Research Methodology

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Student-Supervisor Relationship

- Supervisor-Student relationship is a two way and long term relationship
- Supervisor will guide you in your Ph.D journey by redefining the problem, evaluating the technical details, refining the draft etc.
- Supervisor also can help you to overcome the stress which is very common in this journey
- In some institute (example IITs), the recommendation from Ph.D supervisor is madatary

Students as a Resource

- On the other hand, students are the resources for generating research papers for the supervisor
- So there might be some temptation to be overloaded with students
- However, the commitment to be a supervisor includes the responsibility for completion of a successful Ph.D of a student
- So supervisor needs to be careful before any commitment
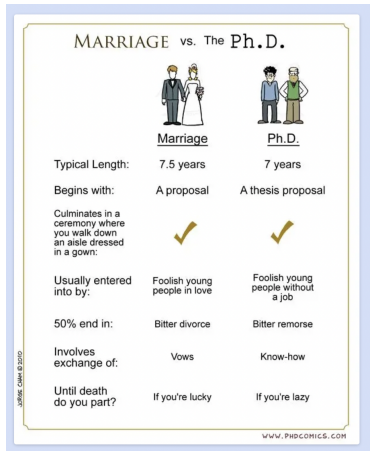
Figure: Marriage vs. Ph.D

Ref: Research Methodology, Prof. T. K. Ghosal, Jadavpur University, 2013

Ph.D Proposal

- Many institutes require that a formal proposal for PhD research be attached to the application for admission
- However, it may require if you apply abroad or for post doctoral application after Ph.D
- The Ph.D proposal in S&T typically contains
  - Statement of the research problem
  - A background of the problem (earlier work and why the proposed area is of current interest)
  - Elaboration of research problem
  - Proposed approach and Methodology
  - Facilities required
  - A rough time line (optional).

Stating The Research Problem

- So far the aspirant has probably selected only a broad research area.
- A further narrowing down and refining the problem are required.
- Having an experienced supervisor makes the above step easy; s/he may prescribe one.
- Often the supervisor would suggest only a tentative "Title".
- The title should have some descriptive aspect but should not be too restrictive; giving the student some flexibility.
- For example, "Study in the field of Quantum Cryptography" etc.

Stating The Research Problem Contd.

- In this phase the candidate should not worry too much about the wording–the title may be changed later.
- Unless it is a sponsored project, where more careful wording must be done at the beginning
- For the 'tentative title''
    - aspirant needs a preliminary literature search
    - needs discussion with the guide
    - initiates discussions with other more experienced members of the team (if there is any)
    - refine and elaborate the scope of the research

Ways to Find A Research Problem

- Starting from a few recent publications in the area of interest, the aspirant should ponder about the following types of questions
    - Can I refine/improve a definition?
    - Can I improve the theory?
    - Can I improve the experiment?
    - Can I broaden the circumstances in which the effect occurs?
    - Can I simulate this on the computer?
    - Can I improve the statistical analysis?

Ways to Find A Research Problem Contd.

- Stated otherwise, the aspirant would try to
  - Find a gap in existing knowledge
  - Find an exception to generally accepted laws/rules/concepts
  - Hybridize two existing theories/approaches
- The above is easier said than done.
- Nevertheless the aspirant must go through this difficult phase.
- Any effort put into this exercise would provide rich dividend later.
- Only after the guide gets convinced that you have done the "due diligence" and prepared a draft proposal, the guide would come to your rescue.

- The first utility of research proposal is
  - Sensitizing the aspirant about the problem during its preparation.
- The research proposal, however, would have to be used and reused often throughout the research life cycle with various revisions and augmentation.
- At any given point of time the proposal is the road map for the aspirant.
- It should be a constant companion, to be regularly perused and analysed to generate action points.
- During discussions with the guide, a hard copy of the proposal should be kept handy.

More about Research Problem

- As the aspirant progresses along the research path, the research proposal would be refined, detailed and redrafted.
- The "approach and methodology" section, which was rather sketchy at the beginning will gradually take a more concrete shape.
- At the end of approximately one year the aspirant may append the following sections (which also would undergo frequent revisions) to the proposal:
    - Tentative time line
    - Thesis outline (Chapter names)
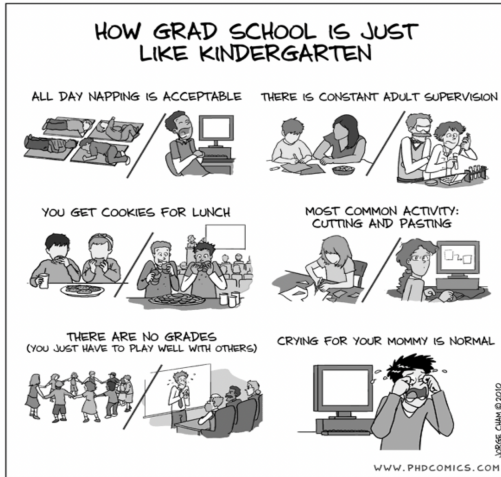   - Tentative conclusions

Figure: Kindergarten vs. Grad School

The importance of student–supervisor relationships

- The relationship between a research student and a supervisor is an important element towards success of the PhD project.
- Maintaining a cordial professional relationship is the minimum requirement.
- Students should strive to develop and nurture this relationship.
- Only highly unusual students successfully complete their research degrees if relationships with their supervisors are poor.
- The relationship will last for several years during the tenure of the project.
- Most often much beyond that.

- A research degree is about research training as well.
- The training is facilitated by a close professional relationship.
- There are two aspects of the relationship:
  1. Formal and administrative; with defined roles of students and supervisors
  2. interpersonal; which takes into account that both parties are human beings

Student–supervisor relationships is special

- The student–supervisor relationship is unique, often based on a mix of informal and formal aspects.
- The relationship between a PhD research student and her/his supervisor(s) is very different to that between the student and course instructor.
- The former is a long term relationship.
- The PhD student is more of an apprentice than a tutee.

- Facilitation
  - Pre-registration
  - During settling down
  - Mid-course help
  - During the final phase
  - Training in required research skills
- Provide continued guidance and academic support

Pre Registration Facilitation

- Help selecting/motivating students who are appropriately qualified and have research potential
- Help selecting topic
- Suggest alternative (more suitable) or additional guides
- Ensuring that the supervisory team has the expertise to supervise in the candidate's area of study
- Advise funding possibilities
- Sensitize the students regarding University Ph D rules and expected role of a PhD student
- Help framing the research proposal
- Getting the application processed by the University, i.e., by the Doctoral Committee

Facilitation During Setling Down

- Introduces with the co-students
- Helps to obtain laboratory facilities
- Convenes or chair the research advisory committee.
- Helps selection of coursework
- Advises to set up a time table
- May give some training assignments.
- Advises preferred modes of interaction
- Informs regarding availability of supervisor
    - Frequency
    - Preferred days and time

Mid Course Facilitation

- Facilitating resources and advising for literature survey.
- Shape, refine and readjust the topic and extent of research as it evolves.
- Assisting to keep the research on track
- Assisting to overcome academic problems associated with the research.
- Regularly review the progress of research and plan.
- Giving constructive feedback on the work in progress
- Fixing a schedule for students to produce written work on a regular basis and motivating them to stick to it
- Advising about framing research papers and preferred modes of communication.
- Reviewing manuscripts to be communicated.

- Advise regarding further actions and framing responses to reviewer's comments on communicated papers.
- Assisting students to prepare for formal progress reviews
- Reporting formally on their progress at specified intervals to appropriate bodies.
- Ensuring availability of adequate resources to support the research project and reviewing this regularly.
- Maintaining a professional relationship with the student and also with others in the supervisory team or advisory committee.
- Making alternative supervision in the event of long absence

Facilitation at the Final Phase

- Assistance in planning to complete the thesis
- Advising about the preferred organization and format of the thesis.
- Reviewing the thesis.
- Sensitize about the submission rules
- Assists to extend the registration, if required
- Advising students to acquire the skills which will help them to advance careers, either inside or outside academia.

Facilitation at the Final Phase Contd.

- Advising the doctoral committee on the choice of examiners
- Assisting the student with preparation for oral examination where applicable
- Arranging the thesis examination and the oral examination where appropriate
- In many countries, the supervisor himself is acting as an examiner
- In cases where thesis is referred for further work, assisting students to complete it within an institutionally defined time period

Facilitation in Training

- In the absence of formal training, the supervisor has to facilitate some remedial measures :
  1. Recommending course work in advanced topics
  2. A research methodology course with strong emphasis on assignment and group work
  3. Arranging regular and periodic colloquium/ seminar
  4. Supervised/evaluated Term papers.
  5. Recommending to work in a big research group (peer level training)

- Additional Facilitation
  - Deputing students to short courses and training programmes on required skills, examples;
    1. Creative writing
    2. Critical thinking
    3. Appropriate Software
- Facilitate Student initiated learning by recommending books and other resources

Roles and responsibilities of students

- Planning and discussing with the supervisor about the research topic and time-table for the research.
- Discussing with the supervisor the type of guidance and feedback that are most helpful, and agreeing a schedule of meetings.
- Taking the initiative in raising problems or difficulties, no matter how elementary they may seem.
- Taking the initiative in arranging meetings.
- Maintaining the progress of the work, in particular, in the form of a presentation of written materials for initial feedback and discussion before proceeding to the next stage.

- Taking care about necessary safety precautions.
- Drafting and circulating the agenda and supporting documents in advance of meetings, and drafting and circulating the minutes of meetings.
- Keeping systematic records of work completed, and providing written progress reports.
- Submitting all documents including the final version of the thesis to the supervisors for feedback before submission.
- Be aware of the fact that your supervisor(s) gets considerable time to evaluate the thesis.

Keeping in Touch with the Supervisor………..

How to keep touch with your supervisor

- It is desirable that the student maintain regular contact with the supervisor.
- Personal meeting is usually the most preferred form of interaction
- Other forms of possible interactions are:
    - Email (often encouraged)
    - Telephony (official line, land line, Mobile, if the guide allows)
    - sms
    - WhatsApp
    - Google Meet, Zoom call, WebEx etc.

- Depending on several things, a student may expect at least 8 personal meetings in a year
- Generally, for about 45 minutes
- There could be short informal meetings also, in between
- Quickly arranged meetings to sort out specific issues
- Pop-up meeting
- Even during coffee break, evening walk

Arranging meeting with supervisor(s)

- Formal meeting generally requires prior appointment.
  - helps both parties.
  - Undivided attention for longer period
  - Time of the supervisor is generally structured (Lectures, departmental meetings) and a suitable slot must be found.
- Arranging appointment:
  - Fixed schedule (often requires confirmation)
  - Agreed during the previous meeting
  - Through email, WhatsApp, sms
  - By phone (follow up after email)
  - Through the secretary/PA
- Special care is needed to arrange joint meetings with more than one supervisors.

- Before arranging the meeting, make sure that there is something worth discussing.
    - Some progress, some interesting result
    - Some detected anomalies
- If you are presenting some results make sure that these are thoroughly checked by you.
- Do not expect the supervisor to correct your manuscript during meeting.
- Instead, you may discuss about
    - The structure and outline of your paper
    - Important sections like conclusion and introduction

- The aspirant should keep a record of formal meetings and review the same in the next
  1. Take running notes.
  2. If more than one students are involved, each should take note
- The record may contain:
  1. The routine things like date, time, location, participants
  2. Review of objectives as agreed and documented in the previous meeting
  3. New results
  4. Suggestions/Advices by the supervisor
  5. Decisions made about future work plan
  6. Date, time and location of the next meeting if agreed

- Compared to personal meetings, email contact is the next preferred mode of interaction.
- Advances:
  1. No appointment or time synchrony required.
  2. May continue even when the two parties are at different geographic location.
  3. The sequence of emails forms a running record with date and no separate minutes needed.
  4. Student gets time to write and revise.
  5. More than one supervisors can be informed simultaneously.
  6. Automatic preservation of the documents

Interaction through emails contd.

- Advantages
  1. Improves writing skill of student.
  2. Helps shy students.
  3. Attachments may be sent

- Limitations:
  1. Cannot replace personal meeting.
  2. Body language cues are absent.
  3. Student has to take care of grammar and (sometimes) spelling.
  4. Possibility of wrong interpretation due to poor language constructs
  5. Dependance on internet connection
  6. Need to wait for mutual responses

- Nowadays, this is one of the essential part of your research life cycle
- Guidelines for such virtual interactions;
  1. All "attachments" should be described clearly in the body of the mail
  2. Different revised versions of attachments should have different names so that these are not overwritten
  3. Do not give extensive homework to the supervisor by email, unless the supervisor specifically asked for it
  4. For example, source code of your manuscript

- In majority of cases a supervisor would offer his feedback during a meeting or in response to an email.
- The quality of such feedback may vary widely.
  - too general or qualitative: Like:"good work", "carry on","you have to put more effort" etc.
  - Qualitative: "The result does not seem to be correct", "Why don't you try a few other cases?","We can publish this if you can provide a theoretical proof using measure theory," "You should investigate why your solution is converging very slowly."
- Progress of PhD research is crucially dependent on supervisory feedback.
- An aspirant should proactively seek specific feedback from the supervisor.

- If feedback and suggestions do not flow spontaneously, the aspirant should analyse possible reasons.
- Possible reasons for inadequate feedback:
  1. The supervisor is withholding comments till the student specifically asks for it (British politeness).
  2. The supervisor is temporarily overloaded and distracted.
  3. He may need time to provide a more specific comment.
  4. Statement, report or request from the student is so ill-formed or contains only subjective opinion that a feedback is not possible: e.g."I could not find any previous work on this topic", "I do not think the author understood what he was doing" etc.

Some suggestions to elicit specific feedback

- Present your findings in tables and graph, highlighting the significant part.
- Append your statement with a question: "this is what I got. Do you think it is plausible?", "how to find out if this result is ok?"
- Request elaboration: "could you be a bit more specific please?"
- Allow more time, wait for his response during the meeting.
- Leave the results so that supervisor gets more time to think about it.

Supervision by team

- What is team supervision?
- Often a research student would have more than one supervisors.
- This we call team supervision.
- Some universities may appoint a supervisory or advisory team along side the guide.
- It is expected that team supervision may provide extra protection to a student

Disadvantages

- Special problems with team supervision
- Possibility of inadequate coordination between supervisors leading to
    1. confusion in a student
    2. inconsistence monitoring of progress
    3. misunderstanding
    4. Difficulty in arranging meetings.
    5. Maintaining balance so that one guide does not feel neglected
    6. Increased delay in publication as the draft must be approved by both

- The styles and standards of supervisions tend to vary with institutions and individual supervision

- There are frightening number of poor supervisions but we would ignore the horror stories and concentrate on the acceptable ones :-)

- There are several possible styles of acceptable supervision, which includes.
  1. Laissez-Faire Style
  2. Algorithmic Style
  3. Spoon-Feed Style
  4. Hybrid Style

Laissez-Faire Style

- In the laissez-faire guidance style the guide provides little or no day to day direction
- Generally a broad description of the problem is all that is told at the beginning
- The student is given ample freedom to explore and come up with solutions
- An effective style
  - for creative, diligent and highly motivated students
  - For average student this style is not so suitable
  - In the early part of a Ph D project i makes the student insecure

Algorithmic Style

- The guide enforces that the student follow a life cycle prescribed by the guide as a strict regimen
- Usually cascade or short spiral life cycle model
- Deviations from the model is strongly discouraged
- Pros:
    - Easier tracking of progress
- Cons
    - May discourage creative individuals who may lose their interest
- In this style, the guide will prescribe the life cycle for a problem
- Students do only what is expected from them

Spoon-Feed Style

- Here the supervisor allocates a series of small assignments, usually sequentially, to the students
- Chalk out the path and/or revise the next agenda based on the results of previous assignments
- Supervisor takes responsibility of generating publications, by fitting the jig-saw puzzle, usually combining the work of two or more persons
- Cons:
    - The student miss the adventure, thrill of mysterious Ph.D journey
    - May discourage and de-motivate creative and advanced students
    - Sometimes the student suffers from lack of subject knowledge

Hybrid Style

- In the hybrid style of Guidance, elements of other styles are employed
- Fairly common
- Usually the best when performed properly
- Must be deliberate and well thought out
- Cons:
    - Some students get confused when a new paradigm is encountered
    - Some students may think that the supervisor is confused or incompetent, as some paradigms may be contradictory

Some points to be remembered

- Supervisors can change institutions, leaving you with some difficult decisions to make
- Dissatisfaction with the supervisory arrangements
- Can often be sorted out amicably and informally.
- May lead to a plea to change the supervisor
    - get to know the rules and procedures of university.
    - It may take a few months before a change of supervision would be possible.
    - The procedure would be painless if the current supervisor appreciates your difficulties and agree to the change.
- Where more serious issues of unprofessional conduct occur then the University complaints procedure is the best option
- When finding a new supervisor do not repeat previous mistakes

- Their goals:
    - Supervision generally does not entail monitory benefits
    - Clearly your supervisor's goal is not (directly) money
    - So what is motivating them?
    - Besides, professional advancement, this is "YOU" who will motivate your supervisor
    - You have to understand their skills on which you can bank upon
    - Similarly, you need to understand their hates
    - Their Limitations
    - Remember that they are not superman/super woman
    - Be understanding

Manipulating your supervisor

- Be positive; Your supervisor is more likely to want to help you
- Honestly inform about your
    - Scientific hurdles
    - Personal obstacles
- Work hard
- They will be more willing to work hard too
- Pamper them with
    - Internal research notes
    - Conference papers
    - Journal articles

- Surprise them by
  - Discovering exceptions and analogies
  - Finding interesting results
  - Proposing some theorems
  - Demonstrating that your knowledge has overtaken their's even if by epsilon
  - Make yourself invaluable and indispensable by
    - Reviewing papers
    - Helping to run conferences
    - Running the lab/group
    - Helping out the newbies

- Bypassing your supervisor
  - by making decisions without due consultation
  - communicating papers without taking prior permission from supervisor
- Accusing
  - Your supervisor for misdeeds
- Hiding
  - yourself
  - some findings
  - some information
- Ignoring
  - advice you don't understand; advice you don't like

9 ways to undermine your guide contd.

- Mixing
    - professional and personal relationship
- Gossiping
    - about your supervisor or colleagues behind their backs
- Denigrating
    - your supervisor, department or institution
- Assuming
    - what something meant; what you're entitled to do
- Sinning
    - Plagiarize, fake results