

# A Guide to PhD Research

by Prof Sean Gong  
Department of Computer Science  
Queen Mary & Westfield College

*This guide is aimed at those involved in PhD research into computing, but much of what is said here applies to all PhDs.*

## 1. What are the aims?

Although a successful PhD is commonly judged by one having (1) *completed a written PhD dissertation (the thesis)*, and (2) *successfully defended it in ones oral examination (the viva)*, it is usually not clear how these two objectives can be achieved within a given time (typically 3 years). *Where to start?*

The path to a successful PhD is necessarily a hard but rewarding process of *conscientiously* developing and mastering the **skills for independent research** and **leadership**. It is important that one must pay attention to the following basic skills:

1. **Formulate plans** to meet short-term and long-term goals, learn to **meet deadlines** under difficult circumstances (nothing is absolute, timing is the essence).
2. Be able to identify the **underlying reasons for changing** plans and goals of research. One must learn to tell the difference between goals and approaches taken and **not to be easily distracted** by the latter.
3. Learn to communicate by **formulating "a message"** through presentations and publications to which peers are interested in listening and reading.
4. Have **initiatives** to make a novel contribution to existing work.
5. Be able to **draw conclusions** from what one sets out to achieve (even from apparently negative results)!
6. Keen to learn **the skills to evaluate** peers work through reading groups, literature search, and publication reviews.
7. Keen and be able to **demonstrate** the importance of ones research to both expert and non-expert audience.

## 2. The role of a supervisor: Essential for making progress

1. Help a student to **define a small project** in the first year with a definite deadline, say before April of the second year (for September start). This will highlight problems in approach and if conducted to conclusion can lead to a conference paper.

2. **Establish a supervision committee** (typically the supervisor plus another two academic staff) at the beginning of first year in order to advise and review the student's progress throughout the following three years.
3. Make sure the student is familiar with the professional standards of published work by **suggesting at least one good PhD dissertation to read** and regular reading groups to attend.
4. Ensure that the student understands that original research can only come about after extensive review and analysis of existing work (published or otherwise), and requires dedicating time!
5. Help the student to write concisely and logically. Graphical illustrations can lead to dramatic improvements in the effectiveness of writing.
6. Ensure the student has a **professional attitude to research**:
  1. Present legible written work at mutually convenient deadlines.
  2. Attend **weekly supervision meetings** and research reading groups with notes on research in progress, methods attempted, and papers read.
  3. Treat research like a job and maintain average though flexible working hours (minimum 8hrs per working day).
7. **Encourage the student to give informal seminars** and "dry-runs" of conference presentations. Help the student to learn how to face criticism and acquire presentational skills.
8. Arrange **first year progress review** for the student with the supervision committee to make sure that the student who fails to make adequate progress by time of first year report (June-July) is encouraged to resubmit by September. Failure again will lead to termination of the PhD program.
9. **Encourage independence** after the first year and make sure a student is able to *set ones own goals and meet deadlines*. Help the student to understand underlying problems when one fails to meet deadlines.
10. Ensure that second and third year students help in the training of first year freshmen and that a student makes active contributions to research group activities, such as organising seminars and reading groups.
11. Encourage final year students to give group seminars before writing dissertation and to **help organise story line and the structure of ones thesis**.
12. Encourage a student to read as widely as possible outside ones discipline and to discuss ones research with friends and non-experts.

### 3. What is expected from a good PhD Student?

1. PhD dissertation of quality *on time* (3 years) and successfully defending the dissertation in the oral exam.
2. Average 1 *publication* in journals (e.g. IJCV, PAMI, IVC, CVIU or PR for computer vision) and 2-3 at conferences (e.g. ICCV, ECCV, BMVC, ACCV, FG or ICPR for computer vision).
3. Actively seek to meet and *express ones views* to experts in the field at workshops, seminars and visits.
4. Be able to *stimulate the supervisor* with novel findings and directions of new research.
5. Be *resourceful* and be able to benefit from peers in ideas, implementations, proposals or demonstrations (do not try to reinvent the wheels all the time)!
6. Keen and can *pass on* the research and knowledge to the next generation of research students.

#### 4. Writing up

A PhD dissertation must not be merely a record of all the work one has carried out over three years! It is essential to appreciate that a PhD thesis is *not a report of everything one has attempted and experimented*. It is about *formulating "a story" to convey a message(s)* that presents novel contribution(s) to the chosen field (*no matter how small the contributions may appear to be*). The dissertation should be structured to include:

1. Problem statement - Identification of unsolved problem and reason for solving it:
  1. The nature, purpose and motivation for the investigation should be clearly stated.
  2. The thesis approach and whether the aim(s) was substantially achieved should be made clear.
2. Background review (the context) - Status of research in direction of solution:
  1. The relevant background material and limitations of existing methods. The candidate must show that one has adequate knowledge of the subject and of the literature and can critically place ones work in a wider context.
  2. The literature survey should not be encyclopaedic and be more critical.
3. Find solutions - Development of ones own ideas and theoretical framework supported by mathematical analysis.
4. Demonstration of the solutions - Implementations, justifications for assumptions, evaluation and analysis of results.

5. Assess the suitability and limitation of ones solutions, evaluate the importance of the contribution (comparative evaluation against other methods, both analytical and experimental).
6. Directions and summary of future work.
7. Appendices (if any).
8. Bibliography.

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