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GUEST EDITORIAL

Why not be an early-bird researcher?

A casual appraisal of our higher education system as prevailing in the country's thousands of colleges and hundreds of conventional universities, clearly reveals that research, at the level of students, is considered to be carried out by 'research scholars', that is, Ph D students. Occasionally, some Master's degree programmes do include a 'dissertation' or a 'project', usually as option to a theory paper. Further down, in India, science undergraduates are generally required only to attend lectures, absorb textbooks and write exams.

Some may suggest that the situation is changing now, but many would be skeptical. Thus an individual can either blame the conditions and excuse himself/herself or propel his/her way out. The latter needs massive motivation and effort.

It is easier to propel, when one understands that it is the only viable option. Excuses can best lead to dormancy. To propel, one needs to contemplate the existence of these excuses. We did that for ourselves and feel many of our peers would be able to relate to the exercise. Let us assume that half of me is making excuses as to why I am not doing my own research and the other half is trying to debunk them:

[I am not cut-out to be a researcher.]

Researchers are intelligent.

As children, we all are curious about everything in our surroundings. It is just that this curiosity fades with time. Those who retain this child-like sense of wonder, often become researchers. These people are not necessarily geniuses, but simply curious and skeptical. They have climbed the learning curve and jumped off the wall of self-doubt. The only way I can also do that is by asking questions and answering them by experimentation (aka doing 'research'). Just try.

[But I cannot ask big research questions.]

Research has to be big.

Research seems big because it reveals something new, but it may not necessarily impact society directly. Asking small questions can be a good start for the beginners. Experiments may fail, but often without me knowing, I will have learnt what kind of questions to ask, how to design an experiment, analyse the data, and interpret the results. Remember, there is nothing called a stupid question in science. In fact, some amount of stupidity is necessary. At this stage, my research work is more important to me than to the world. It is a part of the training process and would allow me to work on better problems later.

[But I want to become a teacher, not a researcher.]

I do not need to do research.

Yes, I do not need to do research, but what if I myself, as a teacher in the future, do not know how to do research? I will not be able to make my students realize how a piece of knowledge was generated. So, whether I want to be a teacher or not, I need to learn how to think through concepts and not just remember them.

[But I study in a non-research college, we are not encouraged to do research.]

Ours is a teaching-oriented college.

My teachers do not know how to do research. Perhaps, they also thought the way I am thinking, when they were students. I enjoy the lectures by that teacher of mine who knows about scientific inquiry and provokes me to think, among others. I am curious, so I can learn a lot about research on-line and by visiting the nearby research laboratories. If I become like him/her, I will be able to inculcate that enthusiasm and skepticism in my students early on.

[But we do not have good teachers and equipment.]

We lack resources

I can always learn the concepts through OpenCourseWare on the internet. What is important is, can I ask questions independent of what is already known and find answers – *my* way? Yes, there may not be any immediate benefits, but I will experience the excitement of the person who first found it. Feynman, a famous theoretical physicist, for example, did some simple experiments on ant behaviour which inspired different people and led to many papers. There was no fancy equipment involved there, but it made a big impact. So experimenting is not always about equipment. If the equipment is really necessary to pursue my question, I can explore and visit nearby laboratories.

[But I do not have any local role model.]

None of my college seniors I know did any research.

My choice of studying science was influenced by the fact that many of my school seniors that I was in touch with pursued science in their undergraduate studies. Now, none of my college seniors are into research-related careers. I may likely do better in non-research careers because I can seek better guidance from my seniors. But then, what about the first batch of students? They never had any seniors, but are doing well, wherever they are. So, why can I not be like them? Once I experience my way, at least my juniors will have a senior to guide them.

[But then, I am too busy with my studies.]

I do not have time.

Teachers have a similar complaint – we have to cover the syllabus within the semester; if we include research we might lag behind. But what is the point in learning only for exams, if I am not motivated to think? First, it is not true that teachers do not have time for research. There are several examples of teachers from undergraduate colleges carrying out excellent research. Second, teaching can be designed in such a way that it stimulates students to ask questions. Students should be rewarded for asking questions and trying to figure out the answers themselves, rather than for topping an exam. Give us creative assignments rather than copy – paste ones; reward us for being unique in thinking. Moreover, there is always time to think. Once I get addicted to the joy of finding answers myself, there will be no time for boring assignments.

[But I will do research during my Ph D training, why now?]

I am still an undergraduate.

I should be focusing on scoring well in courses and understanding more concepts. But, there is no boundary between understanding concepts and doing research. Even veterans do not know all concepts inside or outside their field. I can get through many concepts while I am working on a problem. Sometimes, not knowing too many concepts can be good. I may be able to think in novel ways. The great ecologist, Robert MacArthur, once said: 'One can either keep up with the literature or contribute to it.'

[But how can I start from scratch?]

I do not know where to start.

If there is a culture of research in a college, several ongoing studies may give me an idea about where to start. Also, the role of teachers/mentors becomes important here to stimulate students to raise questions and to lead them to a start. But I can start myself by asking questions and being skeptical. Sometimes reading relevant literature might give me ideas. I can integrate concepts, learn to design experiments, analyse data and use interdisciplinary approaches. If I find out anything interesting, I can even write the results for publication. I can learn to write scientific articles by reading papers and observing how ideas are threaded. Of course, there are many on-line tips for writing well.

[Hmm. I think I can. But I am not creative.]

I am not original enough.

Asking questions is a skill; not learnt in one day. So I need to practice. I can observe a phenomenon repeatedly. Then note down all questions I can think of. At this stage, I will not judge them. I will just list them. Sleep on the list. Forget about it. Come back to it. And can I list more questions? This exercise might lead to one or two questions that could be novel. Often our brain does not like uncertainty, so we just try to explain vaguely and leave it at that. But I should learn to work against it, be comfortable with uncertainty and try to experiment and explain, rather than just making up a story to explain. Once I do an experiment, more questions pop out and the quest continues.

Thus, the excuses are debunked.

Starting early, could help you figure out where your interests lie and what you are good at. It could give you a sense of pride and responsibility when you work on your own questions. Be an apprentice, observe how scientists ask questions, identify problems, propose projects and feel the ownership of your project.

It is encouraging that several premier institutions in India have now made research compulsory for the Master's degree students. Institutions that run 5-year integrated or dual degree Master's programmes are laying emphasis on undergraduate research. The science Academies of India award hundreds of summer fellowships, mostly to the undergraduate students, to work for a period of two months with established scientists. Several students have come out with international standard publications because of these summer assignments, and most have not only learnt how to do science, but have developed an excitement about science that will stimulate them throughout their careers. You may not be lucky getting any of these, but again, that cannot be an excuse.

Let us ask you something. Do you not travel on poor roads? Yes, you do. So, why not do your own research in a non-research environment? Why not make a small start? Why not be an early-bird researcher?

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