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**The perceived benefits and problems associated with teaching activities
undertaken by doctoral students**

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The perceived benefits and problems associated with teaching activities undertaken by doctoral students

Postgraduate students involved in delivering undergraduate teaching while working toward a research degree are known as graduate teaching assistants (GTAs). This study focused upon the problems and benefits arising from this dual role as researchers and teachers, as perceived by GTAs at the University of Cambridge. To this end, GTAs at Cambridge were invited to participate in an online survey (n = 153). Teaching is seen to offer a wide range of benefits to GTAs, including benefits to the GTAs' own research, transferable skills development, career development and teaching skills. Time pressures emerged as the principal problem associated with the role. The data are consistent with findings from previous studies, while also providing further detail about the nature of the benefits and problems. In particular, additional insights are offered relating to benefits and problems associated with different teaching activities, and disciplinary differences.

Keywords: Graduate students; Graduate teaching assistants; Academic socialisation; staff development.

Introduction

Graduate teaching assistants (GTAs) are postgraduate students, typically studying toward a doctorate, who are involved in teaching undergraduate students in addition to engaging in research. GTAs are used extensively in some countries, including: Australia (Crewe, 1996); Canada (Saroyan & Amundsen, 1995); New Zealand (Harland & Plangger, 2004); and the USA (Park, 2004). In the UK the role is less formalised and less well-recognised (Park, 2004), and graduate students often teach without being referred to formally as GTAs (for brevity, the abbreviation GTA will be used from this point onwards to refer to both formal GTAs and also postgraduate students who teach in any capacity). However, recent changes to the UK higher Education landscape may lead

to a greater institutional reliance upon graduate students who teach. It is timely therefore to consider the benefits and problems the role creates for the doctoral students involved, in order for GTAs to gain better support and recognition from institutions.

Since the late 1990s, several factors have increased pressure on the teaching and research capacity of UK Higher Education (HE), including: the introduction of tuition fees for England and Wales in 1999 following the Dearing report (Dearing, 1997); ineligibility of junior research staff for inclusion in the 'Research Assessment Exercise' (RAE) introduced in 1992 (RAE, 2005) pressurising senior academics to privilege research; and political pressure to increase undergraduate numbers (BBC, 1999).

Institutions view increasing student numbers as a major reason for using GTAs, in order to facilitate small-group teaching (Hayton, 2008; Park, 2002; Procter, Spedding & McIsaac, 2004) and to facilitate laboratory classes for large cohorts (Scott & Maw, 2009). These pressures have been renewed recently through increasing tuition fees (Browne, 2010) and replacement of the RAE with the 'Research Excellence Framework' (REF), which requires academics not simply to produce excellent research but also to maximise its economic and social impact (REF, 2012).

The perceived increase in reliance upon GTAs (Park, 2004) has led to concerns that teaching quality may be compromised due to GTAs' novice status as teachers (Muzaka, 2009; Park, 2002; Procter et al., 2004), and that teaching roles may operate to the detriment of the GTAs' own doctoral studies (Linehan, 1996; McGough, 2002; Muzaka, 2009; Park, 2002; Procter et al., 2004). Recently, some of the mechanisms put in place in the UK to develop teaching skills for GTAs have been removed, including the discontinuation of 'Roberts funding' (Roberts, 2002), and the closure of the Higher Education Academy subject centres (Attwood, 2010). Support for GTAs is likely to

have been removed at a time when institutions may be increasingly reliant on their teaching activities, in order to prioritise research by more senior staff members.

A body of work has addressed aspects of the GTA role within UK HE, emphasising development and evaluation of teaching training programmes for GTAs (Chadha, 2013; Goodlad, 1997; Lueddeke, 1997; McCulloch, 2009; Regan & Besemer, 2009; Sharpe, 2000). Views are divided about whether training ought to be discipline-specific or generic, and whether training provides authentic preparation for academic practice, with some authors favouring a move to an ‘academic apprenticeship’ model (Harland, 2001; Hayton, 2008; Muzaka, 2009). In practice, there is wide variety in training provision (Lee & Pettigrove, 2010; Park & Ramos, 2002; Scott & Maw, 2009).

A smaller body of work has sought to investigate the role of the GTA in practice through exploring the benefits and problems associated with the role. Key studies of this type are summarised in Table 1, and the benefits and problems identified in the studies are summarised in Table 2.

--Tables 1 & 2 to go here--

Variation in research methods (Table 1) and results (Table 2) highlight the need for more comprehensive study of the role of the GTA in UK HEIs. Studies are frequently limited to a single department (e.g. Muzaka, 2009; Procter et al., 2004). The voices of GTAs themselves are often under-represented in sampling, with greater representation of undergraduate and staff views (Muzaka, 2009; Park, 2002; Procter et al., 2004). Knottenbelt et al. (2009) present a notable exception to both limitations, sampling across three HEIs and two subject areas. Despite representing the largest sample of GTAs compared to other studies, this only comprises 23 GTAs (Knottenbelt et al., 2009).

Existing studies collectively describe a range of benefits and problems associated with being a GTA (Table 2). However, there are few points of consensus across the field, particularly in terms of benefits. Problems show greater consistency and have received greater focus (e.g. Park and Ramos (2002) address problems but not benefits). Similar factors may present themselves as both benefits and problems (e.g. 'extra income' and 'poor remuneration'), indicating that it would be valuable to go beyond identification of benefits and problems, to explore the relationships between factors which may influence perception as benefits or problems.

This study sought to build upon the existing literature in order to gain a more comprehensive view of the benefits and problems experienced by GTAs, by drawing upon a larger sample comprised of GTAs from all schools of the University of Cambridge. The research questions underpinning this study are:

- (1) What do GTAs perceive to be the beneficial and problematic aspects of teaching?
- (2) Are there disciplinary differences in the benefits or problems identified?

Method

The study used a mixed-methods research design, with two phases of data collection and analysis. First, an online survey containing both quantitative and qualitative elements was used to gain responses from a large sample of GTA about the perceived benefits and problems associated with their dual teaching and research role. The themes which emerged from the survey analysis, particularly with respect to disciplinary differences, were subsequently explored in greater detail with a sample of students through focus groups.

The online survey was divided into three parts. The first part covered relevant demographic information, directly related to the GTAs' teaching experience, career trajectory, and subject area (summarised in Table 3). Note that the teaching modes that GTAs were engaged with at the university include small-group tutorials (two to four students, known locally as 'supervisions') and laboratory demonstrating.

The second asked participants to describe up to three benefits and three problems they had experienced through teaching, using free text responses. The third assessed endorsement of an inventory of Likert scale-based items drawn from previous studies. This structure was intended to facilitate links back to previous studies, whilst not constraining participants' responses to pre-existing findings. The inventory of Likert scale items and the distribution of responses are shown in Table 4.

--Tables 3 & 4 to go here--

As the university does not keep a centralised record of doctoral students who have been involved in teaching, probability sampling methods were not appropriate (Teddlie & Yu, 2007). Due to the unknown number and identity of the population, a combination of purposive sampling and snowball sampling was used (Arber, 2001; Teddlie & Yu, 2007). Prior to data collection, the research plan was subject to the Faculty Ethics Checklist. Informed consent was sought from participants both prior to starting the online survey, and before taking part in focus groups. The online survey was active for a month, from March 10th to April 13th 2012, during which 153 completed responses were recorded. A further 74 responses had been initiated (often only completing the first page, which addressed demographic information) but did not yield sufficient data to be included in the analyses.

Following data collection, qualitative (Part 2 of the survey) and quantitative (Part 3) analyses were carried out simultaneously. Qualitative analysis of the text

responses used a process of analytic induction (Taber, 2007). The first pass took an ‘open coding’ approach towards the data; this was informed by, but not limited to, the findings of previous studies. The open codes were then reassessed and arranged to identify categories, and categories were grouped into broader themes (Miles & Huberman, 1994; Tesch, 1990).

The third part of the survey served to support themes from the qualitative data by examining distributions of responses. Given the ordinal nature of the Likert scale responses (Denscombe, 2007; Jamieson, 2004), nonparametric statistical tests were used to look for differences associated with demographic data obtained during the first part. In particular, Kruskal-Wallis tests were used to compare differences between >2 subgroups (Field, 2009; Jamieson, 2004).

Results and Discussion

Both the quantitative and qualitative data indicate that the benefits of teaching outweigh the problems. The Likert scale items (Table 4) demonstrate a high degree of agreement, with 11 of the 14 items having a median of 4 (‘agree’) with the remaining three items having a lower median. Respondents also identified more benefits than problems in the text responses (357 benefit statements in total; 231 problem statements). Discussion of the results is divided into benefits and problems, and organised according to the themes that emerged from the qualitative analysis. Within each theme, results of Likert scale items are discussed with related evidence from the qualitative responses. Where appropriate, differences based on demographic characteristics are then described and discussed. The final section addresses the second research question and discusses the

extent of disciplinary differences observed in the data.

Benefits

Benefits are discussed according to three themes which emerged when coding the text responses: whether they relate to the GTAs' current PhD research work; career development (including academic socialisation and teaching-specific benefits); or to generic skills development.

--Figure 1 to go here--

Doctoral work

Benefits relating to doctoral research work formed the largest group in the text responses, with 131 of the 153 GTAs contributing at least one instance. Categories within the group include improving their own subject knowledge, gaining different perspectives on their work and ideas, teaching as a break from research, improving academic writing skills, and aiding motivation (Figure 1).

An overview of the relationship between teaching activities and GTAs' PhD research work can be gained from responses to the Likert scale items 'My teaching has a beneficial effect on my research activities' and 'My PhD research has a beneficial effect on my teaching activities'. Responses to both demonstrate overall agreement, with 54% and 57% of participants indicating 'agree' or 'strongly agree' for each statement respectively. The most prevalent benefit in the text responses in relation to PhD work is improving subject knowledge, through: revising and consolidating core topics; and beneficial effects on PhD work due to broadening knowledge through teaching:

"Forcing me to go back to basics in order to have a good understanding of my topic that I could convey simply to students just beginning to look at the area. " - GTA 117

"Teaching a course which is more general also enabled me to become more proficient in areas of my subject which are not my specialization. Due to this, I have actually discovered important links between what I study and other areas and time periods of my subject." [sic] - GTA 24

This benefit was also addressed explicitly by a Likert scale item, 'Being involved in teaching has improved my own knowledge of my subject'. This item received a very high level of agreement, with 76% of the respondents indicating either 'agree' or 'strongly agree'. A related item, 'Teaching has challenged my understanding of the subject and made me think more deeply about the subject', goes beyond acquisition of knowledge to include reflection and critical engagement with the material. There was a trend toward agreement with this item overall, although this was not as pronounced as for improving subject knowledge (65% agree or strongly agree, compared to 76%).

The second most frequently reported benefit for PhD work was gaining different perspectives on work and ideas. It includes self-reflection, gaining novel views and questions from students, and discussions with colleagues through teaching:

"Get in contact with other supervisors from similar backgrounds as me i.e. chance of chatting to people about their research and get ideas of different approaches I could use" - GTA112

"Students who are new to the subject often ask very insightful questions, as they are not yet biased or jaded by the discipline. Some of these questions have led me to do additional research into my subject in order to be able to discuss the answer with them. [sic]" - GTA24

The GTAs' own academic writing was perceived to be improved through adopting a critical eye when marking students' essays, causing GTAs to reflect upon their own written work.

"Marking students' essays has helped me to be more critical of my own writing." - GTA118

"Marking written work has improved my proof reading skills and helped me reflect on the structure of successful essays." - GTA68

The benefits of teaching as a break from research also relate to time management and organisational skills, and contrast with the issue of time as a problem.

"Acts as a break between experiments, which gives me more focus when I return to them." - GTA107

"It's a nice break from the mundane parts of my research. When I go back to it I feel refreshed." - GTA4

Motivation gained from teaching (21 GTAs) was seen as particularly useful for GTAs when their PhD work was proving frustrating, serving as a reminder of their enthusiasm for their topic and reasons to 'keep going':

"Student enthusiasm, and my corresponding love of teaching help to remind me about the purpose of my own work and help to motivate me to do my own work." - GTA10

"I would probably have quit my PhD by now if it wasn't for the pleasure I get out of demonstrating." - GTA107

Career development

Benefits emerging from the text responses that relate to career development include those specific to teaching, and those relating to the process of academic socialisation (Figure 1). Issues specific to teaching include gaining extra income, enjoyment of teaching and enjoying a sense of encouraging the next generation in their field.

"it is always fun to inspire students and make them enthusiastic about a topic of your interest. This will remind you why you first got interested in your topic and keeps you going!" - GTA141

The academic socialisation theme comprises categories relating to the GTAs' professional development as an academic, including: gaining a sense of professionalism; relationship with peers or other students; improved confidence; career development; and relationship with the institution. The text responses relating to this theme show a degree of overlap; for example, increased confidence is often linked to developing a sense of professionalism:

"It boosts my confidence - here is something that I know how to do, I feel it's directly benefitting people and I feel professional." - GTA135

"Enabled me to retain a sense of a professional identity alongside identity of student." - GTA66

Three of the Likert scale items relate to career development and all produced high levels of agreement. Degree of agreement with the item 'I think the experience I have gained through teaching has been a worthwhile aspect of my research degree programme' varied significantly with teaching type, GTAs having experience of both tutorials and demonstrating reported a higher level of agreement (independent samples Kruskal-Wallis test, $\chi^2(2, N=137) = 9.57, p = .01$). The same item also varied significantly according to GTAs' career plans; those who planned careers involving a teaching element showed a higher level of agreement (independent samples Kruskal-Wallis test, $\chi^2(4, N=140) = 10.57, p = .03$).

Generic skills development

The text responses identified a range of transferable skills fostered by teaching. This was the second most prevalent benefit after research activities, reflected in responses

from 85 GTAs (Figure 1). The following categories emerged from the data:

communication skills; time management and organisational skills; and teaching skills.

Improving communication skills was the most widely reported transferable benefit. Text responses provide additional details about the nature of communication fostered by teaching, including enhancing verbal presentation skills, and thinking about clarity of arguments and explanations. This was also borne out by strong agreement with the Likert scale item 'My communication skills have improved through teaching', with 78% responding 'agree' or 'strongly agree'.

Development of time management and organisational skills reflect time pressures being the biggest problem faced by GTAs (to be discussed under 'Problems'). At the same time, some GTAs highlighted development of time management skills as a direct benefit of time pressures. For example:

"I'm getting better at time management, I can juggle my teaching preparation with my experiments more easily now." – GTA33

"When I have had a heavy teaching schedule, I have found myself forced to organize my time better." – GTA26

Related to this are management skills, applied not just to the GTAs themselves but also to how they deal with other people:

"It has taught me how to manage and deal with others in a role of responsibility" - GTA113

"I learnt how to deal with and manage different personalities. Previously I struggled with arrogant or really shy people, whereas now I feel I know how to behave around them and work together." - GTA49

Development of teaching skills also relates to the problematic themes, of the difficulties associated with teaching itself. These also tend to relate to communication

skills, but with a focus on explaining complex concepts simply and in a variety of ways, and how to provide constructive feedback.

"Required me to think critically about the work of other students, and offer constructive advice on how to improve their output." - GTA151

"I have learned how to give constructive, critical feedback." - GTA62

One of the Likert scale items is indirectly related to this, 'My ability to transfer and apply my knowledge to other environments has improved through teaching'. This item exhibits significant differences based on teaching type with GTAs who had experience of both tutorials and demonstrating showing stronger agreement (independent samples Kruskal-Wallis test, $\chi^2(2, N=137) = 8.61, p = .01$). This is logical as they are teaching in two very different environments, having experience in both the laboratory and small-group setting. This is also potentially interesting from the perspective of career development and academic socialisation, as the ability to apply and transfer knowledge from theory to the laboratory is valuable for an academic career.

Problems

In comparison with benefits, the problems reported by GTAs were less numerous and less varied. Problem statements were dominated by insufficient pay or excessive time demands from teaching. To a lesser extent, conflict between teaching and research activities, and problems associated with teaching as a difficult activity also emerged as themes (Figure 2).

--Figure 2 to go here--

Time and pay

The theme of time and pay emerged strongly from the qualitative analysis as the main problem faced by GTAs, featuring in responses from 124 of the 153 GTAs. This reflects

concerns raised in previous studies; that too much time may be spent on teaching activities to the detriment of doctoral activities, and of remuneration which does not account for all of the time associated with teaching. The text responses revealed a variety of activities that require time in addition to time spent teaching, predominantly preparation and marking. Given the dominance of time issues, responses to the related Likert scale item 'My teaching load is manageable' were surprisingly positive, with 72% of participants indicating either 'agree' or 'strongly agree'. As touched upon when discussing generic skills fostered by teaching, links were made in the text responses between time pressures acting as a catalyst for developing better time management and organisational skills. It is also notable that there was significant variation in responses to the item according to GTAs' career plans (independent samples Kruskal-Wallis test, $\chi^2(4, N=140)=11.756, p=.02$), with GTAs intending to embark on a 'teaching only' career demonstrating stronger agreement. It is not clear from the data here why this would be; it is possible that those GTAs who struggle with teaching are discouraged from pursuing it as a career, or those who are planning a teaching career have more realistic expectations of what is involved in teaching.

While time issues were widespread, only seven GTAs explicitly linked these to unfair pay in their text responses, suggesting that remuneration is not the primary reason for GTAs to engage in teaching. Pay was addressed explicitly in one of the Likert scale items, 'The payment I receive for teaching accurately reflects the amount of time involved', which demonstrated a bi-modal distribution of responses. 27.5% of respondents indicated 'agree', while 24.5% selected 'disagree'.

In related text responses, 13 GTAs referred to pay as a benefit, while seven mentioned it as a problem. This does not shed a great deal of light upon the bi-modal distribution, as it was only raised in the text responses by a small proportion of GTAs

(20 out of a total of 153). Text responses describing pay as a benefit were brief (e.g. “the money”, GTA 143) or explicitly linked it to being able to continue their doctoral studies:

“The money will help me to stay in Cambridge longer and actually finish my PhD!” – GTA 45

“Money: the income generated by teaching has been useful in funding my doctoral studies.” – GTA 77

In responses describing pay as a problem, the converse is true, with the perception that doctoral studies will take longer to complete as a result of time spent teaching. This is exacerbated by the additional unpaid time spent preparing and marking. For example:

“Each of my six students' essays took an hour to read and mark. Reading the texts to prepare for the supervisions took three hours. Supervisors were required to attend the lectures for the course. This means that each week I was paid for three hours of upervising and unpaid for ten hours of preparation.” [sic] – GTA 97

To investigate the varied distribution of responses to the Likert item regarding payment, nonparametric tests were carried out to look for differences in responses according to demographic information. The tests indicated significant differences between groups based on discipline (school) and teaching type. Considering teaching type, lower levels of agreement that pay accurately reflects the time involved were reported when conducting supervisions, rather than demonstrating or undertaking a combination of the two (independent samples Kruskal-Wallis test, $\chi^2(2, N=137) = 7.61$, $p = .02$). This may also account for the disciplinary differences to an extent, as schools which do not make use of laboratory-based practical classes (Arts & Humanities, Humanities & Social Science) indicate greater dissatisfaction (independent samples Kruskal-Wallis test, $\chi^2(5, N=139) = 37.60$, $p < .05$).

Research conflict

The theme of conflict between research and teaching activities includes teaching activities not being aligned well with the GTAs' research topic, and tension with colleagues. Tensions with colleagues include difficulties arising from two contrasting viewpoints. Some GTAs reported that they felt pressurised to take on more teaching, while others reported supervisors' disapproval of teaching activities. For example:

“My supervisor is a bit worried that I've taken too much on. Although I feel I can (and am) managing my time, she wants me to stay focused.” – GTA62

Although teaching creates awkward dynamics between GTA and supervisor for some, it should be emphasised that the problem was raised by only 12 GTAS in the text responses. No instances were found of GTAs describing an improved relationship with their supervisor as a result of teaching. Likert scale items relating to the relationship between the GTA and their department reflect a mixture of views; while the item 'I have been given adequate support and guidance for my teaching' has a modal category of 'agree' (68 GTAs), a substantial minority 'neither agree nor disagree' (34) or 'disagree' (27). Training provision was not raised in qualitative responses as a problem, although tensions between GTA and supervisor/departmental colleagues was raised by some (as discussed previously). Perceived lack of authority may be part of the problem, as indicated by responses to the item 'I have sufficient opportunities to have my say on how the course I teach on is run', which produced the lowest level of agreement of all of the Likert scale items.

The category 'teaching & research clash' is concerned with teaching topics that differ from the research topic, and includes issues related to the integration of teaching activities within a research degree programme. The text responses indicate that this can exacerbate time problems due to extra preparation required; for example:

"It is sometimes very time intensive, especially as I almost never teach my areas of expertise, so it can take a long time to get through all the lecture material" - GTA113

"Because of the degree of preparation needed, I spent a good amount of time at the beginning of term getting up to scratch on the material to be treated, none of which is directly relevant to my PhD. It was kind of fun, but as Term progressed, I did start o [sic] feel I was getting behind with the 'important' things." - GTA78

Teaching challenges

The final problem that emerged from the text responses relates to the difficulties presented by teaching, including challenges of working with undergraduate students, pedagogical challenges, and stress. The qualitative data showed links between items in this section; for example, problems working with undergraduates often lead to stress, and are compounded by time issues. The qualitative data show that there are links between items in this section – for example, problems working with undergraduate students often lead to stress – and are compounded by time issues:

"Some of the supervisees (50 per cent, actually...) didn't turn in work or come to the supervision on two occasions. This led to a lot of wasted time waiting fruitlessly for them, chasing them up and then, when this didn't work, communicating with the DoS [Director of Studies]." - GTA78

"The practical side of teaching is sometimes very different and distant to the theory of education." - GTA67

"Supervising as a PhD student creates strange authority dynamics with students, who are only a few years younger and who are depending on me rather a lot, and for whom I have only a limited amount of experience to draw upon." - GTA89

Disciplinary differences

Research question 2 focused on whether disciplinary differences exist in the relationship between GTAs' identities as teacher and researcher. To explore disciplinary differences,

nonparametric tests were first carried out on the Likert scale responses. The test categories were based on schools of the university, and included Arts & Humanities, Biological Sciences, Clinical Medicine, Humanities & Social Sciences, Physical Sciences and Technology. Significant differences according to discipline were found on the following items:

(1) “My teaching has a beneficial effect on my research activities”. (independent samples Kruskal-Wallis test, $\chi^2(5, N=139)=11.73, p=.04$).

(2) “My PhD research has a beneficial effect on my teaching activities”. (independent samples Kruskal-Wallis test, $\chi^2(5, N=139)=11.18, p=.05$).

(3) “The payment I receive for teaching accurately reflects the amount of time involved”. (independent samples Kruskal-Wallis test, $\chi^2(5, N=139)=37.60, p<.05$).

(4) “Being involved in teaching has improved my own knowledge of the subject” (independent samples Kruskal-Wallis test, $\chi^2(5, N=139)=12.87, p=.03$).

Across the four questions which showed disciplinary differences, three pairs of schools showing similarities with each other emerged. These were: Arts & Humanities and Humanities & Social Sciences (AHSS); Biological Sciences and Clinical Medicine (Biomedical Sciences); and Physical Sciences and Technology (referred to together onwards here as ‘Physical Sciences’). In order to understand the reasons behind the differences, focus groups were held to reflect the groups of schools.

Two of the questions which showed disciplinary differences relate explicitly to the relationship between teaching and research activities. Using the ‘mean rank’ generated as part of the Kruskal-Wallis statistical tests revealed that the items ‘My teaching has a beneficial effect on my research activities’ and ‘My PhD research has a beneficial effect on my teaching activities’ showed greater agreement in the AHSS (Figures 3 and 4).

--Figures 3 & 4 to go here--

The higher agreement level that teaching benefits research, and vice-versa, in AHSS compared to other disciplines provides evidence for the supposition by Knottenbelt et al. (2009) that the relationship between research and teaching is stronger in AHSS. The present study also goes further in terms of exploring the reasons behind this relationship, in all disciplinary areas of the University. In Biomedical Sciences, there is stronger agreement that research activities are beneficial for teaching, than teaching activities benefiting research. This is reversed for Physical Sciences. The relationships between teaching and research are relative however; it was clear from the focus groups that there are still important benefits from teaching to research in Biomedical Sciences, and vice versa in Physical Sciences.

Different aspects of research and teaching were identified through the text response and focus group data as being particularly important in different disciplines. In AHSS subjects, gaining different perspectives on their work and ideas, and improving their own academic writing skills, were highlighted as being particularly important. In Biomedical Sciences, particular benefits included enhanced communication skills in terms of explaining concepts to patients and research participants, and time management and organisational skills. Communication skills were also highlighted more generally by Physical Sciences, in addition to enhancing motivation through a break from research.

These differences are linked to an extent to the nature of teaching activities in the different disciplines. Differences were discovered in terms of the benefits and problems experienced by GTAs when facilitating different modes teaching (comparing small-group supervisions and laboratory-based practical demonstrating), and extent of use and exact nature of laboratory practicals and small-group teaching varies according

to discipline. While laboratory-based practicals are less time consuming, GTAs indicate that the beneficial effects such as improving their own knowledge are less pronounced in comparison to small-group teaching. The differences according to discipline found in the responses to the items “The payment I receive for teaching accurately reflects the amount of time involved” and “Being involved in teaching has improved my own knowledge of the subject” are also likely to be related to the different teaching modes used, with payment concerns being raised in relation to small-group teaching in contrast to demonstrating, whereas enhanced subject knowledge is gained from small group teaching.

Conclusions

This study has provided extensive information about the range of benefits and problems perceived by GTAs to be created through their dual role in research and teaching within the context of a UK HE institution. While many of these issues had been touched upon by previous studies, this work has been able to go further, identifying a broader range of issues and examining disciplinary differences. The insights from the focus groups suggested that all of the statistical differences were related to the contrasting forms of teaching undertaken by GTAs in different disciplines.

The findings of this study have implications for practice in UK HE in two main ways. First, the results highlight the importance of providing opportunities for PhD students to gain teaching experience as part of doctoral programmes. In contrast to other sectors (such as the USA; Park, 2004), the inclusion of teaching opportunities in graduate programmes is not standard practice, and may even be discouraged or viewed as detrimental to the PhD (as touched upon here in the ‘research conflict’ section; also, Linehan 1996; McGough 2002; Muzaka 2009; Park 2002; Procter et al. 2004).

Benefits for future careers and transferable skills development from engaging in teaching are widely recognised, i.e. not simply by GTAs who intend to pursue academic careers. It is notable that only two of the survey items, 'my teaching load is manageable' and 'I think the experience I have gained through teaching has been a worthwhile aspect of my research degree programme' showed significant differences according to whether GTAs intend to pursue academic careers after their PhDs. Different types of teaching activities are seen as beneficial in different ways. For example, supervisions are perceived to improve the GTAs' knowledge to a greater extent than demonstrating, while a combination of both supervisions and demonstrating is perceived to give the greatest benefits in terms of learning to apply knowledge in different contexts. For a GTA to gain maximum benefit a range of teaching opportunities, reflecting the authentic academic practice of the GTA's discipline, would be ideal. Given the problems associated with excessive teaching loads (Park & Ramos 2002), however, a balance must be struck. As PhD graduates are increasingly expected to have both an excellent publication record and teaching experience for entry-level academic posts (Brown & Mountford-Zimdars, 2017), sector-wide guidelines may be useful.

Second, the findings help illuminate the debate between whether training in teaching provided to doctoral students should be generic or subject-specific (Harland 2001; Hayton 2008; Muzaka 2009). The results reported in the disciplinary differences section suggest that training would benefit from a degree of differentiation at the level of similar schools within the University, which share similar modes of teaching.

Furthermore, the design of training activities may benefit from pedagogical approaches which build upon doctoral students previous experiences of teaching. The assumption (and concern; see introduction) that GTAs have no previous teaching

experience may not be accurate; 75 of the GTAs sampled reported previous teaching experience, while 78 claimed not to have such experience. It is notable that relatively few indicated problems with teaching as an activity (28 of a total 153 respondents). While issues about training are not the main focus of this study, given that (i) only a small proportion of GTAs report problems as teachers, (ii) the extent that training provided is valued varies, and (iii) around half the GTAs already have previous teaching experience, training perhaps should acknowledge different levels of existing pedagogical expertise. A more detailed study of teaching practice and GTAs' confidence would be beneficial in informing training.

A strength of the study is that it comprised a relatively large sample of GTAs, drawn from departments across all schools of the University, although it is limited in that it focuses upon only one institution, which has a distinctive approach to undergraduate pedagogy (the supervision system). Despite this, the main implications relate to the training and development of doctoral students as academics within their disciplines and the lack of consensus on policy in this area, so as such are potentially applicable across the sector. Although the role of the GTA as an academic apprenticeship covering all aspects of work within Higher Education arguably lags behind some sectors (Crewe, 1996; Park, 2004), it remains informal in a significant proportion of the global Higher Education sector, yet graduates may intend to seek academic positions which call for teaching experience after graduation. For example, the Bologna Process framework for aligning PhD degrees discusses research and communication skills, but not teaching (Bologna Working Group, 2005). As such, graduates may be placed at a disadvantage in terms of skills gained and competition for academic jobs in other countries.

The research design used here would provide a robust model for further research to use as a starting point and deploy at further UK HEIs in order to draw comparisons. Having drawn out a substantive framework of problems and benefits in analysing the data, it would also be feasible now to create a thorough Likert scale inventory, which could be used with GTAs across the country. The paper provides a 'snapshot' of perceived benefits and problems; it would also be potentially very valuable to conduct a longitudinal study to explore how these change across the course of doctoral studies, or to ask early career postdoctoral researchers to reflect on the value of their teaching experiences further into their academic careers.

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TABLE 1: Summary of previous UK-based studies of the GTA role.

Study	Sample	Method
Park, 2002	15 graduate students and 22 senior staff members at Lancaster University	Survey. Participants were asked to describe one benefit and one problem of GTAs, from the viewpoints of undergraduates, graduates, and the department
Park and Ramos, 2002	11 GTAs, 7 teaching staff and 3 department heads at Lancaster University	Interviews. Structured around issues including recruitment, tasks, training, quality assurance, time, payment, and autonomy.
Procter, Spedding and Mclsaac, 2004	217 undergraduates, eight GTAs and ten staff in the Information Systems Department at Salford University	Separate surveys sent to the three groups sampled. GTAs were asked about their experiences, whether the role had met their expectations, remuneration, tasks, career plans and training opportunities.
Muzaka, 2009	51 undergraduates, ten GTAs, eight academic staff and one Deputy Head of Department in a Social Science Department at Sheffield University	Separate surveys sent to undergraduates and GTAs/staff. An unstructured interview was carried out with the Deputy Head of Department.
Knottenbelt, Hounsell and Kreber, 2009	23 GTAs, across two subject areas (Economics and Biosciences) and three UK HEIs	Mixed methods: two surveys and one interview. The study focused upon: GTAs' teaching experiences, preparedness and support, and how GTAs view their roles as novice academics

TABLE 2: Benefits and problems identified by previous UK GTA studies.

	Park, 2002	Park and Ramos, 2002	Procter, Spedding and McIsaac, 2004	Muzaka, 2009	Knottenbelt, Hounsell and Kreber, 2009
BENEFITS					
Extra income	■		■		
Added structure to working week	■				
Satisfaction	■				■
Improving confidence	■			■	
Academic career development	■		■		■
Understand subject better	■				■
Interact with young people	■			■	
Gain new insights on own research area				■	
Apply knowledge in different environment				■	
Deal with difficult questions and people	■			■	
Improve public speaking skills					■
PROBLEMS					
Poor remuneration	■	■		■	
Heavy workload	■		■		
Time pressures	■			■	■
Limited autonomy	■				
Lack of say on how course is run	■			■	
Relationship with department	■	■		■	■
Negative experience	■				■
Lack of feedback on teaching		■			■
Lack of effective training		■			■
Limited subject knowledge	■				
Challenges of teaching					■

TABLE 3: Summary of demographic information about the GTAs who took part in the survey.

	Frequency	% of total
<i>School (total: 152)</i>		
Arts & Humanities	22	14.5
Biological Sciences	15	9.9
Clinical Medicine	15	9.9
Humanities & Social Sciences	33	21.7
Physical Sciences	43	28.3
Technology	24	15.8
<i>Study year (total: 151)</i>		
1 st year	33	21.9
2 nd year	46	30.5
3 rd year	42	27.8
4 th year	21	13.9
5 th year+	9	6.0
<i>Study mode (total: 153)</i>		
Full time	151	98.7
Part time	2	1.3
<i>Terms since first teaching (total: 140)</i>		
1 to 3	57	40.7
4 to 6	39	27.9
7 to 9	22	15.7
10+	22	15.7
<i>Teaching type (total: 149)</i>		
Supervisions (small-group tutorials)	95	63.8
Demonstrating (laboratory-based practicals)	27	18.1
Both	27	18.1
<i>Previous experience (total: 153)</i>		
Yes	75	49.0
No	78	51.0
<i>Training received (total: 152)</i>		
Yes	85	55.9
No	67	44.1
<i>Career plans (total: 152)</i>		
Research & teaching	69	45.4
Research only	31	20.4
Teaching only	9	5.9
Other	14	9.2
Not sure	29	19.1

TABLE 4: Summary of responses to the inventory of Likert scale items in the survey (as percentages from a total of 153 responses).

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Missing
I have had adequate opportunity to gain experience of teaching whilst doing my research degree programme	0.7	7.8	10.5	44.4	28.1	8.5
I have been given adequate support and guidance for my teaching	2.0	17.6	22.2	44.4	5.2	8.5
I think the experience that I have gained through teaching has been a worthwhile aspect of my research degree programme	2.0	3.3	5.2	38.6	42.5	8.5
My PhD research has a beneficial effect on my teaching activities	2.6	8.5	23.5	39.9	17	85
My teaching has a beneficial effect on my research activities	2.6	9.2	25.5	42.5	11.8	8.5
Being involved in teaching has improved my own knowledge of the subject	0	7.8	7.8	43.1	32.7	8.5
My communication skills have improved through teaching	0.7	3.9	9.2	49.7	28.1	8.5
Teaching has challenged my understanding of the subject and made me think more deeply about the subject	3.3	8.5	14.4	45.8	19.6	8.5
My ability to transfer and apply my knowledge to other environments has improved through teaching	2.6	3.3	20.9	45.8	19	8.5
I think my teaching experience will be valuable for my future career	0.7	1.3	11.1	35.3	43.1	8.5
I have sufficient opportunities to have my say on how the course I teach on is run	20.9	24.8	23.4	14.4	7.2	9.2
The payment I receive for teaching accurately reflects the amount of time involved	12.4	24.2	20.3	27.5	7.2	8.5
My teaching load is manageable	2.0	3.3	14.4	62.7	9.2	8.5
The training I have received has adequately prepared me for teaching	4.6	18.3	30.1	34	3.3	9.8

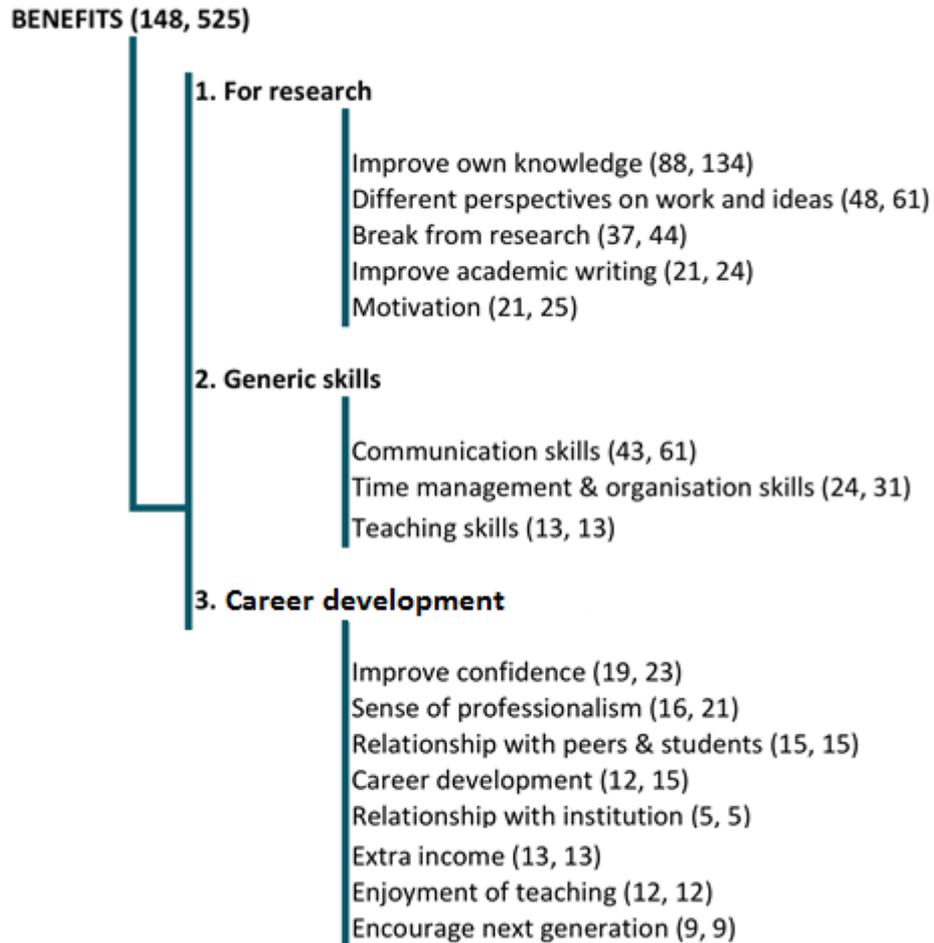


FIGURE 1: Emergent coding scheme for the benefits associated with teaching. Figures shown in brackets indicate the number of GTAs, followed by the number of statements, which contributed to each category.

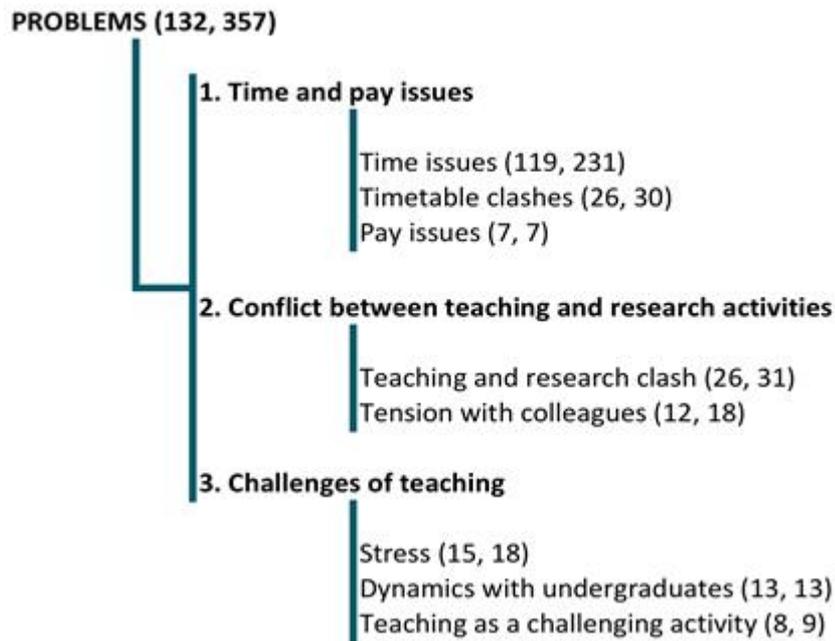
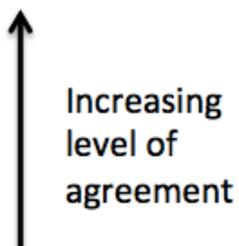


FIGURE 2: Emergent coding scheme for the problems associated with teaching.

School	N	Mean rank
Arts & Humanities	22	86.14
Humanities & Social Sciences	30	77.72
Technology	22	73.00
Biological Sciences	12	72.08
Physical Sciences	38	58.36
Clinical Medicine	15	54.33
<i>Total</i>	<i>139</i>	



 Increasing level of agreement

FIGURE 3: Mean rank scores for the item ‘My teaching has a beneficial effect on my research activities’ according to discipline.

School	N	Mean rank
Biological Sciences	12	87.79
Arts & Humanities	22	82.98
Humanities & Social Sciences	30	72.60
Clinical Medicine	15	71.60
Technology	22	68.39
Physical Sciences	38	55.12
<i>Total</i>	<i>139</i>	



Increasing level of agreement

FIGURE 4: Mean rank scores for the item ‘My PhD research has a beneficial effect on my teaching activities’ according to discipline.