PERSONAL REFLECTIONS OF A 1ST YEAR POSTGRADUATE STUDENT

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ABSTRACT

Undertaking a postgraduate research degree can be a very exciting and daunting experience. The aim of this paper is to relate some of the experiences and reflections of a first year postgraduate engineering student. There have been other articles written on the PhD experience, however I believe that this paper offers insights into the industry based project experience, the benefits and drawbacks of multiple supervisors, and it offers the perspective of a student on an early point of the postgraduate learning curve.

INTRODUCTION

The transition from secondary school to university is a major change; supports are in place, however, to make this transition as smooth as possible. Like school, the undergraduate syllabus is very structured, mainly exam based, and timetabled; generally, if the student puts in the work and makes use of any required support facilities, good results can be expected. The change from undergraduate to postgraduate study is very different, armed with a project proposal, a supervisor or two (sometimes more), and research funding the enthusiastic postgraduate embarks on three years (hopefully) of cutting edge, exciting research, well how difficult can it be?
To put this paper in context, I am a mature, first year postgraduate engineering student in Dublin City University (DCU), I am funded by IRCSET and my research is industry based. My research project involves plant energy characterisation and optimisation. Although the research funding may not fill the coffers, I personally believe that getting funded for interesting research is a privilege.

Embarking on the PhD/Research postgraduate experience can be intimidating; thankfully there are several sources of sound advice. The website Find a PhD.com contains many helpful articles which aim to assist the new postgraduate student [1]. These articles include advice on thesis writing, the expectations of a PhD supervisor in computer science, and in general, several PhD survival tips. One of these articles, "Learning to Survive the Ordeals of writing a PhD" discusses the challenges of a mature student and parent writing a thesis in the social sciences field. There are also books on the market, such as *How to Get a PhD* [2]. Another interesting study was a survey of 2,000 doctoral students that was carried out in the United States in 1989; this research formed the basis of several subsequent articles and offers interesting and valid insights into the world of the postgraduate research student [1].

The objective of this engineering education paper is to relate some of the personal experiences and reflections of a first year postgraduate student. It is very much a personal reflection on the first ten months of research, but hopefully, it may highlight some of the difficulties associated with the transition to fourth level study to supervisors, and give heart to other first year

postgraduates going through the transition. There are three main headings, first I discuss some of the differences between undergraduate and postgraduate study. Second, the paper discusses the 'supervisory management' element. Third, I reflect upon some of the specific benefits and challenges of an industry based research project. Essentially, the goal of this paper is discuss the main differences between postgraduate and undergraduate study, and also to discuss some key differences between academic and industry based projects.

UNDERGRADUATE vs POSTGRADUATE STUDY

What are the main differences between undergraduate and postgraduate study? Success in both requires self-motivation, discipline, a good work ethic and time management. There are key differences, however; in undergraduate study the course is mapped out, the examinable syllabus is provided in books/notes, past exam questions are available, and practice questions are carried out in tutorials. Generally, the expectations of the lecturers are relatively clear and are reflected in the end of semester exam (although this can vary from lecturer to lecturer). Research is very different, the postgraduate research project may not have a pre-determined structure, and this is both good and bad. This structural flexibility enables the student to work at suitable times maximising concentration and effectiveness; flexibility is a godsend for me as a parent trying to maintain a work/life balance. The lack of structure can have a downside, placing the onus firmly on the student to put in the hours and manage the project successfully. Although the project short and long-term goals are usually determined in conjunction with supervisors, the student is largely responsible for planning and organising their own workload.

There is also a difference in the social aspect of postgraduate study, it can take a while to settle into undergraduate study, but attending classes, labs and tutorials with fellow students makes getting to know people a bit easier. In the postgraduate's case, there generally isn't the same interaction with other postgraduate students. The postgraduate office is generally hushed with solitary students tapping away on PCs, and there isn't the same banter that goes along with hanging round before lectures and labs. It takes longer to get to know people and there definitely isn't the same downtime that goes along with undergraduate life. However, when postgraduates do get a chance to talk, the discussion (among other things) of people's research projects and their associated snags and successes can be very heartening and keeps everyone else going. Organising social interaction time outside the working day can really help to motivate and encourage postgraduate students, leading to sharing of experiences and ideas.

Managing a research project can be really exciting, involving new learning and interesting ideas, however, it is not easy learning to collate the huge influx of information in year one. Although honours engineering degree typically courses have a high academic and theoretical content, the new postgraduate is often not prepared for the academic rigour that is expected in fourth level study. Project proposal in hand, the first step is to carry out a comprehensive literature survey. Depending on the level of previous research carried out in one's area, it can sometimes be difficult to know where to begin looking for relevant information. Identifying key books, journals and trade magazines early on makes life much easier. In my experience, there were very few relevant academic articles at the start of my research; it was only when delving deeper into a more specific research area that the research field opened up. Initially, it can be difficult to ascertain what information is relevant and what is not, the hardest thing I found about embarking on the first year was the self doubt and all the 'enough questions':

- Is the quality of my work good enough?

- Am I intelligent enough to do research?
- Have I really understood and critically evaluated that paper thoroughly enough?
- Where does this paper fit into my research?
- Have I read enough papers, have I missed some key papers?
- There is too much information out there.
- There is too little information out there.

However, as the research field becomes more familiar, and both experience and confidence grow, the literature surveying becomes more straightforward. Writing a first paper (in columns and very academic looking) is great, but also quite daunting, thankfully help was at hand. Aside from the help given by my academic supervisors, Dublin City University (DCU) offers a course in Research Methodologies to taught masters and research postgraduate students. This course was really useful; engineering undergraduate projects can tend to be quite practical, often the extensive and critical literary survey is not required. The DCU course thoroughly covered aspects of literature searching, managing references, critically evaluating publications, writing journal papers/theses, and statistical evaluation methods.

Progress evaluation is another key area that is very different between taught courses and research courses. Again, this leads to the constant questioning of whether one's work is good enough. Supervisory guidance and feedback is essential to setting the quality standard for written work. In fairness to supervisors, certain quality levels are expected and supervisors shouldn't have to correct shoddy work. However supervisors should be aware that the average postgraduate student may not have much experience submitting work for outside peer review, and as yet may not possess the academic argument and rhetorical skills of our elders.

The postgraduate tutoring or lab demonstration requirements, expected by universities, offer invaluable teaching and communication skills experience. The undergraduate student interaction is great and I found it really enjoyable; trying to explain concepts and methods clearly to others is a great indicator of how well one understands the particular subject material. For my particular scholarship funding, the maximum extra-research work allowed is six hours per week. In my case, teaching requirements including revising the material, preparing solutions and/or correcting work began to impinge on research project time. This was discussed with my academic supervisors and following their intervention, my workload balanced out in the second semester. It is also a good idea, in my opinion, to match tutors to their interests and aptitudes. A tutor that has no interest in, or understanding of, a particular subject is not in the best position to explain complex ideas to others.

The schedule of the postgraduate project differs from the semester/term based academic year. In undergraduate study, there is the battle to keep up with all the many continuous assessment assignments during term time. Then there is a study break for exam revision, followed by exams and another break – i.e. there always seems to be light at the end of the tunnel. Study pressure and the workload can be frantic, but they are finite. Postgraduate study can sometimes feel never-ending and overbearing, particularly if things hit a dodgy patch. Unlike a lot of nine to five full-time jobs, it is not all that easy to switch off from research. Combined with the self doubt and the worry of not actually coming up with something novel, in first year the long term research outlook can be stressful.

SUPERVISORS ROLE

According to the DCU postgraduate research regulations, the responsibilities of the supervisor(s) shall be [3]:

- to advise the student on the selection of the research topic and the nature and quality of the programme of research to be undertaken;
- to ensure that the student acquires training in the methodology of research and scholarship and in the skills necessary for sustained independent effort;
- to provide contact and guidance through regular and systematic meetings; to request regular written submissions as appropriate and to provide constructive evaluation and criticism in reasonable time;
- to ensure that the student is made aware of any inadequacies of progress or standards below that expected for the degree registered and where necessary, to advise on withdrawal from the programme;
- to liaise with the external supervisor of the co-operating establishment;
- to advise on the methodology and form of presentation of the thesis and its subsequent examination;
- to advise the Registry, through the submission of annual written reports, of the candidate's progress. These reports should include details of the frequency of contact maintained with the candidate and an appraisal of the progress of the work to date.

These are the regulations, but how does the supervisor – student relationship work in real life? Are these regulations adequate for the needs of the novice postgraduate student? Here are some of my musings on the nature of supervision. The postgraduate student is responsible for the success of his/her research project, having said this; the supervisors' role also has a huge effect on the project outcome. An interested supervisor can make a research project immensely more rewarding and enjoyable. From the students' perspective, there is a big difference between the supervisor that keeps abreast of students' research work and shows an interest in it, and the supervisor that is merely making up the research numbers. The same applies to the supervisors' perspective, supervisors expect their students to show initiative, be interested in their project, and to be responsible for the quality of produced work. Expectations need to be articulated and managed on both sides, in the 1989 United States postgraduate survey mentioned earlier, 51% of students felt that faculty members were not explicit in their expectations of students [4]. Often students do not realise the other research, teaching and administrative responsibilities of the academic staff. Accurate, proof read work, handed in on time, can make the supervisors life much easier. This should work both ways, students' work that is handed up on time and proof-read, should be returned to the student in a prompt fashion if possible. From the students' point of view, it is not ideal to be frantically amending work two hours before a submission deadline. In essence, initiating and maintaining a good student-supervisor relationship is a key project goal; mutual respect and trust positively influence any research project.

I have several bosses, both academic and industrial. Dealing with multiple supervisors, on the one hand, offers many advantages, joint supervision can be synergetic and bring several viewpoints to the discussion table. Multiple supervisors with varied expertise contribute different approaches, methodologies, and visions for the project; the downside is that it is almost impossible to keep everyone happy. In the 1989 survey, 63% of students either sometimes or always felt that they could not satisfy the "conflicting demands of various people" [4]. A mix of academic and industrial supervisors ensures that the research remains grounded and focused, the industry based supervisors tend to have a specific question they want answered, primarily how to reduce cost. The academic supervisors have the academic method of best addressing and answering that question. Engineering, by its nature, attracts reasonably grounded academics, and industry mentors tend to have an engineering background, so the two often have the same

outlook and approach. Although, having several brains to pick can be inspirational, it can also be confusing. Interpreting one person's vision of how things should be done can be difficult, adding another to the mix can truly confound!

ACADEMIC vs INDUSTRY BASED PROJECTS

There are various types of engineering projects, from the purely mathematical and theory-based projects to those that involve significant industrial input and collaboration. There are several interesting benefits and challenges of industry based projects compared to academic projects. Academic projects often follow on from, and build on, previous research. This offers the new postgraduate student a good starting point, and is the basis of a thorough literature review. The academic research field is often well established, with previously identified key journals, research bodies and authors. The first six to eight months or so can involve retesting others work and reviewing related journal articles. This greatly reduces project start up time. In contrast, the industry based project may not have a literature history, research may be project based and related in trade journals. Some industries are very secretive about research, and do not publish findings in the academic press, therefore it can be difficult to access information, often one doesn't have the firm academic footing that inspires confidence. Also, the practicality of familiarisation with two research locations, and two sets of people, adds to the workload. From my perspective, in the first year, there were two steep learning curves to climb; one which was discussed earlier was familiarisation with the research field, and the other was familiarisation with the industry partner.

Beginning an industry based research project is like starting two new jobs at once, there is an initiation period for both the academic and industry streams. Practically, there is the administrative side of getting IDs, initiation health and safety training, orientation, meeting key personnel, getting set-up with offices, laptops, familiarisation with systems etc. For large organisations, it can take time to settle in and find one's way around. Then there are the preliminary project meetings, meeting industry mentors, and trying to define early project goals and targets. Initially, my research colleague and I were included in internal energy project meetings and soon got up to speed on current industry partner projects. In retrospect, this orientation went very smoothly due to good supervisory planning.

Industry based projects have an advantage in that they are reality based, from a mechanical engineering basis there are real plants, real data, and real engineering problems. There is also a wealth of engineering and process know-how. Industry collaboration, from the students' perspective, places the engineering function into a greater overall business context. The interaction between the various business and engineering functions becomes clearer too. Attending and contributing to project teams has also been a great experience: seeing the development, implementation, management and success of some projects, as well as the 'falling off the radar' of others has been very educational. Observing the synergy, but also the challenges of multifunctional teams, and their respective agendas, has been enlightening. One learns a lot very quickly, working in the dynamically changing business world. From the 'real world' educational perspective, industry based research is a rapid, intense teacher. From the long term research project perspective there are some challenges. Long term academic research, e.g. the three year PhD, does not always fit in with industry cost saving projects that need to be implemented before the next quarter's financial performance indicators. The dynamic nature of business means that things change very quickly, what is popular and a great idea one month can

fall out of favour quickly the next. The expected payback on engineering cost reduction projects can be as low as six months. This can lead to a rapid, refocusing of effort from one project to the next; my research project theme changed quite a bit from month to month. People in industry change quickly too; my initial industry mentor left three months after the start of my research project. All in all, defining my project area has been the most difficult challenge in the first year of research. I thought that my initial project proposal had my project direction mapped out exactly, however, be warned - there is often a difference between the vision of the project proposal and reality. There are two other challenges of industry based research. First, the postgraduate can often feel very much the outsider (the annoying one), constantly relying on industry personnel to provide access to information, and equipment. Most people try to help out, but sometimes the student can feel completely disenfranchised, one can end up emailing people two or three times without response, trying to get information. The academic based project allows much more autonomy in comparison; the student generally has a rig, access to test equipment, and within reason can test away to their hearts content. Second, confidentiality and IP protection plays a major role in certain industry partner's corporate culture. In my project, process and data protection is paramount; all written work must be assessed and passed for outside publication. Preparation for conference paper deadlines begins early to ensure proposed papers follow the necessary review channels. So, although there may be an abundance of data and information, publication of the information is not permitted. IP is highly valuable in today's business environment, so it is understandable that protections are in place. From the 'publication-hungry' postgraduates' point of view, this can feel very restrictive at times, like a form of censorship.

CONCLUSIONS

This personal reflection has addressed some of the important issues I encountered in the first ten months as a postgraduate research student; these have included the transition to postgraduate study, the supervisory relationship and the differences between industry-based and academic projects. The main points can be summarised as follows:

- Postgraduate social networking should be encouraged and organised.
- Progress evaluation and the expectations of supervisors need to be more explicit, particularly in the first year.
- Building a good supervisor relationship is paramount to project success.
- There are both advantages (multiple inputs - ideas, viewpoints, technical knowledge) and disadvantages (conflicting demands, can't please everyone) to having several supervisors.
- There are both benefits ('real world' education, real engineering systems, and process expertise) and drawbacks to industry based projects (PhD and industry project timelines very different, dynamically changing objectives).

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