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Undergraduate research: a learning process

Abstract

Undergraduates can do publishable research. At the end of 1994, I invited students in my second year STS class to participate in a research project over the summer. I promised them no credit and no money-just the experience of learning how to do research, plus an expectation of becoming author of a published paper.

I believe that a considerable fraction of undergraduates is capable of doing research worthy of co-authorship of scholarly papers. We should be trying to make research an achievable activity, even an everyday one. Learning by doing is an excellent way to proceed.

Undergraduate Research: a learning process

Brian Martin

Undergraduates can do publishable research. At the end of 1994, I invited students in my second year STS class to participate in a research project over the summer. I promised them no credit and no money—just the experience of learning how to do research, plus an expectation of becoming author of a published paper.

Six students volunteered and lasted the distance. (Another started but wasn't able to follow through.) There were two research teams, each comprised of three students and myself. We started at the beginning by selecting a topic. I provided guidance on suitable projects, skills for searching the literature, interviewing and writing. I also participated in all the activities, investigating my aspect of the topic and writing my part of the papers, and took responsibility for making sure the project was completed. As well as researching and writing, we presented seminars on our research, first to each other, then to the departmental postgraduate seminar series and finally to a major STS conference.

This first summer of undergraduate research seemed to work pretty well. It also stimulated some ideas for improvement next time around.

- Once classes began the next year, it was virtually impossible to make progress. Thus it was essential that the research project was nearly complete—namely with a polished draft completed, ready to be circulated for comment—by the end of the summer. We didn't quite make it that first summer, leading to lengthy delays.
- The two projects were in areas which I had not researched before. I decided that in future it would be better if the topic was in a field which I knew well. That way there was less risk of not finishing by the end of the summer and less risk of failing to get published. (On the other hand, starting a brand new topic is a learning experience in itself for everyone.)
- I hadn't spelled out expectations for the students in sufficient detail. One of the students, Chris Dimmer, encouraged me to prepare a sheet to give to the next year's students, for example spelling out the amount of time students should expect to devote to the project. Possibly the biggest problem is that getting an article published takes time, so that the satisfaction of seeing one's name in print is long deferred. One partial solution would be to publish a working paper immediately as well as seeking journal publication. I do think that journal publication is important. This is "real" research, to be read and scrutinised in the usual way, not just a training exercise.

The papers from that first summer were both published—one after two prior rejections—which was satisfying given that they were both rather unconventional topics.¹ The next summer two students worked with me on a project which proceeded on schedule, avoiding some of the difficulties of the previous summer.²

You might think it would be easier to do the research without dragging undergraduates along. I'm not so sure. Some undergraduates are very astute, and they can be less constrained by established thinking. Working in a team provides stimulation to proceed on projects that might otherwise lapse due to lack of incentive. Finally, the aim of the exercise is not just research efficiency in the short term, but fostering wider involvement in and understanding of research. If more of our students begin their honours and postgraduate work with a realistic idea of how to do research, that is a different way of promoting "efficiency."

Undergraduate research is also possible in other fields. I know because, many years ago while doing my PhD, I worked with individual students on two separate summer research projects. One had finished first year physics and the other had just finished high school. Publications also resulted from those collaborations.³

I believe that a considerable fraction of undergraduates is capable of doing research worthy of co-authorship of scholarly papers. We should be trying to make research seem an achievable activity, even an everyday one. Learning by doing is an excellent way to proceed.

Acknowledgments I thank Chris Dimmer, David Dingelstad, Helen Gillett, Richard Gosden and Nickolas

Vakas for comments on a draft of this article.

Last year's project from a student's perspective

My first reaction to last year's project was one of interest, but this quickly subsided to one of doubts: "Will I have time?," "Is it just a means of getting free labour?," and so on. However, I eventually agreed to attend the first meeting in order to find out more before writing the idea off. During our first and subsequent meetings my doubts were overcome and I became intrigued by our research topic—the challenge had begun.

Though we had deadlines and the work had to be done, I found myself researching the topic out of interest, and it didn't take long before we were writing our first draft. Writing the paper wasn't as overwhelming as I thought it would be, in fact I felt under less pressure than when doing an assignment! My opinions were considered equally along with those of Brian and Chris, and producing our final copy was very satisfying.

In retrospect I realise that Brian is right when he says that undergraduate research is a learning process—at least I found it a worthwhile experience.

Helen Gillett

YOU PROBABLY NEED HELP WITH STATISTICS

Whether you conduct quantitative research yourself, or are supervising a research student, you will find that the service courses in statistics which you did years ago have left you ill-prepared for the task before you. There is nothing shameful about this; would one or two courses in your discipline make someone else as expert in it as you are?

However, the Statistical Consulting Service, based in the Department of Applied Statistics, is here to assist you. We will advise on:

- planning an investigation so that your research hypotheses are formulated clearly, the data you collect are appropriate, and the variability in the data is minimised;
- how to collect the data, and to prepare them for analysis in a computer;
- the most appropriate form of analysis, and which statistical package to use;
- how to interpret the output from the package; and
- how best to present the conclusions you draw from the analysis.

The service is funded principally by the Office of Research. As a consequence, if your research (or that of a student you supervise) does not have external funding, you will receive up to ten hours of FREE advice per calendar year. If you receive external funds, the advice is still available, but you have to meet the cost. Naturally, there are some conditions attached. For information about these, ring Ken Russell on extn 3815. To make an appointment, please ring Kerrie Gamble on extn 4308.

The service is available throughout the year, including December and February when most researchers are hard at work. You should take advantage of it. Some points to consider:

- we don't expect you to be a statistical genius;
- we won't talk down to you or use lots of statistical jargon;
- we won't use a complicated analysis if something simple will do the job.

And one final point ... Many people think that you only seek advice when it is time to analyse your data. This is **WRONG!!!** No amount of statistical sophistication can salvage a poor investigation. You should see the consultant at the very beginning of your research, so that s/he can help ensure that it is properly planned.

Appendix: Handout given to students in second session, 1996.

Research project, Summer 1996-97

If you are interested in gaining direct experience in doing research, you may like to join me for a research project this summer.

What's involved You will join a team and help in deciding on a specific research project, formulating a research plan, searching the literature, organising and undertaking interviews, writing up results and participating in seminar presentations.

Potential advantages and disadvantages You will gain experience and insight in doing research and in working as part of a team. You will help make a contribution on a socially valuable topic. You can expect to be co-author of at least one published paper. You will get a feeling for what it's like to do research at the honours or postgraduate level.

There are no credit points involved and no payment for your time. (A small amount of money is available to cover minor expenses.) Research can be hard work and there will be time pressures. Your learning will be experiential (that is, you'll learn by doing) rather than by explanation and reflection.

What's required of you You must make a commitment to devote at least eight weeks of major effort to the research in the period December 1995 to February 1996—that amount of time is necessary for literature searching, analysis, interviews, writing and revising papers, and group discussions. You must be willing to work in a team, to adapt to a specific research topic and to meet deadlines. The work required is of the quality and quantity needed to obtain a high credit or better.

What's required of me I will participate in and guide the research team. Also, I will ensure that the research is published.

I have been involved in similar projects on previous occasions. To get a feeling of what's involved, I encourage you to talk to STS students who were involved in projects last summer.

Research topic This will be chosen from the general field of communication and/or technology for social

defence. Social defence is the use of rallies, strikes, boycotts, noncooperation and other methods of nonviolent action as an alternative to military defence. It is in the Gandhian tradition, with a pragmatic orientation. This is a pioneering and socially valuable research field. I've been working in this area for years, so I know the key literature and places to publish. Although the research topic may seem narrow, actually it has enormous scope. There is a vast amount of work that can be done, in fields such as telecommunications, linguistic analysis, chemistry, engineering, medicine, psychology and zoology—in fact in virtually every field of study. If several students are involved, a mutually agreeable topic will be sought. If you'd like an overview of the field, I can provide an introductory article.

I am open to suggestions of other research topics. You can have a look at my research interests and publications on my web page (address below).

What to do if you're interested Meet in 19.2003 on Tuesday 26 November 1996 at 12.30 and we'll begin discussing projects and procedures. I've set this date because it's after all marks have been submitted at the STS examiners' meeting. Feel free to discuss the matter with me at any time.

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¹ Christine Dimmer, Brian Martin, Noeline Reeves and Frances Sullivan, "Squatting for the prevention of haemorrhoids," *Townsend Letter for Doctors & Patients*, Issue #159, October 1996, pp. 66-70; David Dingelstad, Richard Gosden, Brian Martin and Nickolas Vakas, "The social construction of drug debates," *Social Science & Medicine*, 1996, in press.

² Helen Gillett, Brian Martin and Chris Rust, "Building in nonviolence: nonviolent struggle and the built environment," *Civilian-Based Defense*, Vol. 11, No. 3, Fall 1996, in press.

³ Brian Martin and Clinton Stewart, "A note on the effect of stratospheric ozone fluctuations on mean transmitted ultraviolet," *Journal of Applied Meteorology*, Vol. 15, May 1976, pp. 526-527; Greg Houseman and Brian Martin, "A technique for determining probability distributions for creation and destruction of ozone and other tracer particles," *Tellus*, Vol. 29, 1977, pp. 455-461.