be represented as a simplex coordinate ($p_{j,i,v}$) in a simplex plot (equilateral triangle), such that the least distance from $p_{j,i,v}$ to each of the sides of the equilateral triangle are in the same proportion to the values $v_{j,i,1}$, $v_{j,i,2}$ and $v_{j,i,3}$.

The set of motivation BOEs $\{m_{j,i}(\cdot), i = 1, \dots, n_c\}$ associated with the business o_j can be combined using Dempster's combination rule into an *aspiration* BOE, defined $m_j(\cdot)$.

Moreover, using $m_{j,i}(\cdot)$ and $m_{j,k}(\cdot)$ as two independent motivation BOEs, $[m_{j,i} \oplus m_{j,k}](\cdot)$ defines their combination, given by:

$$[m_{j,i} \oplus m_{j,k}](\{x\}) = \frac{m_{j,i}(\{x\})m_{j,k}(\{x\}) + m_{j,k}(\{x\})m_{j,i}(\{x, -x\}) + m_{j,i}(\{x\})m_{j,k}(\{x, -x\})}{1 - (m_{j,i}(\{-x\})m_{j,k}(\{x\}) + m_{j,i}(\{x\})m_{j,k}(\{-x\}))},$$

$$[m_{j,i} \oplus m_{j,k}](\{-x\}) = \frac{m_{j,i}(\{-x\})m_{j,k}(\{-x\}) + m_{j,k}(\{x, -x\})m_{j,i}(\{-x\}) + m_{j,i}(\{-x\})m_{j,k}(\{x, -x\})}{1 - (m_{j,i}(\{-x\})m_{j,k}(\{x\}) + m_{j,i}(\{x\})m_{j,k}(\{-x\}))},$$

$$[m_{j,i} \oplus m_{j,k}](\{x, -x\}) = 1 - [m_{j,i} \oplus m_{j,k}](\{x\}) - [m_{j,i} \oplus m_{j,k}](\{-x\}).$$

This process is then used iteratively to combine the motivation BOEs into an aspiration BOE. For a student o_j , its aspiration BOE contains the information necessary for its final classification (to self-employment or employment aspiration). To illustrate the method of combination employed here, in Figure 1c, the combination of two example BOEs, $m_1(\cdot)$ and $m_2(\cdot)$, is shown graphically in a simplex plot to a new BOE denoted $m_C(\cdot)$.

The configuration of a CaRBS system depends on the assignment of values to the incumbent control variables (k_i , θ_i , A_i and B_i , $i = 1, \dots, n_C$). With the question responses labelled 1 to 5 and then standardised, the domains of the control variables are set as; $-3 \leq k_i \leq 3$, $-2 \leq \theta_i \leq 2$, $0 \leq A_i < 1$ and $B_i = 0.6$ (see Author, 2005b). The evaluation of specific control variable values is solved here using an evolutionary algorithm called Trigonometric Differential Evolution (Fan and Lampinen, 2003), with operation parameters; amplification control $F = 0.99$, crossover constant $CR = 0.85$, trigonometric mutation probability $M_t = 0.05$ and number of parameter vectors $NP = 10 \times \text{number of control variables} = 180$.

Associated with any evolutionary algorithm is an objective function (OB), here a positive function which measures the misclassification of students from their known defined categorized aspiration (self-employment or employment). The equivalence classes $E(x)$ and $E(-x)$ are sets of objects known to be classified to $\{x\}$ and $\{-x\}$, respectively. The subsequent OB is given by:

$$\frac{1}{4} \left(\frac{1}{|E(x)|} \sum_{o_j \in E(x)} (1 - m_j(\{x\}) + m_j(\{-x\})) + \frac{1}{|E(-x)|} \sum_{o_j \in E(-x)} (1 + m_j(\{x\}) - m_j(\{-x\})) \right).$$

which has the range $0 \leq OB \leq 1$. The division of elements of OB by $|E(\cdot)|$ takes account for unbalanced data sets, in this case with different numbers of students to the two aspirations of self-employment and employment.

An indication of the evidential support offered by each question to the known self-employment and employment aspiring students is made with the evaluation of *average*

motivation BOEs. More formally, for those students in an equivalence class $E(\cdot)$, the average motivation BOEs, defined $am_{i,\cdot}(\cdot)$, is given by:

$$am_{i,\cdot}(\{x\}) = \sum_{o_j \in E(\cdot)} \frac{m_{j,i}(\{x\})}{|E(\cdot)|}, am_{i,\cdot}(\{\neg x\}) = \sum_{o_j \in E(\cdot)} \frac{m_{j,i}(\{\neg x\})}{|E(\cdot)|}, am_{i,\cdot}(\{x, \neg x\}) = \sum_{o_j \in E(\cdot)} \frac{m_{j,i}(\{x, \neg x\})}{|E(\cdot)|}$$

where o_j is a student. As BOEs they can be represented as simplex coordinates in a simplex plot describing the evidential support of a motivation based question to the aspiration of the students.

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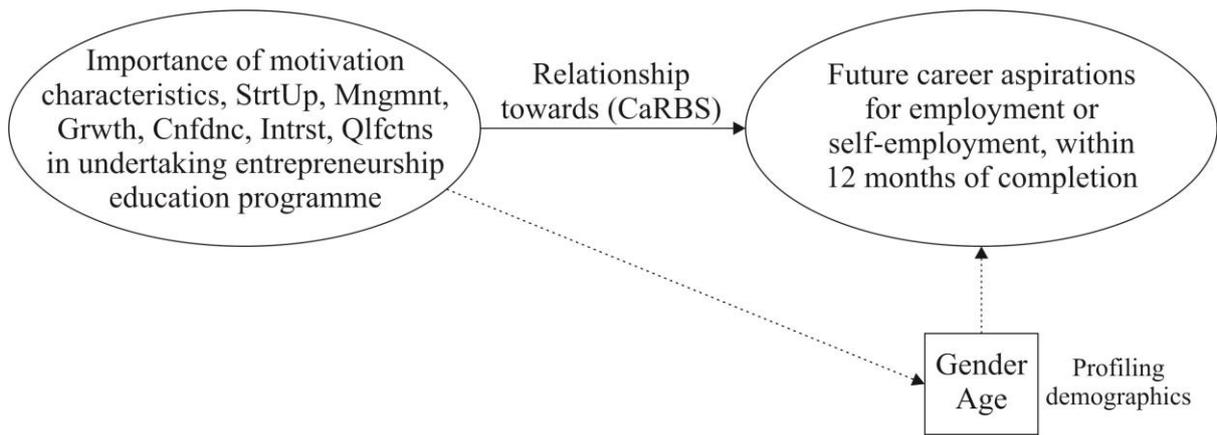


Figure 1: Visualisation of considered Motivation-Aspiration research problem

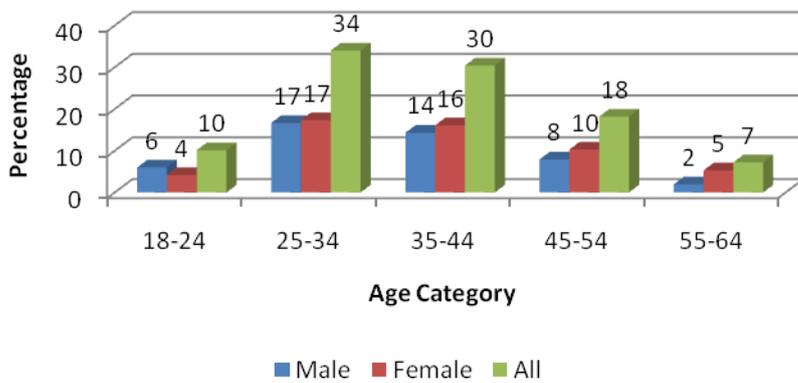


Figure 2: profiles the survey respondents by gender and age which reveals gender representation in each age category.

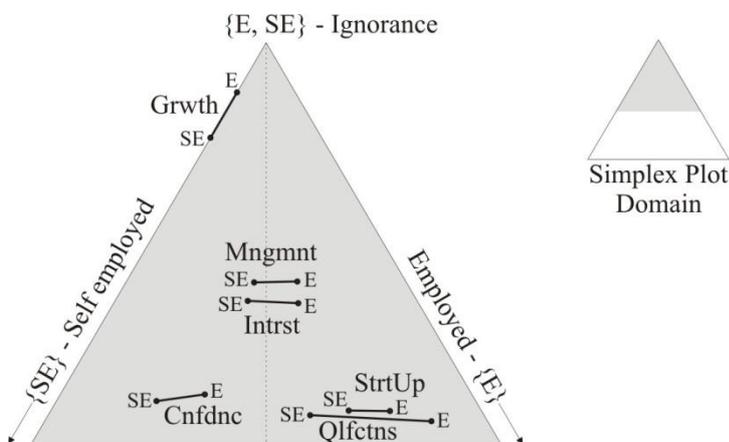


Figure 3: Simplex plot based elucidation of relevance of motivations to segmentation of self-employment (SE) and employment (E) aspirations of students

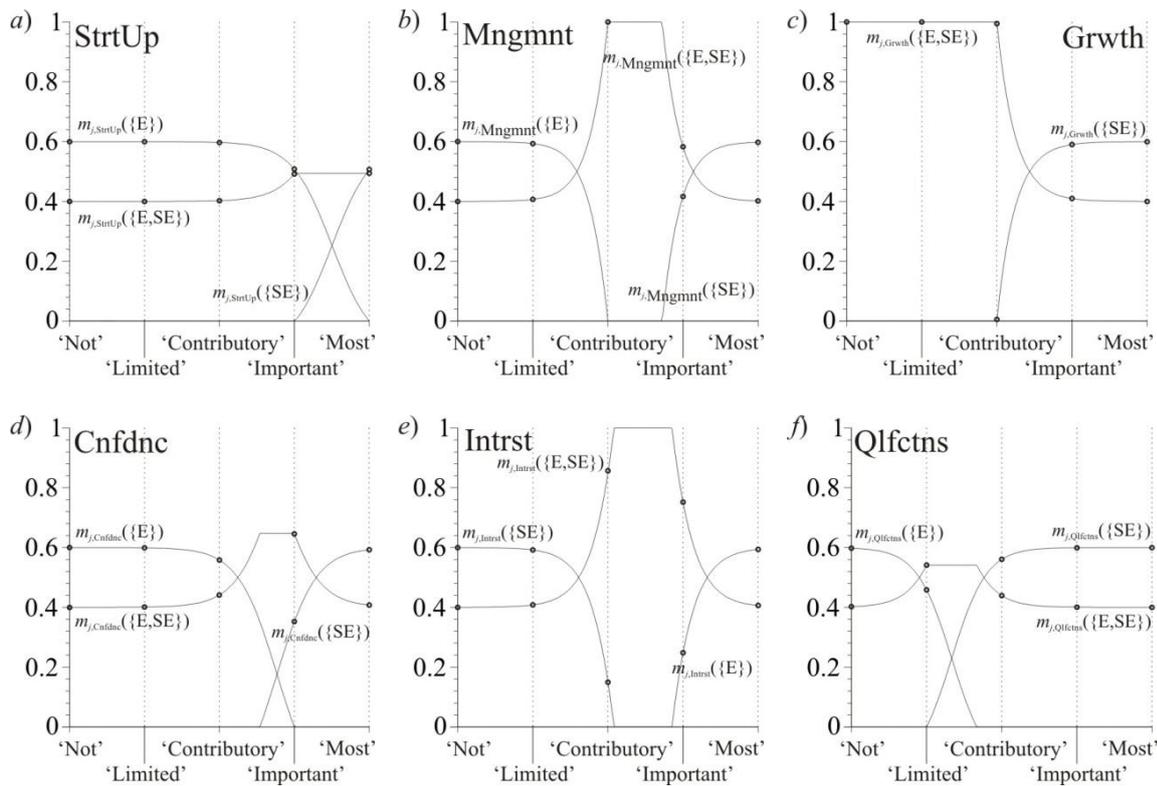


Figure 4: Direct relationship between response terms and mass values in motivation BOEs

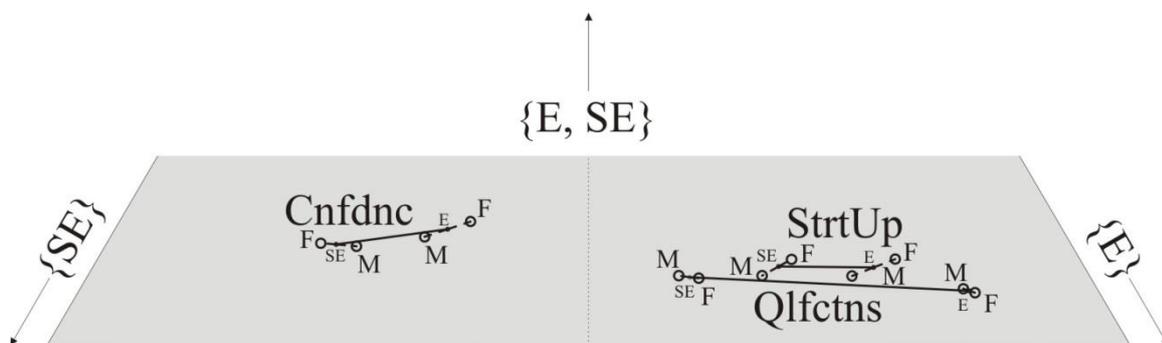


Figure 5: Simplex plot based elucidation of relevance of certain motivation characteristics to discernment of self-employment (SE) and employment (E) aspirations, with the added demographic of gender considered

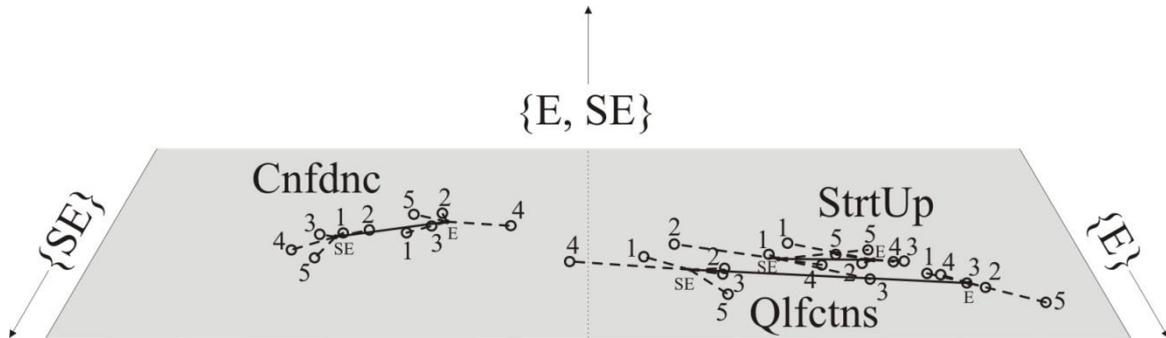


Figure 6: Simplex plot based elucidation of relevance of certain motivation characteristics to discernment of self-employment (SE) and employment (E) aspirations, with the added demographic of age considered (1 - '18-24', 2 - '25-34', 3 - '35-44', 4 - '45-54' and 5 - '55-64')

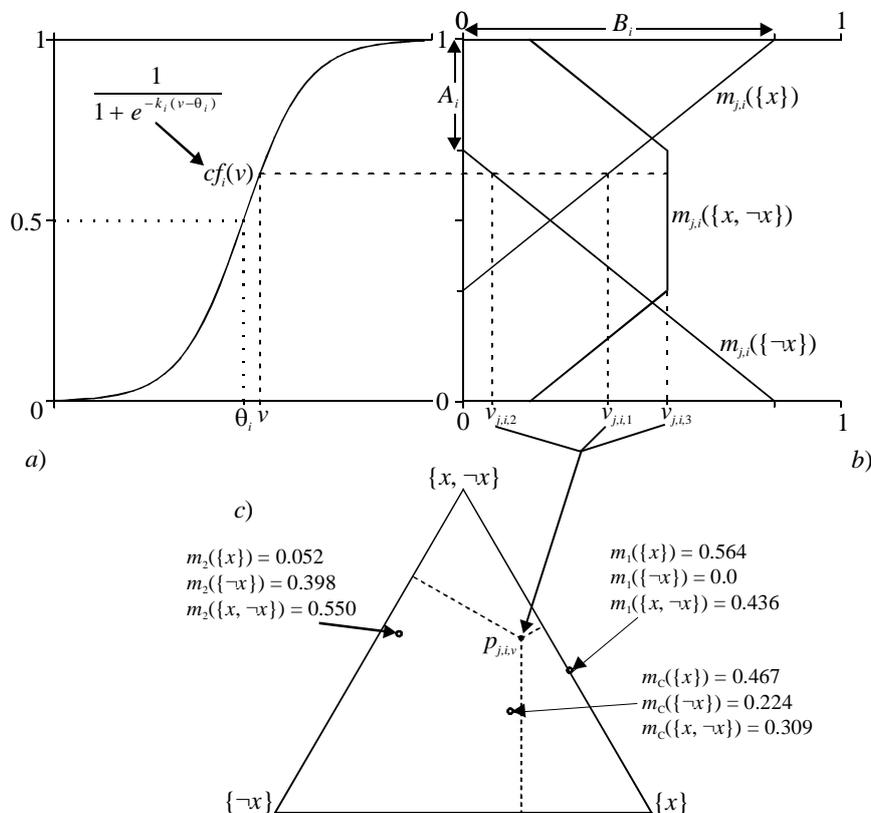


Figure A1: Graphical representation of stages in CaRBS for a single characteristic motivation value

Table 1: Likert scale employed within Research Instrument

1	2	3	4	5
Not	Limited	Contributory	Important	Most
Important	Importance			Important

—————→

Table 2: Student Enrolment by Gender 2002-06

	Males	Females	Combined
	$N_1 = 337$	$N_2 = 383$	$N_T = 720$
Mean (M)	38.31	36.27	37.37
Median (Mdn)	37	35	36
Standard Dev. (SD)	11.22	10.52	10.94