

# From Project Proposal to Published Paper: Disseminating Students' Research Findings

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## I. INTRODUCTION

The supervision of undergraduate and Masters level project work can be one of the most rewarding aspects of the role of a university teacher, especially in cases where there is genuine engagement in research activity on the part of the student. There is a sense of pride for both the student and the supervisor when the work is completed in the form of a strong dissertation, often accompanied by an imaginative poster presentation and/or strong viva performance. These requirement(s) of the degree provide the opportunity for the students to demonstrate the value of the research that they have conducted to the local academic community.

The dissemination of good student work can extend beyond the home institution and be made available to the wider research community. This paper considers how to identify undergraduate and Masters project work that has publication potential, argues the reasons why it is worth devoting extra effort in extending student work completed for purposes of publication, and how to determine possible outlets for such work. It draws on the experiences of staff in the School of Computing who have been successful in disseminating students' research findings in a variety of media from newsletter serial publications to high-level refereed journals.

## II. REASONS TO EXTEND STUDENT WORK COMPLETED FOR PURPOSES OF PUBLICATION

Between them, the authors of this paper have published with 8 students in the past 10 years. Jointly with six individual students, Hall has published two articles in international refereed journals, presented two refereed papers at international conferences and made two invited conference presentations. With encouragement, six further students have published individual work solely in their own names on the basis of projects supervised by Hall. Hall is currently working on two articles based on student project output, and has plans to analyse further data collected by an undergraduate in 2003/4 with a view to publication. Buchanan has gained a publication in the *International Journal of Ad-hoc Networks* (2004), and the *International Conference in Information Warfare and Security* (2004).

Much of the motivation for such interest in helping students find outlets for their work is clear: it is in our personal interests to add to the list of quality work on our publications lists; it is in our research group's interests to enhance the body of work that can be drawn upon for the next RAE submission; it is in the University's interests for

staff to be seen to be research active. Staff also derive a sense of satisfaction from a job well done. From the students' perspective it is a boost for them to see, usually for the first time, their names in print (and associated with an expert in the field), and the external validation of what they have achieved enhances their job prospects (*see* Case studies 1 and 2). For those who intend to pursue a research career the publication of their project work is likely to be the first many. There are also less obvious reasons for participation in this kind of publishing activity. These can equally be related to individual, institutional and student gains. A tutor who takes the trouble to devote time to helping students publish their work gains a reputation as a *good* supervisor, and thus is likely to attract a keen following of potential project students each academic session. For a new academic without a strong publication record, the opportunity to publish student work, albeit usually in relatively low profile publications such as trade press journals, is a means of starting to build a publication profile. The University benefits from the visibility of student-supervisor publication work in that it has the opportunity to promote an image of an institution that cares about its students (*see* Case study 3). Encouraging students to bring their work up to a standard that is publishable prompts them to reflect more deeply on their learning (*see* Case study 4).

## III. MATCHING TO LEARNING OUTCOMES

A key element of project work, especially at Honours level is in the justification of a mark which is over 70%, which is highlighted by the following statement for the marking of student projects in the School of Computing:

Over 70% - A mark in this band indicates an excellent level of achievement. A professional piece of software or other deliverable will have been produced and a dissertation **worthy of dissemination**.

Over 85% - ... first class technical achievement together with a dissertation containing a contribution **worthy of publication**.

(Lawson, 2004)

It is also noted that a mark of over 70% should be assigned as thoughtfully as one less than 40%. It can thus be seen that the work must be *worthy of dissemination*, which typically means that it could be accepted in a form which could be useful to others, whereas *worthy of publication* would point towards a respected academic journal. It is thus key that if a student is

expected to receive a mark of over 70% that the supervisor discusses the possibility of a publication, based on the submitted dissertation. Students can then decide if they feel confident enough in their own work to achieve this. At no time should students feel that they are being pushed into this, as it is important for them to see the benefits for their own career, whether it is in research or in industry.

If a paper can be produced and submitted before a viva takes place, then the examiners can assess the merit of the paper. This often enhances the perception of the work by the second supervisor, in the same way that published work often helps to justify novelty in a PhD thesis. A particular benefit is where a paper can be submitted, and accepted, before the viva, as this can fully justify that the work has been accepted as worthy of publication. External examiners also feel comfortable about assigning high marks if there is evidence of publications, especially with peer-reviewed papers in respected conferences.

Often the process of creating a paper is one which students find beneficial, especially one those who are at the top end of a 2:1, or as a 1<sup>st</sup> class classification. This is typically a new skill for the student, who is unused to taking a large document, and distilling it down to a few papers, without losing the key elements. This can often lead to a strong sense of teamwork where the student feeds drafts to the supervisor, who then rigorously edits and tries to focus the paper. Unfortunately few undergraduate students go through this amount of rigor in their work, and many struggle, initially, to know how to write a research paper. For these students must be guided towards a fairly standard layout of:

- **Abstract.** A summary of the paper, identifying its key aims, the methods used, and the results.
- **Introduction.** A focused discussion of the main aims and the context of the work.
- **Background.** A discussion of the key underpinning theory/technologies involved in the area.
- **Model/Design/Methodology.** An outline of the key elements of the work. Many students are keen to add too much detail in this section, as they do not see that the actual implementation is of less interest than the methodology used.
- **Results.** A key area of the paper, which should summarise the main results from the work, especially focused on proving delivery on the aims of the work.
- **Conclusions.** A reflective statement on how well the work has matched the aims.

A key element for peer-reviewed publication is to present results which prove that the output meets of the aims of the work. For example, for a paper based on a practical implementation in the field of computing, the output should demonstrate that the system is faster, easier-to-use, improves processes, is smaller, and so on. Thus at an early stage in a project the student must try and identify, typically from the literature review, the key performance metrics of the system, and how these can be measured. In many cases a discussion of this is important before any design work is tackled, so that the actual design can support the experiments. In

Engineering, this concept is known as design for test, the design is well suited to the experimental analysis.

#### IV. CASE STUDIES

The following gives a few reflective case studies from the School of Computing.

##### **Case study 1: A dream job in computer games development**

The goal of a BSc Software Technology student was to be employed by a computer games company. For his final year project he created a real-time military strategy computer game. The work involved a fair amount of engineering. For example: when one squad attacked another, each squad's formation would break up into individual one-to-one fights; if a soldier won one fight it would go and help another; and after an enemy squad was destroyed the winning squad would re-form and be commandable as a squad again. The unique selling point of the system was that it learnt continually as the user played: its strategy changed in response to that of the user. This greatly extended the game's playability. With his supervisor, the student had a paper accepted, and published, in a big international conference. Subsequently the student found a job with a well-known games company on the strength of this paper. The fact that the ideas had been externally reviewed and accepted were probably a lot more persuasive than the student simply talking about his project work at an interview - games companies receive a very large number of employment enquiries.

*Professor Peter Ross, School of Computing*

##### **Case study 2: Island hopping**

A number of School of Computing undergraduate and MSc students completed projects in association with the Royal Observatory. Some of the MSc work reached a high level, and this resulted in a couple of the students getting their names on a publication, one of whom was then employed by the Observatory. The job involved a lot of travel between the two main observatories - in the Canary Islands and Hawaii.

*Dr Alistair Armitage, School of Computing*

##### **Case study 3: "You're here, you're young, you're Scottish, you're Hazel's - welcome!"**

The high profile work of their predecessors has helped Information Management students and graduates at their first conferences and professional events integrate at networking sessions. A short story illustrates this. A set of new graduates working in the financial services sector in London attended an evening meeting of the City Information Group. Initially shy, the ice was broken for them when it soon became clear that the networking track had been prepared for them, not least because the quality of the output from their course was known through the earlier publications of their peers.

*Hazel Hall, School of Computing*

#### Case study 4: Post-project reflections

A postgraduate project required a group of students to create a web site for a talking newspaper organisation. The opportunity to publish an account of the work completed – the adaptation of what was learnt and the wider appreciation of the field through reading in the context of practical constraints encountered when working with a client organisation – formalised and captured the experience. The students thus reflected more deeply on their learning than they might have done otherwise.

*Tom McEwan, School of Computing*

#### V. NOTE OF CAUTION

If the reasons for devoting effort to helping students publish their work – either as individuals or jointly – are so obvious, perhaps it is surprising that this practice is not so widespread. Explanations can be proposed on a number of counts. First is the problem of identifying work that is worth publishing. This is more than a question of what constitutes *good* work (and it is not just the best work that merits publication – see below). Further difficulties may arise after student work that has potential has been identified. The risk is that students then follow a track of advocating their own output. It can be very problematic coping with the disappointment of students, whose work might not deliver what was anticipated, when they are told that it is not worth publishing. Consideration must also be paid to the level of what can be achieved by students in comparison with full time academics and researchers. Given the choice, serious researchers prefer to publish papers based on funded project work, conducted with their peers, than with students without a track record in the domain. There are also arguments for an academic responsibility to guard against flooding the subject area with less valuable work (as opposed to increasing the *quality* of what is available). Further problems relate to information risk such as the ramifications of mishandling intellectual property rights, and making available work that might be readily plagiarised. For example, in the domain of computing, publishing software code might be good for the advertising the quality of students, their programme and institution. This practice can also attract some constructive commentary that is educational. However, it makes life harder for some other academics because it increases the opportunities for plagiarism elsewhere. Indeed, the practice might lead in time towards a new model of handling student projects.

Another note of caution is concerns rejected papers. For this the supervisor should take great care in not building up the student's expectations, such as saying that it doesn't matter too much if it isn't published, as being picked for the process in the first place was an excellent result. They should also be buffered in some of the comments which come back from reviewer, which can often be quite stinging. It is thus important that the supervisor picks the right level of publication, so that the paper does not look out-of-place. For example a paper with very few results which do not show anything has very little chance of being accepted for an

international conference. Saying this, though, the supervisor should also use their judgment in trying to publish the work in as high a ranking publication as the paper merits. This is typically down to the experience of a supervisor, and their PhD students.

#### VI. IDENTIFICATION OF UNDERGRADUATE AND MASTER PROJECT WORK THAT HAS PUBLICATION POTENTIAL AND OUTLETS FOR THE WORK

Often it is the obvious high quality of a piece of student work that prompts the supervisor to raise the question of publication. However, it is not only work that achieves the best marks that merits interest. Indeed, the output of some such projects is unsuitable for publication. For example, in the case where a student has produced a comprehensive analysis of the literature and executed a highly competent piece of research, but the results of the study are unremarkable in that they relate little that is new to the domain, seeking a publication outlet for the work will be difficult. Average work, on an interesting theme, that can be enhanced with extra effort on the part of the co-author tutor, is more easily disseminated (*see* Case study 5). In some cases, the knowledge that innovative project work is being undertaken at the institution prompts conference organisers and journal editors to commission material (*see* Case study 6).

#### Case study 5: The bibliographic control of grey literature/why football fanzine editors misbehave

A final year Information Management student completed his project on the theme of the bibliographic control of grey literature, i.e. how ephemeral publications such as leaflets and reports with low circulation numbers are identified and recorded as per the terms of the 1911 Copyright Act. His field work was completed with editors of print football fanzines. The work had publication potential because it used an interesting set of data subjects, and because the results provided entertaining insight into the alternative practices of underground publishers. It was presented as the last paper at a (serious) conference on serial publications by the student and tutor, dressed in football shirts. In the published version of the paper an editorial note advised that like all sporting events, the material reported was been seen live. (A further interesting point about the live presentation of this paper is that it was witnessed by some influential people from the serial publishing and information management industries. The ramifications of this have included further invitations to present, and invited membership of two high profile industry committees.)

*Hazel Hall, School of Computing*

The usual channels can be used for identifying places at which to publish student work: research active staff are familiar with the literature of their domain and where to find calls for papers etc. What is important with student work is to recognise the level of what can be produced. For example, if

the work has been completed by an able student in an area in which the tutor is expert, there is no reason why it should not be submitted for the consideration of referees of a top journal or conference. However, in some cases, for example work that merits publication on the grounds that it is innovative or interesting (rather than for its theoretical significance), it is advisable to seek publication in less prestigious fora such as the non-refereed trade press or practitioner conferences. Another avenue is to seek publication in response to learned societies' efforts to attract student interest. For example, Napier Information Management students have had the results of their final year project work published by a special interest group of the Chartered Institute of Library and Information Professionals as a result of entering their work for a competition.

### Case study 6: Commissioning the code-breakers

The organisers of the 2003 *International Conference on Virtual Communities* knew of the reputation of University staff in this area of research and so made an approach with a request for a paper. In the event student work on a world-wide virtual community of over 2,500 code breaking enthusiasts was prepared for the event. The paper was also subsequently published in an international refereed journal.

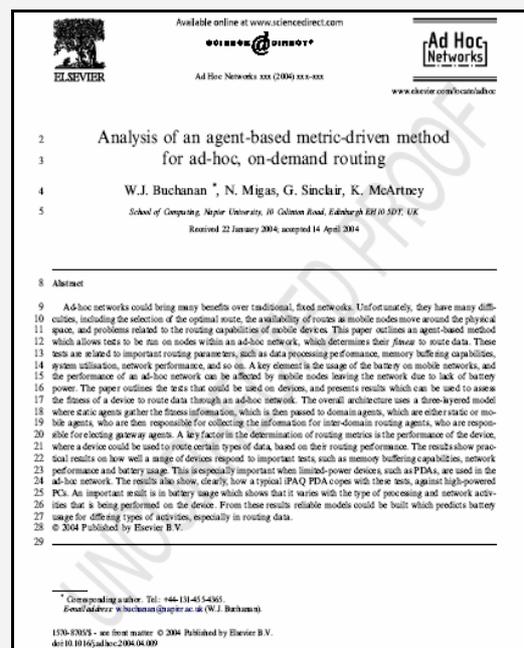


Hazel Hall, School of Computing

### Case study 7: Ad-hoc Networks

A key element of integrating research with undergraduate projects is to find the best students. Often these types of students will actively find their supervisors, as someone who they respect for their knowledge and skills. This was the case with a Software Engineering student who created a system which could test mobile devices for their fitness in creating networks which do not have any fixed infrastructure. The student was identified as a first-class Honours student at the start of his project, and his work was integrated closely with PhD students in the School of Computing. This is a key link as the supervisor can guide and advice, but it is typically the PhD students who can discuss the fine-detail of the project, and help with the experimental part. At the end of the project the creation of a research paper was discussed and the PhD student and supervisor discussed the merit of each experiment, and in the results that it showed. The appraisal was that it did show many new things, and it was decided to try and publish it at the highest level (*Journal of Ad-hoc Networks* – the most respected journal in the field of ad-hoc networks), rather than reducing the quality and going for a lower-level conference.

The viva then went ahead with the knowledge of the paper, which made it easier for the marking team to justify the mark of over 70%. The only regret was that the paper had not been accepted at that point, and that the other examiner had to take the word of the supervisor and the PhD student that they thought that it merited publication. This problem has been overcome this year by getting a student to submit to a conference in June 2004 (*International Conference in Information Warfare and Security*), thus the examiners were well aware that the paper had been peer-reviewed.



William Buchanan, School of Computing

## VII. PAPER PUBLISHING AS AN ASSESSMENT METHOD

Many researchers see that PhD students often struggle to produce papers in the first year of their research. This is possibly because they have not been given a foundation in how to write a research paper. In the current year the ASMN (Advanced Security and Mobile Networks) module used a research paper as the second element of assessment. The first element was a standard coursework submission. After this the specification given for the second assessment was:

### Coursework specification

The objective of this coursework is to write a research paper which is submitted to the following conference:

#### 1st International Conference on the Application of Mobile Networks

The aim of this conference is to present novel applications of mobile networks, or provide reviews of current technology in the key areas of RFID, Ad-hoc Networking, Location-finding in GSM networks, GSM/3G technology and Location-based services.

To assess if there was a correlation between their marks in a *traditional* coursework and in the creation of a research papers, the marks were matched between the first assessment and the second. The first test was graded, in order to give feedback to the students, and the results of the second assessment gave the following:

- Students who gained a C in the first coursework, scored an average of 45%
- Students who gained a C+ in the first coursework, scored an average of 49.2%
- Students who gained a B- in the first coursework, scored an average of 55%
- Students who gained a B in the first coursework, scored an average of 58.9%
- Students who gained a B+ in the first coursework, scored an average of 60%
- Students who gained a A- in the first coursework, scored an average of 65%

It can be seen that there is a distinct correlation between the two. It was also observed that students who gained an A-, B+ and B in the first coursework generally wrote papers which discussed their own novel applications for mobile networks, while students who gained a B-, C+ and C generally wrote review papers. Also the B+/B students are often difficult to differentiate their performance, while there is typically a wide gap between the A student and B one.

The student feedback on the paper writing exercise was good, and one interesting comment was:

I think that after the two courseworks we submitted, we feel that an exam would be easy, because the courseworks requires us to master the content of the lectures and even deeper.

This shows that the depth of research possibly allows for deeper learning than with examinations. Another comment highlights that some students struggle to take a large amount of material, and summarise it:

I did not like the four-page limit as it forced me to cut a lot of information out ...

This is interesting as a key element of writing a research paper is in actually knowing what you want to write about and then telling the story with as few distractions as possible. Unfortunately many students feel that the depth of research is often measured by the thickness of their print-outs from the Internet. Overall, for this module, most students enjoyed the process of creating a paper, especially the ones at the higher end of the marks.

## VIII. CONCLUSION

It is often worth the additional effort required to bring a piece of student work up to publication standard, especially in cases where the work is of obvious high quality, interesting and/or innovative. The case studies presented in this paper support this view. The practice of publishing student work, it is argued, enhances learning and teaching by linking together the themes of innovation, scholarship and research.

### REFERENCE

Lawson (2004), [http://www.dcs.napier.ac.uk/~alawson/honproj/version2docs/assessment\\_guide\\_v2.doc](http://www.dcs.napier.ac.uk/~alawson/honproj/version2docs/assessment_guide_v2.doc)

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