

The PhD thesis by publication in Engineering: insights for supervisors

*Jane Moodie and Karen Hapgood.
Faculty of Engineering, Monash University
Corresponding Author Email: jane.moodie@monash.edu*

BACKGROUND

In the Faculty of Engineering at Monash University, the thesis by publication was introduced in 2004 as an alternative route to the PhD degree. Literature suggests that the thesis by publication may offer significant advantages to students and to supervisors, particularly in encouraging journal publications of the research and in facilitating the writing of the thesis. However, given that most Engineering supervisors have had little experience supervising research students undertaking a thesis by publication, there may be challenges that need to be considered.

PURPOSE

What are some of the important considerations for academics in supervising a successful thesis by publication?

DESIGN/METHOD

This paper is based on a review of literature on thesis by publication, and on critical reflection of the authors' experiences in their work with Engineering doctoral students undertaking both traditional PhDs and PhDs by Publication. One author reflects on her work in her role as academic advisor in the Faculty of Engineering working with numerous supervisors and their students writing theses by publication. The other reflects on some of the challenges of supervising her first thesis by publication.

RESULTS

A number of considerations in supervising a successful thesis by publication have been identified. The research project must lend itself to the thesis by publication. There are clear benefits to the student in research training in writing for publication, but careful planning is needed to manage the time-consuming demands of writing the high quality papers required. In addition, there are challenges in presenting the thesis as a coherent body of independent research work.

CONCLUSIONS

This study provides insights that can be used by supervisors to inform their supervision of students undertaking a thesis by publication. While there are a number of challenges that need to be carefully considered in undertaking a doctorate via this route, for some research projects and for some students the thesis by publication can be a valuable alternative to the traditional PhD thesis.

KEYWORDS

thesis by publication; doctoral supervision, Engineering, PhD

Introduction

The thesis by publication, where the thesis submitted includes papers that have been prepared or accepted for publication, was introduced as an alternative to the traditional PhD thesis in Australia in the late 1990s (Cuthbert and Spark, 2008). The thesis by publication is a new format rather than a new degree, but this new format may result in significant differences in the planning of the research and of the publications, and in the writing and eventual examination of the thesis. While supervisors are familiar with the demands of the traditional PhD thesis, they may not be so aware of the particular demands of the thesis by publication. For many Engineering supervisors, it will not be clear what benefits if any the thesis by publication provides.

The literature on thesis by publication has mainly focused on the introduction of this type of PhD thesis in the Humanities, Social Sciences and in Nursing (Francis et al, 2009; Robins and Kanowski, 2008; Brien, 2008). In these disciplines, typically PhD students write a traditional thesis, and then after submission, they write papers or other publications that report the outcomes of their research. However, for a range of reasons, many students fail to publish anything, resulting in lost opportunities to acquire valuable skills in writing and publishing papers, to strengthen their research from the external review of papers and to disseminate their findings quickly. In addition, without an established publication record, they may find it difficult to be competitive in the job market, particularly for entry level academic positions. Thus the thesis by publication with its focus on doctoral research publication seems to offer many significant advantages to students in these disciplines.

By contrast in medical and scientific disciplines including Engineering, most PhD students already publish papers during candidature. In these disciplines, there are well-established practices of joint publication, where students typically write papers co-authored with supervisors and sometimes others. Within these disciplines doctoral research publication is already the norm, but the thesis by publication may offer other benefits. With its stronger focus on publication, it may encourage better planning of the work resulting in additional publications, and since much of the writing has already been done in the papers, it may also facilitate the writing of the thesis.

Despite being offered in Australian universities for only ten years or so, the thesis by publication is already widely established in Medicine and the Health Sciences. For example more than half of PhD theses in the sciences at Macquarie University (Dowling et al, 2012) and in Medicine and Health Sciences at Monash University are now theses by publication. In Engineering at Monash, the number of theses in this format submitted each year is smaller, ranging between 10 - 20% of the 45 -70 PhD theses submitted. Most students still write a traditional thesis.

Given the small numbers of theses by publication since its introduction in Engineering at Monash University in 2004, most Engineering supervisors and candidates have little direct experience or knowledge of the thesis by publication. While some supervisors are enthusiastic about what a thesis by publication offers, others have expressed reservations about it. Most of the theses submitted have been successful at examination and in five of the last six years, the Engineering Faculty prize for the best thesis of the year has been awarded to a thesis by publication. However, there have also been a number of problems with examination of theses by publication which were difficult and time-consuming to address.

In order for supervisors to abandon the familiar traditional thesis in favour of the thesis by publication, they need to know what the potential benefits and drawbacks are of the thesis by publication, to have ways of addressing such drawbacks, and to understand when it might be

more appropriate for a student to choose to undertake a thesis by publication than a traditional thesis.

This paper presents a case study of the experience of an Engineering academic supervising her first PhD by publication. The experience of this supervisor is then generalised drawing on the experience of the first author in her work as an academic advisor assisting numerous Engineering students with planning and writing theses by publication.

Thesis by publication – a supervisor’s experience

My university brought in thesis by publication in parallel with a more traditional thesis. As it seemed to offer a way to gain a good publication record quickly, a number of the PhD students were keen to try it, including my student who was closest to submitting. Even early in candidature, the student was keen to publish as many papers as possible. In their first paper, the draft really described a series of experimental results without any real discussion and was not ready for publication. In addition the English required substantial grammatical editing to be coherent. This first paper was written for a conference using the student’s preliminary results but was written by me. Throughout the candidature, the student’s writing in their papers gradually improved. Later papers were written by the student but still required substantial re-drafting. In some cases I felt that I had written the entire paper, correcting and re-correcting each line, one at a time.

As the student progressed in their PhD and got closer to submission, the haste to publish more and more papers increased. The student initially misunderstood the faculty rules for the minimum number of papers in a thesis by publication, and the minimum authorship fraction required for each paper. They initially took the rules to mean that if the minimum number of papers was N , then if they wrote N papers they would have a PhD thesis and be awarded a PhD. We had discussions about how a thesis still needs to be a coherent body of work, far beyond N papers on a related topic. The student then wanted to try to turn every chunk of work into a paper, and to ensure that they were the first or major author to satisfy the minimum authorship requirements. In addition, the student did not understand that the papers alone were not enough for a thesis, and did not see the need for a broader discussion of the findings in the individual papers. The faculty guidelines did not emphasise enough the importance of a final paper or discussion chapter to bring the entire thesis together. Eventually the student understood that it was the quality and contribution of the work as a whole, not the quantity of published papers, and the thesis by publication was prepared without further issue.

I then began to contact potential examiners, to see if they would be interested and available to examine the thesis. I asked two well respected, mild mannered academic colleagues, and used the recommended email to inform them that this was a thesis by publication. I was surprised by their independent passionate responses. They each wrote back long emails, explaining that they did not want to examine this thesis because of the format, and detailing the reasons why they objected to this format and felt it was inferior. Their objections were essentially a) unclear authorship b) lack of a coherent structure compared to a traditional thesis, and c) the feeling of “rubber stamping” the thesis, since the papers are all already published and therefore there is little or no opportunity for comment and review. Their comments were all valid criticisms, and in part I agreed with them (although I felt less strongly about it!).

I did find two examiners who were more accepting of the format, and the thesis passed with minor amendments and the student was happy. Later on, when talking to the examiners on a separate matter, I thanked them for reviewing the thesis, and for being flexible with the format. Whilst they had examined PhDs by publication previously, particularly European PhD theses, they both said that they preferred the traditional format. Examiner A commented that

he thought that the final integrative discussion chapter was critical in making it a thesis, and commented that this chapter and the literature review chapters were also very helpful in establishing authorship. He said that the papers were clearly better written, indicating that I had had a major role in editing those sections. However, since the literature review and discussion chapters were not as well written (particularly grammatically), he could see that these were clearly the student's own work and that the quality of the ideas in these two chapters, combined with the research reported in the chapters with papers, clearly constituted a thesis. Examiner B commented that he had some suggestions about how to improve the analysis, but there was really no point in commenting since the work was already published, and so he did not mention these suggestions in his report. This means that the student missed a valuable opportunity for feedback and improvement of their research analysis skills. This is ultimately a very important part of research training. In part, they gained this feedback and opportunity to improve from the reviewers' comments when the papers were submitted to the journals. However the reviewers only ever read one paper, whereas the thesis examiners read the whole thesis and are in a position to make far broader suggestions about the entire body of work.

Overall, I think there are advantages and disadvantages to the thesis by publication. The advantages are the strong encouragement it gives to students to publish papers and to gain experience in writing papers as part of their research experience. As a result, more papers are published, and this benefits both student and supervisor. It provides an opportunity for external feedback from the reviewers on each section of the work. The thesis by publication also leads to many discussions about choosing which journal to submit to, the fact that not all journals are considered equal and research metrics. For students with poor language skills, it also helps reduce the time spent grammatically editing the writing in the final thesis as the papers go straight into the thesis.

The main disadvantages are that the student does not produce a single, coherent thesis story, and, since the earlier analysis is already published, misses the chance in the final thesis to reinterpret their earlier findings in light of their later ones. Their work is in effect "frozen" at the time it was submitted. The thesis by publication also muddies the water of authorship of the thesis more than usual, as supervisors have a much greater input into the paper writing process. When these papers are included in the thesis, it is not as clear whose work is presented. A UK style viva would compensate for this, but is not common in Australia. Finally, gaining copyright to include the papers in the thesis might also be an issue. For early career staff, encouraging students to submit a thesis by publication is a good way to build their track record as fast as possible, provided they can balance the quantity versus quality of papers with the student. For more established staff, the traditional thesis seems to work well unless the student's writing is not strong, and papers and then the thesis will need significant editing. I encourage most of my students to write a traditional thesis, although if I had a student whose project was suitable with clearly defined papers possible and who was keen to do a thesis by publication, I would consider it, provided they were not going to allow their research work to be driven solely by the need to publish papers.

Considerations for Engineering supervisors

This supervisor's experience highlights a number of important considerations for supervisors in advising a student to undertake a thesis by publication and in supervising the student once this decision is made. In the case study, the PhD by publication provided valuable opportunities for student learning, particularly in the development of skills for writing and publishing journal papers and of high level skills of analysis and synthesis as shown in the successful integrative discussion in the final thesis. The PhD by publication also resulted in challenges to the student and supervisor from the pressure to publish, from the communication of the thesis as a coherent body of work, and from the concerns of

examiners. In this section these considerations for supervisors will be discussed in more detail.

Suitability of the thesis by publication for the research project

Thesis by publication works well when each phase of the research is of sufficient substance and scale that it can be reported in highly ranked journals, or when the research falls into a number of closely related, often sequential, but essentially discrete studies. Ideally the work reported in each published paper should be equivalent to that reported in one chapter of a traditional thesis, rather than being part of a patchwork of short and perhaps lower quality papers.

However, the thesis by publication format does not lend itself to all projects. It may not be suitable for experimental research projects where each paper repeats, for example, reviews of the literature or descriptions of the experimental methods, which would cause unwanted repetition in a thesis by publication. A thesis by publication also might not be suitable for projects where there is significant collaboration in a large research group, since there would typically be many authors for each paper perhaps making the contribution of the student not substantial enough to meet guidelines. It may not be possible for projects based on long term data collection and analysis where the papers cannot be written until the end of the research thus making it difficult for these papers to be accepted and published in time to be included in the thesis. Finally, for some research projects, for example in some Electrical Engineering fields, the publications may be short letters that do not include much of the detail that needs to be included in the thesis. For such projects, a traditional thesis is usually more appropriate.

Thesis as a coherent body of work

Even though the thesis by publication includes a series of papers, it is still expected to form an integrated body of work, and to tell a cohesive story. However, it is easy for the student when focusing on completing the research work for one paper at a time to equate the research output to a number of papers, and to lose sight of the research project as a whole. Like the student in the case study, many students think of a thesis by publication as a compilation of the required number of papers. They ask what the minimum number of papers for a thesis is, rather than whether their papers together cover the work of the whole PhD. However, in writing the thesis, the student needs to demonstrate the overall significance and contribution of the collective work. This places particular importance on the writing of those parts of the thesis that frame the papers, in introductory, linking and concluding chapters, and in sections and chapters that include work that has not been published. In particular the student must present a convincing discussion that synthesises the findings of the individual papers, and conclusions that emphasise the contributions of the entire body of work. If the integrative discussion is not included in a final paper, then it should be included either as a chapter itself or as a significant part of the concluding chapter.

As in the case study, in our experience examiners often comment in their reports on the way students have, or have not, presented the thesis as a coherent body of work. Some of these comments are very positive; for example one examiner of a thesis by publication at Monash says “I was particularly convinced by the context and structure provided by the introduction and conclusion and the success with which these chapters tied the publication chapters together into a cohesive story.”

However, often comments emphasise that this coherence is lacking, as in another examiner’s suggestion: “the conclusions chapter should be strengthened to provide a unified conclusion to the thesis, rather than simply repeating the conclusions of a subset of the published papers.” Examiners may ask for additional sections or substantial rewriting to

provide this overarching argument, and perhaps because of the very nature of the thesis by publication where parts of this discussion have already been included in each of the papers, such revisions can be very difficult to make. Attention must be paid to the presentation of this argument, as examiners use it to assess the student's ability to conceptualise the research as a whole.

Pressure to publish

In a PhD by publication, there is considerable pressure to publish papers. The student may be tempted to publish parts of the work too early. Early papers may then lack sufficient analysis and be, in effect, little more than experimental reports. These papers cannot include the more mature thinking developed later in candidature and, unlike in the traditional thesis, there may be no opportunity for further discussion of these early findings in a thesis by publication. In the rush to achieve publications, later publications may also be published too quickly before more substantial analysis has been undertaken. This can mean the student misses the opportunity to explore the full significance of the work.

In addition, the pressure to publish may also drive the direction of the research. The student may take a narrow focus on work that will get results quickly and be publishable, rather than exploring interesting but perhaps riskier research paths that would have been possible in a traditional PhD but where publications are not assured. On the other hand, students often comment favourably on the beneficial effect of the push to publish. Reflecting on their experience of PhD by publication, many say that planning publications helped them to structure their work and to break up the research and the writing into manageable and achievable steps.

As in the case study, it is often a challenge to deal with the pressure to publish as many papers as possible at the expense of the quality of the papers. Care must be taken to manage this as too many papers may mean a loss of quality. However, this may also result in improved research training for the students, where they gain quite extensive experience in drafting, editing and reviewing papers. This experience may prepare them better for future writing for publication as independent researchers.

Substantial time and effort on writing papers

Writing high quality papers for publication is very demanding and time-consuming for students. As Brien (2008) states, "in terms of challenges, the PhD by Publication also puts increasing demands on candidates, especially in preparing work not just to the commonly required "publication standard", but actually for publication." It also puts greater demands on supervisors who need to devote substantial time and effort to assisting their students write the papers. This task can be made much more difficult if students have poor language skills and need additional assistance developing their research writing skills.

Getting papers published also takes time with significant differences in journal review and acceptance times. Some journals take a few weeks whilst others can take up to a year to complete the review of a paper. For papers that will be included in a thesis by publication, this difference may affect journal selection and so high quality journals with longer review times may have to be avoided.

However, for a thesis by publication, the time spent on writing and publishing papers is also time spent on writing the final thesis. With most of the work already published in journal papers that go straight into the thesis, the writing of a typical thesis by publication can be much less arduous than the writing of a traditional thesis.

Authorship

The supervisor in the case study describes her extensive involvement in the writing of the papers with her student, and her experience is shared by many supervisors. In Engineering, there are well-established practices of joint publication of papers co-authored by research students and their supervisors. Typically, the input of the supervisor in early papers is extensive, with the student as a novice researcher learning how to write, and then to publish, papers. Throughout candidature, the student progressively develops the skills of writing for publication and can usually assume more responsibility for the writing of later papers. However, since the writing in papers for highly ranked journals needs to meet exacting standards, it is generally accepted that the supervisor will almost always have substantial input into the writing of journal papers.

By contrast, the writing of the traditional thesis is seen to be the first independent work of a junior researcher. Some weaknesses in expression, grammar and argument are acceptable to examiners and supervisors, provided the research work is fundamentally sound. Typically supervisors as co-authors would have much greater involvement in the writing of the papers than in assisting students with the writing in the traditional thesis.

The thesis by publication is substantially constituted by the co-authored papers. This can lead to concerns, particularly of examiners, about how to assess the contribution of the student to both the research and the writing of the work. Examiners comment that they necessarily focus on the writing framing the included publications to assess the student's independent contribution. For example, one examiner of a Monash thesis reported using "the introduction and conclusion as evidence of the independent capabilities of the PhD candidate." This again highlights the importance of focusing attention on the quality of the writing in the framing argument of the thesis.

Examination of the thesis

A thesis by publication may be welcomed by some examiners. If the examiner views the inclusion of published papers favourably, then the task of examining the thesis may be more straightforward. The papers in the thesis have already undergone rigorous peer review and been accepted for publication, thus demonstrating the quality and relevance of the work. The examiner can concentrate on the research as a whole and on those parts of the thesis that have not yet been examined. One examiner of a Monash thesis commented that "since most of the results have already been vetted in the scientific review process, [...] I do not have any specific scientific comments. Instead I comment on the thesis as a body of work."

However, a thesis by publication may present difficulties for examiners. Examiners used to marking traditional theses may not be clear exactly what they are expected to do. For a traditional thesis, examiners say that an important part of the assessment is to make comments on the work to assist the student in further developing and improving it (Mullins and Kiley, 2002). For a thesis by publication, there is little point in commenting either constructively or critically on work that has already been published as no changes can be incorporated. Examiners may be uneasy with this changed role and may be left with the feeling of being asked to rubber stamp the thesis, as reported in the case study.

In the case study, the Engineering academics who refused to examine the thesis had serious objections to a thesis by publication. The eventual examiners also had some reservations about this thesis format. Such attitudes may change as more academics gain experience and knowledge of the thesis by publication, and perhaps as the role of examiners of theses by publication evolves. While examiners are usually directed to the university regulations governing the thesis by publication, it seems that more explicit

guidance is needed. Some universities provide this. The University of Canberra (The University of Canberra Gold Book, 2008) gives examiners direction about how to assess unpublished and published work in the thesis. For papers that are not already published, it is recommended that the examiners consider “whether the papers submitted in the thesis are of a standard suitable for immediate submission to a peer-reviewed journal”, while for accepted or published papers, the focus should be “only on the quality of the research therein and how the work fits into the broader context of the overall thesis”. At Monash, to ensure that the prospective examiner is prepared to examine a thesis by publication, the email to them explicitly states that the thesis for examination is a thesis by publication, and directs them to the university guidelines for this degree.

Conclusions

In this paper, we have examined some of the important considerations for Engineering academics in their supervision of students undertaking a thesis by publication. The thesis by publication as a doctoral degree in Engineering at Monash is in its early stages, and while some supervisors are advocates of this thesis format, it has yet to be widely adopted. Concerns expressed by academics, particularly in their role as examiners, include the challenges of clearly establishing the contribution and independent understanding of the student when the thesis is comprised of co-authored papers, and of presenting the thesis as a coherent body of work. However, it is clear that if careful consideration is given to the nature of the research undertaken, to the demands of publishing more high quality papers and of writing the thesis in this format, the thesis by publication can provide a valuable alternative to the traditional PhD.

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