
Doctoral Supervision in Water Engineering: A Case Study in Western Sydney University

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Abstract

Doctor of Philosophy (PhD) is the highest degree in academia. In PhD study, a student is trained so that he/she can become an independent researcher at the completion of the PhD degree. Many students enrolled in a PhD program has little understanding of conducting research and writing research papers. The supervisor of the PhD student has a significant role in transforming a doctoral student from a naïve researcher to a confident scholar. The research culture of the research group or university also plays a part in this process. The author of this paper presents his experience in the supervision of PhD students over the last 24 years in the field of water, environment and sustainability engineering. In this paper, he presents several key steps in the supervision of a PhD student. Some of his PhD students conducted research in water engineering at a distinguished level, which was demonstrated via publication in the top journals, receiving numerous citations and authoring chapters in national guideline called Australian Rainfall and Runoff (ARR). He also owns WSU's Vice Chancellor's Excellence Award in Higher Degree Research Supervision on two occasions. It is expected that this paper will be useful to new supervisors and PhD students to enhance their research skills.

Keywords: Research culture, sustainability, PhD students

1. INTRODUCTION

Doctoral supervision is a high-level teaching activity where a student gets the opportunity to learn from a subject-matter expert in a scholarly and interactive environment. Often, a doctoral student carries out research under a supervisory panel, which is headed by a Principal Supervisor or Chair Supervisor.

According to Polkinghorne et al. (2023) in the UK, a doctoral study focuses on a “single intensive research study” on a selected topic. They noted that a blend of support is needed for a student for development of research skills under a supervisory team. Masek and Alias (2020) noted that effective supervision has multiple definitions such as, “self-development, professional growth and career development” of the students being supervised. They also pointed out that doctoral study depends on research environment, student attitude and supervisor's experience.

There is a difference in the expectations, needs and working process of a student and a supervisor, which affects the outcomes of a doctoral study (Gill and Burnard, 2008). Richards and Fletcher (2020) stated that the doctoral supervision is based on ‘critical friendship’, where the main elements are: (a) maintaining a balance in assisting a student, (b) establishing a social relationship with a student, and (c) reducing control and make a student to struggle and learn. Löfström and Pyhältö (2020) highlighted the role of ethics in doctoral supervision by analysing data from 236 doctoral students. They found both

positive aspects such as “engagement” and “satisfaction” and negative issues such as “burnout” and attrition intentions”. They also noted that “autonomy” and “beneficence” are important for engagement and “fidelity, justice, and non-maleficence” are important for satisfaction.

Carless et al. (2024) discussed provision of feedback to doctoral students using data from twenty doctoral supervisors in Hong Kong. They noted that more authentic feedback on research by a student is obtained when a student presents his/her research in a conference or submit a good journal article. They also noted that a balance is to be maintained in assisting a student in addressing the comments by reviewers in publishing a journal article as this is the time when a student comprehends his/her research significance, limitations and opportunities.

This paper presents reflections of the first author who has supervised 29 PhD students in water engineering over the last 24 years to successful completion. He first presents his own experience as a PhD student and then he outlines his own reflection as a PhD supervisor.

2. JOURNEY AS A DOCTORAL STUDENT AND SUPERVISOR

The author was a PhD student at Monash University during July 1993 to Dec 1996. He was supervised by Professor Russell Mein, Professor Eric Laurenson and Mr Erwin Weinmann. Mein and Laurenson are well recognized in flood hydrology for their RORB model – the most widely used rainfall-runoff model in Australia. The author was also assisted by Dr Bryson Bates from CSIRO Land and Water, and Prof Rory Nathan, The University of Melbourne (who was working at Sinclair Knight Merz during author’s doctoral study). The author received the best supervision by group of experts who are highly reputed in engineering hydrology nationally and internationally. The author received an intellectually demanding research environment at Monash University which assisted him to become an independent researcher in water engineering.

The author took his first year of doctoral study to carry out literature review and defend his research proposal, second year to collate streamflow and catchment data from over 100 catchments using maps, websites and data handbook and conduct some preliminary data analysis and third year to carry out modelling and analysis in regional flood frequency analysis (RFFA) area. The last six months of his candidature were used to write the doctoral thesis. He initially struggled to learn Excel and FORTRAN program and scholarly writing. He could not publish any journal article during his candidature; however, he published two conference papers in National Hydrology and Water Resources (HWRS) symposium (Engineers Australia) during his candidature. Two journal articles were published based on his doctoral research after submission of the thesis and one of these papers were published in *Water Resources Research* – a reputed journal in water engineering area.

The experience of the author in his doctoral study has influenced his style of supervision (Rahman, 2018), e.g., high standard of research, high quality publications, interaction with the supervisory panel members and fellow students and a research culture where the student is not forced to do things rather to provide encouragement via tailored guidance and networking. He supervised 25 PhD students to completion as Principal Supervisor and another 4 PhD students as Co-supervisor during the last 24 years. Currently, he is supervising seven PhD students as Principal Supervisor.

3. STRATEGIES IN SUPERVISION

The author has adopted the following strategies in doctoral supervision:

- Thesis topic: The student is given a topic within a month of candidature, which is done in a meeting between the student and supervisor. Often, the student is given few topics to select one.

- **Milestones:** Milestones are set in the early stage of the candidature, which are revisited as the candidature of a student progresses.
- **Literature review:** A student is asked to write a review paper within the first six months, which allows the student to examine the relevant literatures in a critical manner and to be familiar with the key researchers in the subject area.
- **Data collation:** A student is asked to gather data either from an experiment or from the secondary sources. The obtained data is checked carefully to ensure consistency by both the student and supervisor.
- **Data analysis:** A student is asked to learn data analysis by Excel, R or Matlab or Python program. It is vital for a student to master data analysis and presentation style using high quality illustrations.
- **Scholarly writing:** A student is provided necessary guidance to learn scholarly writing from the very beginning of the candidature. Since many PhD students are from non-English speaking backgrounds, learning of research writing is a challenge to most of these students.
- **Feedback:** A feedback on written materials is provided as soon as possible with greater details. A hard copy commented file is generally provided to the student rather than a soft copy so that the student has to think/reflect during revision of the draft paper/thesis chapter as to why certain change has been recommended.
- **Linking students:** Students are linked with each other who are working in the similar field and also with former PhD students so that they can learn from each other.
- **Attending conference:** A student is encouraged to attend conference as this helps in networking with experts in the subject area and getting important feedback on the ongoing research tasks.
- **Journal publication:** A student is encouraged to publish two to five journal articles from the doctoral study. A paper outline is prepared at early stage and a target journal is selected. At least two key articles are identified in the subject area from the target journal to understand the standard of the proposed article. A thesis is compiled based on the published or submitted journal articles.

4. EVIDENCE OF SUCCESS

The author’s PhD students have succeeded in publishing high impact journal articles (mostly Q1) as can be seen in Table 1. The number of journal articles published by his doctoral students vary from 2 to 11 (average: 4.23). Some of these publications have received a good number of citations in Google Scholar: Ishak’s paper in Journal of Hydrology has received 203 citations, Omos’ paper in Water has received 198 citations, Haddad’s paper in Journal of Hydrology has received 181 citations, Aziz’s paper in Stochastic Environmental Research and Risk Assessment journal has received 157 citations and Zaman’s paper in Journal of Hydrology has received 134 citations (as on 1 Nov 2024). The author received WSU’s Best PhD Supervisor Award in 2015 and 2017 due to his outstanding supervision.

All the students completed PhDs in the author’s supervision have secured jobs and making significant contributions in their fields. Two of the students (Haddad and Loveridge) co-authored chapters in Australian Rainfall and Runoff (National Guide). One student (Haddad) co-developed a software with the author (ARR-RFFE software), which has been used thousands of times to estimate design floods in ungauged catchments in Australia.

Table 1. Few PhD students supervised by the author and their journal publications from their PhD study.

Student	Number of journal articles published	Q1	Other than Q1
Haddad	11	11	
Amos	6	6	
Haque	6	5	1
Loveridge	5	4	1
Van der Sterren	5	3	2
Zaman	4	3	1
Laz	4	3	
Mamoon	4	3	1
Yildirim	4	4	
Kuruppu	4	3	1
Zalnejhad	4	4	
Preeti	4	3	1
Ishak	3	3	
Aziz	3	3	
Hajani	3	3	
Ali (Sabrina)	2	1	1
Rahman (Ayesha)	2	2	
Caballero	2	2	

5. CHALLENGES

The author has faced number of challenges in supervising doctoral students in water engineering over the last 24 years: (i) Few students showed very slow progress in learning scholarly writing; (ii) Few students lost motivations towards the end of the candidature; and (iii) Few students were hesitant in addressing comments by the reviewers on the submitted journal articles. It was also challenging to edit a full thesis when it was not checked carefully by a student. The notion that supervisor will fix everything for the student puts a supervisor in pressure, which was the case for few students supervised by the author.

The author has supervised PhD students in diverse topics such as rainfall-runoff modelling, statistical hydrology, rainwater harvesting, microbiological quality of harvested rainwater, social hydrology, impact of climate change assessment, water sensitive urban design, rainfall estimation and water quality modelling. The author has to learn many new things during his supervision to guide students, which was often challenging.

The author found that few students needed little supervision where the student took the lead in completing the data analysis, paper and thesis writing. One the other hand, he found students wo needed too much supports at every stage of their doctoral study. He also found that the student who is more courageous in exploring ideas and does not depend too much on the supervisor does better in his/her doctoral study. In the area of statistical hydrology (the major research area of the author) two skills are vital for a student to succeed: programing skill and scholarly writing skill. A doctoral supervisor should be active in research/publication and should have strong networks with his/her peers nationally and internationally, which helps to find good examiners and reviewers of submitted journal articles. The author has examined over 30 PhD theses, which has assisted him in editing theses of his own students.

6. CONCLUSION

Doctoral supervision is an art which needs to be mastered over time. The author has presented his reflection as a doctoral supervisor in water engineering for over two decades in Western Sydney

University. Every student is different with different needs, and hence a supervisor needs to customize his/her supervision for each student to get the best outcomes as experienced by the author. The author has supervised 25 PhD students to successful completion during the last 24 years. His doctoral students have published widely in high impact journals and made significant contributions to the writing of national guideline (Australian Rainfall and Runoff). Overall, his supervision experience has been positive, with every student having a distinct intellectual journey, which was not always smooth. New doctoral supervisors should receive guidance from the senior supervisors in achieving the best outcomes from a doctoral study.

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