A simple note on research issues

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[This simple & basic note is for someone who has NO/little IDEA on how to initiate a research. It is based on my 15+ talks in Bangladesh, JP, and Malaysia.]

To initiate a research project, you may follow the points:

- Research is systematic.
- Understand the nature of problem to be studied & identify the related area of knowledge.
- Review related literature to understand how others have approached or dealt with the problem.
- **Selecting and Defining the problem is the MOST DIFFICULT and important part of research.** Few steps in reviewing literature:
  1. Define your **idea** in as **general terms** as possible by using general sources: e.g., newspapers, popular periodicals & [**e-**]magazines (e.g., IEEE Spectrum) – *e.g., traffic accident problem, health issues, food processing problem.*
  2. Search through the secondary sources (e.g., books on specific subjects & reviews/**surveys [from experts, published in top journals]**). *How others are solving traffic accidents.*
  3. Search through the primary/base sources (original reports of the original work/experience. E.g., journals, proceedings, abstracts, scholarly books, etc.) – *e.g., how others are solving traffic accidents with proven methods.*
  4. **Compile a list of keywords and terms** related to the research problem.
  5. **Discuss** the research problem with specialists and/or colleagues for help in finding sources of better literature. http://wikipedia.com is a source but not perfectly-academic! Use http://thefreedictionary.com to get different meanings of words.
- Then, Propose/Develop/Experiment/Collect-data in an organized and controlled manner to arrive at valid decisions.
- Collect/produce data through experiments/survey. Do on real-life data, or simulated/artificial data.
- Need to work on extensive & diverse ranges of data. E.g., if you work on datasets for human face recognition, try to consider more [but don't try all at a time though]: e.g., front face, inclined face, less light, more light, clear image, noisy image, etc.
- Need detailed ANALYSIS of the results - not just writing the findings.
- Draw some valid conclusions.
- **Generalize** the findings/results in different settings: e.g.,
  - Where/why/how it fits
  - Where/why/how it fails
  - Find constraints/limits
  - Study on diverse & extensive datasets/samples/…
  - Find genuine future scopes
- Finally, **write down the research report** … with proper citations/bibliography
  - as a journal/transactions manuscript/paper (usually in …8/10/16/+ pages);
  - as thesis/book format;
  - as a conference/workshop proceedings paper (usually ~4 to 8/10 pages);
  - as an extended abstract of the work (~2 pages);
  - as a concise abstract of the work (in 150/200 words)

#Problem to get research papers?

Most of the journals or conf. proceedings are not Open-Source. **Pay/subscribe** to download! It is difficult for developing countries. How to get **free papers**?

- Google search topics/title. If you get related PDFs – fine!
- Else, you can see free ABSTRACT. Read it. If you need it – search again with 'TITLE' of the paper.
- No? – then find websites of the authors [they may upload the PDF]
- No? – then find emails of the authors & email with subject: "Need your paper: 'Paper title…'"
- There are some websites to get e-books & papers *illegally*! I can't promote these.

• Write to org./inst. that may have an interest in the research problem.

• From the survey of primary sources, contact any related researchers to help you. Engage in **collaborative researches / discussions** with experts – not difficult if you try positively & smartly [at least, email/Skype-based advice, comments are common]. Find the experts in many universities in your country [e.g., there are ~150 univs in BD. Break the barriers of non-cooperation/egoism 😉].

#Limit the Problem Area: The problem should be small enough and sufficiently specific for adequate treatment and competent analysis. Articles/papers often suggest recommendations on future research work [*read* Discussions / Analysis / Conclusions] **[PLAN as per TIME & CAPACITY]**

#Think differently! Need Brain-storming

- Be alert to research approaches, which may have been overlooked.
- Learn from shortcomings/limitations of other methods.
- Try an approach in another perspective.
- Think about the universe & its creatures – how it works, how an animal moves or eats or jumps [e.g., monkey robot, spider robot, etc.]

#Find problems/demands of the community & then think. E.g.,

- Workers die in water-tank. Develop a robot or mechanism to assess the toxic-level before a worker is going inside the tank.
- Farmers need automation, use of ICT.
- ICT-based health service for poor or rural areas.
- Food-processing, preserving milk/fish during summer to keep longer [no formalin approach]
- Mobile apps. – what people need? 'People' does not mean who are in the city. Main-Dhaka or financially-rich people is not Bangladesh...
- Newspapers, magazines and non-technical articles may contain unique problem areas that have not yet been researched!

#Need interactions – through?

- Conferences, meetings, workshops and courses.
- Don't miss chances to attend lectures/talks all over BD – even if not directly related. At the upper-level, many areas are related (e.g., biological image processing – biology & programming, bioinformatics, etc.).
- Informal discussions with colleagues and other interested members.
- Convert your **আড্ডা** into academic **brain-storming sessions.**

Plan to change the world by solving some core problems.

#Interest: Need more in-depth study.

- Problems are big – so, reduce it into a **smaller** & manageable research
- Budget: Make a simple budget & search for funding sources [Google can help]. Ask your parents or rich relatives to fund you. Engage your money & best-efforts on more academic activities.
- Know **your capabilities** and limitations
- Need a **supervisor** [at least during the PLANNING phase]
- **Uniqueness** - no repetitions of other works – try to change/modify/upgrade/experiment - a liiiiiiiiiiiiittle bit *at least*

#Experiments:

•Do expt. as much as possible – need diverse experiments in different situations/conditions.
•Even it fails – ensure to make experiments on different cases.
•E.g., a **line-follower robot** may walk on smooth path. But?

- What about on grass? On sandy path? On concrete roads?
- On slippery path? On darker area? On occluded path?
- On zigzag path? On muddy path? Upward directions?
- Downward directions? …

#Need to analyze – in-depth – *considering*

- Where it works well & WHY,
- Where it fails & WHY,
- What are the boundaries,
- Show experimental proofs,
- Where it may work upon some improvements [that you could not try]
- Need mathematical/statistical analysis/tools for investigation
- Need comparative results/analysis with other state-of-the-art works

- Running-time or complexity?
- Cost? Realistic? Implementable?
- Be concrete on your findings & conclusions.

#Bad Research?

- Looking for something when it simply is not to be found.
- BIIIGGGG NOOOOOOOOO to plagiarizing/copying other people's work.
- Self-plagiarism is new to many people - it means publishing the same item to more than one copyrighted books/journals.
- Plagiarism / **নকল**?: Refer properly – do not just copy & paste. Rephrase anything and must provide references of the sources.
- Falsifying data to prove a point is wrong.
- Misrepresenting information & misleading participants must be avoided.

#Good Journals?

- Scientific Citation Index (**SCI/SCIE**)-indexed journals, **SCOPUS**-indexed journals, **PubMed**, etc.
- **Impact Factor** (IF) is important but IF only from SCIE journals. Be careful about most of the paid online journals. No benefits to publish in crap journals! Few fake journals show their fake-ImpactFactor, fake indexing! Take care.
- Online journals are okay - if it is from trusted publishers. Even 'nature' has online journal, e.g., Scientific Reports. IEEE has online journal, e.g., IEEE Access.
- **Special Issue:** in reputed journals are good to publish related papers quickly.
- On conference, see the committee, lists of academic sponsors/co-sponsors/technical-co-sponsors, etc.

So, in short:

- You need a Supervisor who will guide you - s/he should be an expert on the topic you want to explore.
- You need to have some sorts of research facilities related to the work areas.
- Read related works from related top journals and conference proceedings - to know where the progress are, what challenges ahead to solve, etc.
- Based on your study, fix one or two core challenges, try for their solutions, engage trial and error n strife well with background knowledge...
- Good or average results?: Based on the environment, time you give [e.g., 4th yr Bachelor student may get 12/6 months, Masters student may get 1/2 yrs, PhD students get 3/4 years, etc.]. Some works need teamwork.
- Research is not difficult at all - just need plan-wise concentrated relentless efforts.

Again, you need to find a supervisor to guide you and do not over-think on a topic, rather gain knowledge on related areas and concentrate on a topic... Follow, research ethics. There are lots of guidelines - Google and get. Or, buy good books by good writers on research methodology. Note that, research methodologies and strategies for social science or arts - may be significantly different than science/engineering topics... though, structures are more or less the same.

Give your best-efforts locally – before you explore!

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Plan to submit & attend: 8th ICIEV & 3rd IVPR