

# On the shoulders of students?

## A bibliometric study of PhD students' contribution to the advancement of knowledge

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### Introduction

Graduate students are an important part of the academic workforce. In the Canadian province of Quebec, about 27,500 distinct students were enrolled in doctoral programs at some point in the province between 2000 and 2007, and about 8,500 graduated during the same period (GDEU database). Still, apart from a few micro-level bibliometric studies (Cursiefen & Altunbas, 1998; Lee, 2000) or surveys (Nettles & Millett, 2006), very little is known on graduate students' contribution of the creation of new knowledge. In order to shed light on this question, this paper presents the results of the first large-scale survey of PhD students' publication activity, using the whole population of PhD students enrolled in Quebec's universities between 2000 and 2007 (N=27,393). It provides a measure of the extent to which graduate students participate in the publication process during their studies and as well as the percentage of the province's paper to which they contributed. It also assesses the effect of this participation to papers on students' ulterior careers in research and degree completion.

### Method

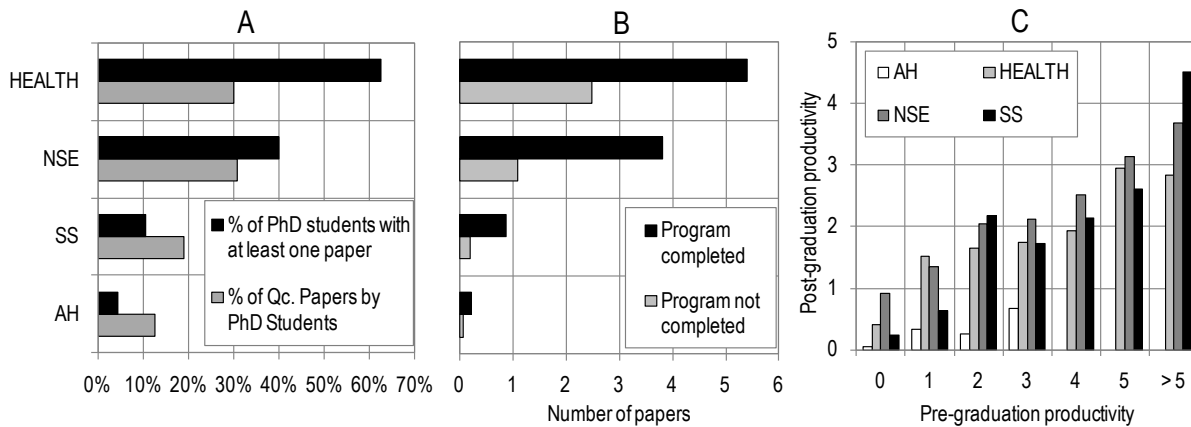
Papers authored by Quebec's PhD student were retrieved from Thomson Reuters' Web of Science (WoS) by matching the names of all of Quebec's PhD students with the names of authors of papers with at least one address from Quebec. False positives—i.e. papers authored by homographs—were removed using both manual validation and an algorithm.

### Results and Discussion

Figure 1A presents the percentage of Quebec's university papers to which at least one PhD student contributed as well as the percentage of PhD students who published at least one paper during their doctorate. It shows that 63% of PhD students in health and 40% of those in NSE have contributed to at least one paper during their doctorate. On the other hand, about 10% and 4% of students in SS and AH, respectively, have done so. The tendency is similar in terms of their overall proportion of the output of the province. Indeed, for both health and NSE, about 30% of all Quebec university papers have PhD students as authors or co-authors. On the other hand, a smaller proportion of the province's papers are authored by PhD students in SS (19%) and AH (13%). Several factors explain these differences, among which the different formats of doctoral theses (article-based vs. monograph) as well as research collaboration with faculty members are the most important.

Figure 1B presents the number of papers by doctoral students of the 2000-2002 cohorts, for those who completed their doctorate as well as those who had not completed it as of the end of 2007 (N=6,596). It clearly demonstrates that, in each of the disciplines, those who had completed their doctorate published a higher number of papers than those who had not completed the program.

These data provide strong evidence of the links between participation in research and degree completion. Indeed, an important aspect of the doctorate is to contribute to the advancement of scholarly knowledge in a discipline. It is thus normal that, by publishing papers—which are contributions to knowledge—doctoral students increase their chances of completing their doctoral degrees.



**Figure 1. A Percentage of Quebec's university papers co-authored by PhD students and percentage of PhD students who published at least one paper during their studies, B. Average number of papers by doctoral students having completed their program and by doctoral students that have not completed their program as of the end of 2007, for 2000-2002 cohorts (N=6,596), C. Relationship between pre-graduation productivity and post-graduation productivity, for the subset of doctoral students who graduated in 2003-2004 (N=2,319)**

Finally, Figure 1C shows that those who publish more during their doctorate are more likely to publish more afterwards. This is indisputably an effect of socialization and integration into research: students who are more involved in research during their doctorate are socialized to the publication *habitus* (Bourdieu, 1980) and keep it after graduation, when they themselves become members of the scientific community. This also suggests that those who have been involved in research during their doctorate are more likely to obtain research positions after graduation.

## Conclusion

Taken altogether, these figures show the essential role of doctoral students in the research system, as they also contribute to a considerable proportion of the new knowledge being created. Similarly, these original data also highlight the relationship between PhD students' socialization to research – as measured by their participation to peer-reviewed papers – and both degree completion and the likelihood of pursuing a career in research. By extension, the fact that the almost all PhD students' papers are authored with faculty members underlines the central place of research teams in reducing time to completion and increasing degree completion. Though no panacea can solve the problem of time to completion, our results show that a better integration of doctoral students into the collective dynamics of research yields better individual and collective results.

## References

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