

‘Science in action’: doctoral scientists and identity construction

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## **Introduction**

Across all disciplines, doctoral degrees have traditionally served as an apprenticeship for an academic career. According to Lave and Wenger (1991), the apprenticeship model develops from the assumption that sustained participation in a vocation facilitates the transition from novice to expert. A threshold level of knowledge and skill must be demonstrated for the individual to win recognition as an ‘expert’, at which point they become a legitimate member of the community of practice (COP).

Increasingly, however, doctoral graduates assume non-academic careers. This trend is true both in the UK and internationally (Vitae 2011, 2013; Barnacle and Dall’Alba 2011). As a result, there is ongoing debate as to how well the contemporary PhD prepares its students for their varied future trajectories (for example, Roberts 2002; Park 2007).

This paper focuses on doctoral students in science, mathematics, engineering and maths (the ‘STEM’ disciplines). It shares the results of a two year study which explored doctoral scientists’ motivations, aspirations and values and, in turn, how these aspects inform identity construction. Doctoral scientists are a particularly feted group in UK higher education policy; both policy-makers and industry expect that they will contribute in vital ways to the growth of the knowledge-based economy (Leitch 2006; CBI 2013). It has been argued that the type of identity best suited to the knowledge economy is the ‘liquid’ identity - where traditionally strong influences of discipline and academic norms are replaced by an emphasis upon multi-disciplinarity, transferable skills and flexibility (Bauman 2000; Barnett in Temple 2011)

## **Method**

UK domiciled scientists at a research intensive university participated in a two-year study, including focus groups, an online survey and depth-interviews. The inquiry focused on exploring the motivations, values and ambitions of doctoral scientists, and how these aspects shaped both their daily lives and future plans. Full ethical approval was received by the participating institution, and participation was voluntary and fully informed throughout.

Three initial focus groups were held, with eight students per session. Doctoral scientists relished the opportunity to talk about their values and science-in-context, since they seldom have the opportunity to do so in their everyday research. The focus groups informed the content of the online questionnaire, as is widespread practice in educational research (Cohen et al. 2007; Burton et al. 2008).

The online survey achieved a 15% response rate (n = 165), and was followed by depth-interviews. Sixty-eight doctoral scientists (41% of the survey sample) self-selected as willing interviewees. Twenty students, chosen to represent the range of demographic characteristics and attitudes evident in the survey data, were interviewed. Interviews followed a semi-structured approach, addressing salient themes from the survey.

All data were analysed and coded using grounded theory techniques, namely: coding, memo writing and constant comparison (Strauss and Corbin, 1998).

## **Findings**

Across the population of doctoral scientists, five identity types emerged, differentiated by values, motivations and ambitions. Most doctoral scientists aspired to a strong and permanent identity, informed by long-held values and ambitions.

Seventy per cent of doctoral scientists retained their original intentions for embarking upon the doctorate, whether that be becoming an academic (40%), working in industry (20%), or conducting socially-oriented research (10%). The remaining 30% admitted to a shift in ambitions, occurring typically after the first year of study. This shift led to a more pragmatic position, in which multiple potential careers - and future identities - were imagined. Doctoral scientists who experienced this transition, however, reported that opening their minds to other career trajectories and vocational selves was hugely challenging.

All doctoral scientists were revealed to have a preoccupation with the coherence of their identity: prior educational and work experiences, motivations, values and future plans could not be radically at odds with one another. The need for a coherent normative logic, together with an apparent aversion to cognitive dissonance, led students to adopt a highly strategic approach to doctoral life; making very specific choices regarding research topics, publications, networking and career planning, to reinforce their chosen identity.

## Discussion

Doctoral scientists perceive an acute *absence* of community, and instead develop highly individual and strategic responses in order to manage their personal preferences. The conceptual value of COP is therefore limited in this context. Particularly unsatisfactory is COP's tendency to oversimplify the complex reality of contemporary academia and scientific research careers, and the outdated assumption that the COP in which doctoral scientists train (the academy) is the same community that they will enter as 'experts'. Other assumptions inherent to COP - of comparable individual experiences and an idealised linear trajectory - are also considered problematic when applied to the situation of doctoral scientists.

Game theory is employed to offer a more accurate insight into how doctoral scientists construct identity. Game theory analyses the strategic decisions and behaviours that an individual pursues in order to heighten the chance of bringing a desired outcome to fruition. Originally located in mathematics, and developed through the work of von Neumann (1903-1957) and later Nash (1928-present), game theory has been applied to economics, evolutionary biology and political science (Binmore 2007, 3). This endeavour of applying a game-theory informed analysis to a study of identity construction is considered novel.

Throughout the course of their PhD, doctoral scientists' are involved in a game, played in reference to identity and desired career outcomes. Game strategies are pervasive, informing doctoral scientists' attitudes to: the immediate context of the university; publications; risk; freedom; knowledge; public engagement; and, careers. This paper will detail the five unique game strategies associated with each identity type.

Applied to this particular context of doctoral scientists' identity construction, the benefits of the game-theory analysis are four-fold:

- it draws out the *individual* nature of, and importance of individual values to, the doctoral journey
- it emphasises the intensely *competitive* environment that doctoral scientists inhabit
- it allows detailed examination of the *strategic decision-making processes* which enable doctoral scientists to construct a particular identity

- it reveals how identity construction is informed by calculations of *risk* and *probability*

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