Report on ANU Course COMP4130

DRAFT Version 1.1

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December 2015

Executive Summary

This report addresses a review of the Bachelor of Software Engineering course COMP4130, offered to 4th year students in the degree program at the Australian National University (ANU). The review took the form of a site visit held over 7-9 Dec 2015, in which program and course leaders, together with a small sample of students (3 from 34), were interviewed. These interviews, together with the study of a number of supplied written materials, namely course logistic information supplied to students, on-line courseware, and a representative sample of student examination papers, form the data upon which this report is based.

The review finds that the academic standard of the course offered is very high, and that no substantive changes to the course content are suggested. However, there are a number of circumstances in which improvements could be made, and suggestions for such improvements are offered.

Recommendations:
1) Ensure that Learning Objectives are expanded to cover the detailed outcomes of the course
2) Publish these learning outcomes at every opportunity: handbook, Wattle pages, assignment handouts, lectures and notes.
3) Promote the awareness of staff-student liaison committees, and the names of representatives on them to students through Wattle and lectures.
4) Continue to promote the use of anonymous feedback mechanisms such as Piazza.
5) Ensure that an adequate system of examination paper moderation is in use.
6) Encourage the use of consistent marking guidelines: it is suggested that each assessment component should be marked out of its actual weight in the overall course result, or at least consistent scaling procedures be applied.
7) Explore how students can be made more aware of the different study techniques engaged by different modes of delivery. If the two halves of the course cannot be delivered in similar modes, then more attention needs to be paid to giving adequate preparation about these different modes to the students.
8) Encourage the use of peer review of teaching within the school. Student satisfaction surveys give only one dimension of the teaching quality on offer.

I am grateful to Associate Professor Clive Boughton (who taught the first half of the course, on Software Quality), Mr Pascal Rabbath (who taught the second half of the course, on Software Process), Dr Shayne Flint (the program director), and Dr Ramesh Sankaranarayana (Associate Director (Education) for the School) for their generosity of time, and their willingness to discuss all aspects of the course.

Assessment and Course Objectives Alignment

I am firmly of the belief that if learning objectives are set, they should be promulgated to the students at each and every opportunity. Students learn best when they can see where a learning activity is heading, and to do this effectively requires an understanding of the intention of each learning activity. This is reflected in the oft repeated advice about public speaking (which applies to every lecture): “say what you are going to say, say it, and then say what you have said” (Dale Carnegie).

Hence, lectures (and related notes) should have a published framework, assignments should link to lecture topics, and laboratory work to the published course objective skill sets. The first three levels of Bloom’s Taxonomy (Knowledge, Comprehension, Application) are strongly reinforced when students are able to make their own linkages between the concepts learnt and the objectives addressed.
So I was a little disappointed when I went looking at the learning management system (at ANU, a system
known as Wattle, based upon Moodle) for strong links into the course learning objectives. I think it would be
very useful to the students to at least have those learning objectives addressed by each section in the Wattle
page http://wattlecourses.anu.edu.au/course/view.php?id=12739 listed at the start of each section. Of
course, having a finer granularity of the learning objectives would assist in drilling down this process!1

The only connexion that I could find was via a link labelled “Course Outline”, which led to the handbook
entry for COMP4130. There the objectives are listed as:

On completion of this course, students will be able to explain and practice:

1) techniques for verification and validation of various artefacts that are typically produced during
the development of small to large software systems;

2) software process and measurement techniques which have been found to enhance the capability
and maturity of software development organisations.

Notice the emphasis upon “techniques”. For a 4th level course, this does not suggest any of the upper 3
levels of Bloom’s Taxonomy (Analysis, Synthesis, Evaluation). Reading through the lecture materials suggests
that this is a little unfair. Certainly there is a significant amount of attention paid to Analysis (for example,
in analysing the causal factors affecting software quality), and a fair amount of attention paid to Synthesis
(for example, in developing the correct resourcing level to match business requirements for quality software
development). To the extent that choosing between the various techniques requires some form of Evaluation
also addresses the 6th level of the taxonomy.

So the overall course content does substantially address all levels of Bloom’s Taxonomy. However, I would
argue that this is not reflected in the course objectives adequately. It might also explain why 2 of the students
interviewed misinterpreted some of the learning material content (see next section). It is worth noting that
the second half of the course (known as ‘Software Process’) has listed its own set of learning outcomes, viz.
(my Bloom annotations):

1) Define the principles and practices that are critical to a successful measurement program. (Knowledge)

2) Describe how to design and implement an effective measurement process. (Comprehension, Application)

3) Show how to adapt fundamental measurement disciplines to address unique management and tech-
nical information requirements. (Analysis, Synthesis)

4) Explain how to use measurement to drive decision making to achieve project and enterprise objec-
tives. (Evaluation)

That these are not reflected in the overall course objectives is a serious error in its own right; that the stated
course objectives do not reflect the course content is an oversight that must be addressed as soon as possible.

Student Responses

Parenthetical Note: The phrase “student responses” seems to be used in the guidelines for this review to mean
“student assessment submissions”, rather than the more normal usage of “student feedback comments”. I have
interpreted it in both contexts, addressing the latter in this section, and the former in the next section.

In terms of accessing student feedback, there are several types available: firstly, through the formal university
process known as ‘SELS’ (Student Experience of Learning Support), with a primary aim of quality assurance;
secondly through comments made in Wattle; and thirdly by direct interviews with students.

1 The web page http://www.ajhurst.org/~ajh/teaching/fit2070/2014/timetables/index.xml gives an
example of how this might be done.
The SELS feedback is not available at the time of writing, but from recall it did not give rise to any significant concerns not elsewhere identified. Likewise, the Wattle commentary and student forums tended to focus upon logistics and learning issue clarifications - no issues of teaching quality were raised, substantive or otherwise. Indeed, just 2 postings elicited any debate. The first was a set of missing files not correctly posted, and quickly fixed, while the second concerned a short discussion over an assignment extension, granted because of some lateness in delivering the assignment specifications. The period of delay appears to be two weeks, but there is some ambiguity here, and the (one) student’s claim of having a 4 week submission period reduced to 2 weeks is partially remediated by the lecturer’s offer of 26 days (only 2 days short of the original contract). This relative lack of replies indicates that students seem comfortable with course delivery and outcomes.

Not quite so with the student interviews, however. One difficulty with conducting this review late in the year was the fact that many students become unavailable once the semester has finished. The circumstances leading to this were due to factors not easily controlled, and it was deemed to be better to conduct the review as soon as possible, rather than to delay it further. However, this did mean that only 3 students were available for interview during the visit, and indeed, only one of them was a face-to-face interview, the other two being conducted as a (joint) Skype session. Whether the views of 3 students (out of 34) can be seen as significant is debatable, but 2 of the 3 raised one issue which does need to be addressed in forthcoming offerings. This issue concerns the structure and timetable of the delivery of teaching material. More on this later.

Apart from this issue, comments made by the students in these interviews reinforced the written feedback conclusions. One student praised the course as “investigative”, “problem solving” and in his view, covered software quality well, “through specification to testing”. He found the course to be of great value in his professional life, and was actively employing techniques he had learnt through the course. The other two students had more mixed reactions, stating that the course was “old-fashioned”. When quizzed, it turned out that these students felt that there was a little too much emphasis upon the history of software quality, and not enough upon “modern-day practice”. Opinions may differ on such approaches, but certainly in the view of the author, a little bit of history is no bad thing. “Those that forget the lessons of history are doomed to repeat them” (George Santayana, 1905)

One concern that came to light in these interviews was that the students did not know their student representative on the staff-student consultative committee. Given that there is an email address for each year representative on the course Wattle home page, one might argue that there were no issues of sufficient concern to prompt these students to find out who their representative was. Nevertheless, it is something that the school may wish to pursue, and explore ways in which the avenues of student feedback might be raised in the collective student consciousness. Feedback received during semester via Wattle commentary is particularly valuable in this respect, as it gives time for staff to respond to issues (and for current students to see and appreciate this concern for their welfare) in a way that end-of-semester feedback (such as SELS) cannot do.

**Benchmarking of Student Responses**

Student assessment material made available to this review included a number (8 out of 34) of student exam scripts, and the overall marking scheme. Inspection of the exam scripts and comparing the marking revealed no significant anomalies, however there were a couple of discrepancies within the marking structure offered. The most significant of these was an error in the examination marking scheme. Although the instructions quoted that the two sections (‘A’ and ‘B’) of the exam were each worth 40 marks, adding up the marks for each question revealed that the total for section B was in fact 30, not 40. When questioned about this, Dr Boughton admitted that this was an oversight, and suggested that Mr Rabbath had likely marked the section out of 30, and then scaled it to 40. Mr Rabbath was not available to confirm this. In any event, the two sections of the exam appear as marks out of 50 in the final result tally sheet, so they will have been scaled anyway. The fractional marks recorded do seem to confirm this. The largest discrepancy between the two sections of the exam was 11.5 marks (23%), and most (28 out of 34) were 7.5 marks or less (15%).

The error of overlooking the marks totals in the examination paper indicates that the paper was not adequately proof-read. A number of universities have a formal process of moderating all examination papers, and if ANU is not doing this, or is not pursuing this more rigourously, then it is suggested that attention to this detail should help to avoid such solecisms in future.
There were two assignments, with assignment 1 based upon the Quality section of the course, and offered in two parts, each marked out of 100. Results for assignment 1 were consistent, with the average mark for part 1 being 78%, and for part 2 being 73.1%. Details of assignment 2 were not available, but the results were still consistent, at a slightly higher average of 80%.

This gave final grade distributions at HD:4, D:19, Cr:7, P:3, and N:2; much as to be expected with a final year course where the cohort of students is somewhat filtered by the earlier years. This is consistent with the author's experience of final year cohorts. Individual scripts examined suggested no cause for concern in the benchmarking of this cohort against other advanced level cohorts.

Benchmarking the student assessment therefore suggests no significant alterations other than normal evolution of assessment material for this course, such as occurs from year to year anyway. A perhaps minor improvement would be to endeavour that the need for scaling is reduced by making each assessment component worth its weight in marks. This gives a clearer perspective to students, and helps to avoid errors such as the misalignment of marks in section B of the examination.

**Teaching Modes**

The student interviews raised one significant structural issue with the delivery of the course. This was that the two halves of the course content were delivered by different lecturers, using different modes of delivery.

The first half was delivered in normal lecture mode of an hour and a half on Thursday afternoons at 1400 hours. These lectures were given by Dr Clive Boughton, and were followed immediately by a tutorial session of an hour and a half, with a notional 10 minute break between them. These lectures continued from the start of semester (19 Feb 2015, being the first Thursday of the semester) until the mid-semester break, starting on Monday, 6 April 2015, immediately after Easter, giving a sequence of 7 weeks of lectures and tutorials.

The second half of the course was delivered in an intensive mode by an external lecturer, Mr Pascal Rabbath, who comes to the course with extensive industrial experience in the use of CMMI (Capability Maturity Model Integration) and SCAMPISM (Standard CMMI Assessment Method for Process Improvement (Service Mark)). These lectures were delivered over a period of two and a half days, originally timetabled for 0900-1700 Wednesday 8 April 2015, 0900-1700 Thursday 9 April 2015, and 0900-1300 of Friday 10 April 2015. These dates and times are important, as there was a misunderstanding that led to the lectures being shifted by half a day, namely 1300-1700 8 Apr, 0900-1700 9 Apr and 0900-1700 10 Apr. Notice for this change was given very late - the exact timing of the notice is not clear, but the Wattle Forum reports that as late as the week before (1 Apr) the original timing was still in place. In any event, some students arrived on the Wednesday morning (0900 8 Apr) to find that they were early by 4 hours for the new timings. This caused some consternation, as there were reports that some students had organized job interviews for the Friday afternoon, and now were unable to keep them.

In discussion with Dr Boughton, he agreed that this state of affairs was unfortunate, but was due to circumstances beyond his control, which related to external time demands upon the sessional lecturer, Mr Rabbath, and which occurred only days before the intensive part of the course was due to start. While there were some aggrieved students most seemed to take in in their stride, as evidenced by the lack of specific comments directed at this unfortunate glitch. Indeed, what comments there were related more to the consequent extension of time allowed for assignment 2, based upon the Rabbath lectures. In this situation again, most students seemed more confused rather than upset, and there appeared to be no long-term disadvantage to the lecture mode delivery and subsequent assessment arrangements.

Given that it was seen as invaluable to involve Mr Rabbath in this way (and he made it clear he would be unable to continue to operate any other way), it would be good for the School to endeavour that people, both staff and students, are not caught unprepared in future, both in terms of the timing and the mode of delivery of the intensive part of the course. Dr Boughton assures me that students should have been well aware of the logistics of the intensive delivery, but the fact that for most of the students they had not previously been exposed to this mode (some had, but there was no evidence as to how they fared), it might be appropriate to explore ways in which students can be made more aware of the different pedagogical approach employed. One suggestion is to offer small components of other courses in similar intensive mode, and make these mandatory.
for all students. I acknowledge the difficulties in doing this, but I think the School does owe it to its students to prepare them as well as it might, particularly in light of Rabbath’s comment about it being a more realistic work place environment (see below).

**Academic Standards of Course**

It is difficult to assess the real academic standards of any course without also sitting through it. Nevertheless, attention to objectives, process and outcomes should give a pretty fair idea of the nature of a course, and it is on this basis that I make these remarks. As identified above, I was a little disappointed with the standard of setting out and articulating the learning outcomes with the course, but this should be easily corrected with some attention to the detail.

I have read through the lecture notes made available to students from both parts of the course, and find them to be of a generally excellent standard, both from the point of view of presentational quality, and of academic soundness. In any delivery of a teaching unit, much will depend upon the pedagogical approach adopted by the lecturer, and I had extensive discussions with both lecturers involved in the course.

Dr Boughton has maintained a strong allegiance to the changing standards of modern university teaching methodologies. Not only does he provide students with the modern resourcing deemed essential in today’s higher education, but he also provides commentary and guidance to students on how they should approach their study of Software Quality. I was struck, for example, at the fact that he not only made learning materials available through Wattle, the ANU’s adaption of the popular Moodle Learning Management System, along with the various feedback forums, assessment materials, and teaching timetables; but he also made available the Piazza system as an alternative to student feedback, commentary, and peer group learning. A significant difference of Piazza over Wattle is the fact that students can give feedback anonymously. The author’s experience is that anonymity does encourage feedback from students from other cultures where lack of deference to a teaching instructor is seen as impugning the instructor’s authority.

Mr Pascal Rabbath, in part due to his transient presence on campus for the second half of the course, had given a lot of thought to the delivery and assessment components that he offered. He argued that the intensive mode of delivery allowed better coverage of material, as it would flow in a continuous fashion across the 4/8 hours of each day, and would not require much revision from topic to topic as they were covered. As well, his professional obligations precluded him from adopting a slower-paced delivery, to the extent that he thought 5 half days would not be nearly as effective as 2 and a half days. He commented that such intensive mode delivery was more akin to the real world of workplace learning, and was therefore an important experience for students.

On the other hand, my thoughts were that a slower delivery would give the students much needed time to reflect upon the material of each day, and this was echoed by the comments of those students interviewed. Nevertheless, my experience with students is that they may not be aware of the value of such reflection, and often skip it once outside the classroom. “I’ll catch up with that another time” would be a common rejoinder.

Rabbath’s view on assessment was also interesting. He argued strongly for multiple choice questions, but his section of the exam did not include any traditional multiple choice questions. I may have misunderstood his arguments for being prospective, rather than retrospective, for he was certainly conscious of the need to design MCQ papers carefully, to ensure that the correct form of distractors is maintained, and acknowledged that careful design require more preparation than the more descriptive type of answers. He also acknowledged that flexibility in setting examination papers was important, to allow for proper alignment in measuring the learning outcomes. He would have no argument with me on this score.

**Specific Comments**

I am well aware of the political drivers in the use of devices such as the SELS student feedback mechanism, and here, as elsewhere², I have professional misgivings about their use. Student evaluations are all very well, but should not be used in isolation. Just as significant are peer reviews, and external reviews (such as this report).

² [http://ajhurst.org/~ajh/research/seminars/PeerReview-caulfield.pdf](http://ajhurst.org/~ajh/research/seminars/PeerReview-caulfield.pdf)
Resourcing issues, such as the cost of external reviewing, do colour the choices available to universities, so approaches such as undertaking external reviews where SELS-type student responses indicate some potential problems, are warranted. But treating student surveys are a primary mechanism for determining teaching quality is not a sound process, as the following quote (from an internal Monash memorandum by A.J.Hurst and C.Kopp, 2010) suggests:

... teaching surveys are presented as part of a teaching quality measurement mechanism, which implicitly represents a belief that student perceptions of teaching quality are a useful measure of actual teaching quality.

There is considerable literature on teaching quality, primarily authored in the United States, which identifies academic achievement of students as the principal measure of teaching quality. In fact some longitudinal studies performed in the US have attempted to identify teaching staff of high quality by explicitly tracking long term academic achievement of students after they have been taught by given teaching staff. These studies also indicate there is a very high correlation between student academic achievement, and the cognitive ability of teaching staff.

Other work showed that the correlation between student survey outcomes (“popularity polls”) and subsequent academic achievement was in fact negative! Teachers who made material popular in the early stages of a students study often had poorer learning outcomes in the longer term, even though they scored highly in the surveys. On the other hand, unpopular lecturers were often those who presented significant learning challenges to students, who then proceeded to do well in later years. It would seem that dumbing down material to make it popular and easily digestible gives students a false sense of security in their abilities, and they subsequently find difficulty when more profound ideas and concepts are presented.

It is beyond the remit of this report to make particular recommendations on these issues to the school. However, it is worth bearing in mind that teaching quality is an elusive goal that requires due diligence to exploring as much evidence as possible. Where conclusions are drawn, such as in this report, the limitations of the evidence examined must be borne in mind.