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Computing the Clever Country?

Alan Kay

the sage on the stage or
the guide on the side ?

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Student Projects Revisited: A "Head Start" into the Workplace

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Background

Problem-based educational techniques have long been an integral part of computer training programs. The techniques used may be as simple as an in-class discussion of a case study to a year-long work project with an industrial client. Some institutions, Wollongong University for example, have even initiated scholarship programs to assist students to undertake extended unpaid work experiences with industry and public agencies.

Unfortunately an increase in student numbers and the difficulties of finding acceptable 'projects', and project supervisors, has resulted in students being counselled against these activities in recent years at some institutions. This paper looks at the recent experiences of several degree and associate diploma computing students at the University of Central Queensland (UCQ) which suggest that well-organised student projects are important for providing skills in working in a team, working towards deadlines, and learning "how to learn on the job". With the current emphasis on educating for Australia as a "clever country" these skills are essential to every new graduate.

A Personal Perspective

I am a lecturer within the Department of Mathematics and Computing (M&C) with responsibilities for end-user computing and instructional development. To date this means that I have been primarily responsible for introductory computing for non-technical students (Health Science and Education) and one-third of my time has been seconded to the School of Health Science to manage that School's computer activities.

I have supervised, or co-supervised, approximately 18 associate diploma (ADC) and degree computing student projects during the past three years. I also have administrative responsibility for coordinating 84901, the ADC Project (see below). As such, I am one of the strongest supporters of project students within M&C. I am however in a unique position within the Department as I have administrative responsibilities for a major project within another School which requires student assistance to perform its activities.

This paper reports on the experiences of some of the computing project students who worked on projects within the School of Health Science (SHS). In every case, I was involved with the selection of the students and the matching of students and

project topics, most of which I had also originated.

As the academic staff member directly responsible for both the management of SHS computer activities, and as many as 12 project students at any one time, I organised student 'staff' meetings where we discussed individual progress towards project goals and tried to emphasise links between the various projects. Normally held twice a month, these meetings permitted the most interested students to see where their activities fitted into SHS goals and helped to focus peer pressure on non-performers. The meetings also permitted students to discuss problems

they might have encountered with academic staff, provided a channel for me to present complaints from staff, and generally assisted me in my role as a 'buffer' between the students and staff.

The buffer role is not insignificant and, for me, causes the most 'extra' work. Recently, for example, it took me several hours to investigate an alleged security incident, including obtaining working logs and a statement from the student involved, and reassuring UCQ's Division of University Computer Services that one of my Project students should have his network privileges restored in order to continue his project. Similarly, I have had to placate academic staff who saw the project students as free labour and were unhappy at having the students' needs come before their own, and had to negotiate reasonable grades for students who had completed very successful projects but had submitted poorer quality reports (the reports have traditionally been used at UCQ as the main indication of the quality of the project).

At the conclusion of each project I was also responsible for coordinating the students' assessment. Usually I was able to get reports from at least one, and often two or more, academic or support staff regarding each student's work and working relationships. While these reports, from staff who had been working directly with the students, formed the basis of the evaluation, they were often not sufficient as support staff could not be directly responsible for student assessment.

Computing Projects at UCQ

The University of Central Queensland, formerly the Capricornia Institute of Advanced Education, offers an applied computing program through the Department of Mathematics and Computing. We offer courses (Master of Applied Science, Graduate Diploma in Applied Computing, Bachelor of Applied Science (Mathematics and Computing), Bachelor of Computing, and Associate Diploma in Computing) which prepare students to work in careers which require the application of modern computing techniques. Graduates have typically been hired in programmer/analyst positions within government and industry. All courses can be completed through full-time (normally on-campus) or part-time external study.

> **84344** [Degree Computing]
> **Computing Project** (3 hrs, two semester subject)
> Student are [sic] normally required to have successfully completed most of their level II mathematics and/or computing subjects before commencing a project. In this subject a practical computing project is undertaken. The emphasis is as for 84346 Project but with the additional requirement that the work demonstrate a sound knowledge of computers and computing.
> *Note:* Students may not enrol in 84344 without first arranging supervision by a lecturer within the Department of Mathematics and Computing. This must be initiated by contacting the Graduate Assistant.

84346 [Degree Mathematics or Computing]
Project (3 hrs, two semester subject)
Students are normally required to have successfully completed most of their level II mathematics and/or computing subjects before commencing a project. In this subject a practical project is undertaken, supported by project discussions and report writing. Skills in modelling, problem solving, practical orientation, and communications ability are required to be demonstrated. A typed report on all aspects of the study is to be submitted for assessment. This subject may be completed over two years when studied externally.
Note: Students may not enrol in 84346 without first arranging supervision by a lecturer within the Department of Mathematics and Computing. This must be initiated by contacting the Graduate Assistant.

84901 [Associate Diploma Computing]
Project (6 hrs)
Students select a project of a practical nature and carry it out under the supervision of a member of staff. The project must include a problem presentation and final report, in addition to a fully documented system with operating instructions.

Source: Mathematics and Computing Departmental Handbook, 1992

Computing students have often had a 'project' in their final year. The project allows the students to apply their theoretical knowledge in a safe working environment. Properly supervised, the project is an opportunity for the students to develop their talents in an area of computing that holds a personal interest, is of practical value, and stretches their knowledge and capabilities. The credit value for the project subject implies that students will spend approximately one day per week of productive work for a full academic year on the project. Students taking the subject as a semester activity (ADC students) are expected to do two days per week of productive work for completion. Students keep weekly logs of their work, participate in group discussion sessions to explore common problems, make a formal presentation on their work to workmates or a university audience, and present a final report that includes relevant project specifications and results.

UCQ delivers computer courses to students via both on-campus and distance education modes. The students learning at a distance typically are employed and can usually organise an acceptable project within their normal work environment. On-campus students do not have the same opportunities and typically require assistance in developing a project as well as significant time for supervision. This has led to the lecturing staff counselling on-campus students against the project.

As can be seen from the subject descriptions above, all of the project subjects have approximately the same requirements, both in terms of the project itself and the time allocated. In my experience, the quality of the projects ranges broadly, as do the topics. Within the projects which I have supervised there have been those which focussed on programming (the traditional style of computing project at UCQ), documentation and evaluation, network management, and user support.

New Opportunities

The School of Health Science at UCQ received a National Priority Reserve Fund grant (1991 and 1992) to develop Computer Assisted and Computer Managed Learning (CAL/CML) materials within its pre-registration nursing education program. Working

with novice computer users, the CAL/CML activity has resulted in the acquisition of a significant computing resource and the in-house development of both software tools and student courseware. One of the keys to the success of this program has been the involvement of more than a dozen associate diploma and degree computing project students.

CAL/CML development is, like any software development, a labour intensive task. Ideally tools would be specified and developed before implementation of the program. Courseware would then be developed for testing, perhaps in a live setting, but with the users knowing the capabilities of the tools. Because of the paucity of commercial materials at a reasonable price when the project began, SHS has undertaken the iterative development of its own tools as well as courseware preparation. Computing project students have provided at least 50% of the technical support for the software development and approximately 25% of the courseware development support.

Computing project students have, in general, been reliable and productive. Their learning curve has been at least as quick as the specialist computer staff and generally faster than the academic staff whom they are assisting. Their performance has been equally as good in the areas of staff relations, team building and their ability to function as members of an academic development team.

Student Benefits

The School of Health Science 'advertises' for project students on the computing student notice board towards the end of a semester for the following semester and interviews interested students. Student selection, both their selection of SHS, and us of them, continues until about week 2 of the semester. We feel that it is particularly important that prospective project students understand that they will be working as if they were paid staff, and will be subject to the same constraints (and privileges) as paid staff. One of the attractions for students is that SHS is working in an area that has wide application and with computers (Macintosh) that have not been widely used on the rest of the campus.

The computing students have performed tasks as diverse as network management (an AppleTalk network with 30 plus academic users and a 20 station student lab), prototype development and coding (two major software development projects), staff training and documentation (preparing training materials, testing and documenting software tools and network procedures), and courseware preparation (editing text and checking syntax for instructional materials prior to compilation). Individual work situations varied according to duties and capabilities. Most students worked with staff as equal partners in informal development teams and gained new insights into both student and staff roles.

The comments which follow come from interviews with two of the 1991 project students. They had two quite different experiences, one working on user support, and the other doing a conventional programming task, but they are typical of the project students who have worked for SHS on the CAL/CML activities.

The student who was responsible for faculty support felt that the tools she was using would also be useful within her own (computing) program. 'I think it would be really beneficial' for computing students to use the [SHS] CAL tools to develop materials for their own subjects. 'It would be excellent... to actually work on something that you would see the end result from'. The hardest thing she had to do during the project was 'the personal interaction with other professionals... I feel that I won't be

quite so nervous [in the future]... which will be great for me in the work force'.

For most of the project students the work was varied, often much more than either party realised at the beginning and, just as in the workplace, was seldom without its frustrations:

> 'I got to work on case studies that academics had already compiled... and just sat down and filtered through them, one by one, organising [them] for CAL_Maker [our in-house authoring tool]... so basically, that's what my job has been and, as you know, I've done little bits and pieces of other things: getting on to [potential suppliers about] graphic materials that we could use in [the] case studies, and spoke to the marketing co-ordinator down there regarding copyright, which I found was a plus for me because I really didn't understand the ins and outs of it; and talking with him I became a bit more confident with the subject...'

> '...the preparation of the leaflets was a great plus in my opinion, because [preparing documentation for users] must have to be the hardest thing you could ever come at... Through trial and error I realised what sort of things they [the users] expected and what level I had to aim it at, so I think next time I'll go into that with my eyes wide open.'

and rewards:

> 'I won't be quite as nervous and apprehensive when I walk into a [work] environment, the next time, which will be great for me in the workforce... I guess confidence is something you learn... confidence about yourself to be able to handle these kinds of professional environments.'

The other student, working with an academic staff member on a two-person team developing a prototype clinical simulator, learned that the software development process is seldom easy. An initially complex design forced them to restart at least twice, simplifying each time. This simplification led to the abandonment of features such as a rotatable 'visual assessment of the patient'. 'It hasn't been forgotten, and it will add a lot to the value of the product...' but 'simplifying it was the best thing for us' as it enabled the product to run on the available hardware.

The external evaluation teams for the M&C computing degrees have emphasised that we should be providing experience working in groups rather than just as individuals. This student found that both members of the group can make a contribution.

> 'It was only by bugging [the other team member] enough that we started to sit down and work together as a team— where I knew as much as he knew and he knew as much as I knew— and it was good because it gave us two perspectives, from the academic side and from the student's, [towards] how things would work.'

> '...[I approached] it from an absolute novice point of view on the student's side, I have absolutely no idea of what these [nursing] terms mean, so it's got to be almost doubly clear to me what to do at each part... [not knowing anything about the content] was an advantage.'

As was apparent from all of the students working with the School of Health Science, this student found that the project often had its surprises. His academic staff colleague was using the CAL development activity as part of his own higher degree work, and

> 'I didn't know [his project] was due in until about a week before [the end of the semester] so I was sort of coasting along at half pace thinking I had about another four weeks to get this done, and suddenly I found I had one week...
>
> 'It meant we had to work very hard, nearly twelve hours a day for 6-7 days... We did get it done... we spent a lot of time working out how does this fit with that, how does that end up over there, what sort of format is it in here, and what sort of format was going to [be needed here]?
>
> 'When we told the thing to go, it ran— everything worked— perfectly...!'

It would be fortunate if all students were given a similar opportunity to discover that teams can be effective in problem solving.

Conclusion

The benefits haven't been one-sided at all. As the SHS dean recently indicated 'it has been a big plus that staff who are used to seeing only nursing students get to see and work with students who are also staff, and who know more than they do.' The academic staff's acceptance of the role of knowledgeable students is complete enough that one of the students who subsequently joined the staff commented 'the people who worked closely with me haven't change their attitude at all', and the changes that he observed among the other staff were, he believed, because 'not many of the staff knew that they could call on me for help [in his role as staff programmer assigned to a specific project], now all the staff know that they can call on me for help... and they do!'

Well organised projects require the students to think, and to perform as working professionals. As one project student stated, 'some student don't want to take a project because they believe that Project will require them to think! They also don't want the extra work.'

Supervising students engaged in project work is time consuming, but without good supervision the project is likely to be a failure for both student and supervisor. It should be noted however that supervising specialist staff isn't any easier, and the rewards to both the institution and the students should outweigh the costs. For me as an individual, working with project students keeps me fresh; I'm forced to keep ahead of several bright young enthusiasts. The institution gets innovative ideas and quality work for a reasonable investment, the student gets a work experience that provides a 'head start' into the workplace.

Acknowledgements

I owe a particular debt to the two students who have allowed me to quote them here, but my thanks go out to all of our computing project students. This paper, and much of the work accomplished by the CAL/CML team within the School of Health Science at UCQ, would not have been possible without their enthusiasm and dedication. It is perhaps indicative of their general ability that SHS has hired several of them on a part-time basis, and two of them full-time, to continue the work they started as students.