

A Certificate in Computing and Communications Technology at Level 4 (CCCT4)

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Abstract

Enrolments for the old one-semester Level 4 Certificate in Information and Communications Technology (ICT) were waning, students coming from Level 3 complained about repetition at Level 4 and a restructure required that all courses at Waiariki Institute of Technology now needed to be one semester long and worth 15 credits. An innovative programme was required. One that was challenging and interactive, giving students a taste of cutting edge technologies, while still retaining the basic computer concepts required at this level.

A new one-year, 120 credit certificate was devised that encompassed the NACCQ Certificate in Computing qualification, for those who wanted to study at Level 3, but also allowed for further advanced students to study some more exciting Level 4 options. Two compulsory courses at each of Level 3 and 4 constituted half of the programme, with the other 60 credits coming from options.

Students were given freedom to choose their options and the order in which they wanted to study those options. This gave rise to some timetabling issues.

1 Background

Waiariki Institute of Technology (Waiariki) had been running the National Advisory Committee for Computing Qualifications (NACCQ) programmes Certificate in Computing Level 3(CIC) and Diploma in Information and Communications Technology Level 5 (DipICT5) in its many incarnations over a number of years.

In 2003 Waiariki franchised Unitec's Bachelor of Computing Systems then two years later dropped the NACCQ Level 5 programme, due to falling rolls and the inability to keep two programmes afloat at Level 5. It subsequently became evident that there was a definite need for a programme of study to bridge the gap between school and degree study.

This invited paper appeared at the 21st Annual Conference of the National Advisory Committee on Computing Qualifications (NACCQ 2008), Auckland, New Zealand. Narissa Bayler and Linda Fraser (Eds). Reproduction for academic, not-for profit purposes permitted provided this text is included. www.naccq.ac.nz

Although Waiariki had the Level 3 course there was still a need for many of our students to have slightly more experience in computing before moving on to Level 5, and in particular degree study.

In 2004 a Level 4 one-semester certificate programme was developed using some of the less challenging Level 5 DipICT5 modules and adding a few local Level 4 courses. These modules were being run in eight week blocks with seven credits for each module, continuing with the mastery concept and an 80% pass rate in all courses to gain a 60 credit certificate. Some of the courses had good pass rates but there was a high level of drop outs. Not many students actually completed the qualification. Level 3 was still going well with almost all of those who completed the course gaining a certificate. The very best Level 3 students were able to go straight to the degree but most of them needed the Level 4 experience before being ready for undergraduate study.

Another problem was the repetition of word processing, spreadsheets, Access database and communications skills at both Levels 3 and 4. Students starting off at Level 4 needed to cover these skills but those coming from Level 3 found it repetitive and boring. Students complained that the gap moving from Level 3 to Level 4 was too big. This may have been because many of the modules used were Level 5.

By 2006 the Level 4 course was attracting small numbers and Waiariki had undergone a restructure. Computing left behind the old alliance with Business and moved in with Art and Journalism to become the new School of Computing Technology and Communications. There was a push to embrace some of the new technologies and being unshackled from Business meant that Computing could move into new directions in alliance with art, communications and technology.

Part of the restructure meant all new courses were required to be worth 15 credits and be taught over 13 weeks. Courses were to be taught by specialists and all courses were to be available to programmes across Waiariki. There was a buzz in the air and a move to new exciting era, and so the Certificate in Computing and Communications Technology at Level 4 (CCCT4) was born.

2 Rationale

There were four main parameters surrounding the development of this certificate qualification. The

qualification needed to be 120 credits over one year's full time study. To give it credibility as a 'hard core' computing course it needed to have some compulsory computing components other than office skills. The programme needed to cater for a wide range of interests whilst avoiding the trap of making too much compulsory. Prospective students were expected to be would-be technicians, future programmers as well as students who leaned more towards the arts. However, they all had the common goal of gaining more control of their computers and obtaining skills to make them good employees. Additionally the programme was required to provide cutting edge and relevant material reflecting current industry practice (Kaufman and Simons).

2.1 Waiariki's Aims for this Qualification

- To encompass the entire 60 credit CIC qualification for those who required it
- To use the Level 3 basic office skills and communications modules for all students so that these skills were taught only once over the span of the certificate
- To allow the more advanced students access to more options
- To have better success rates for Level 4 students
- To give students a good base knowledge which would stand them in good stead if they continued on to undergraduate study at Level 5
- To include modules that could be offered standalone for part time study or as part of another Waiariki qualification
- All courses had to be worth 15 credits
- Courses consisted of 13 teaching weeks

3 Content

Fortunately CIC modules are 5 credits each and so putting them together to make 15 credit courses was reasonably easy numerically, but putting the right modules together in 15 credit bundles required a lot of thought to decide which courses made the best bedfellows. There were the decisions as to the order in which the modules would be offered. Up until this time CIC modules had been delivered consecutively and there was some concern that students may not have enough computing skills to start off with four modules at the same time. Also under the previous regime, students enrolling in the 60 credit Level 3 certificate followed by a 60 credit Level 4 certificate underwent some repetition in the areas of basic office skills and communications and some had expressed dissatisfaction with this situation.. It was, however, still important that all students got a good grounding in basic office skills and communications. Since these would only be offered at Level 3 in the new certificate, these courses needed to be compulsory components for both Level 3 and Level 4 students.

3.1 Final Arrangements

The final arrangement and the order in which the modules are taught is shown below:

3.1.1 Desktop Computing Skills 1

- AP310 Word Processing
- AP330 Spreadsheets
- AP320 Databases (flat-file)

This course became compulsory for all students at Level 3 and Level 4.

3.1.2 Desktop Computing Skills 2

- AP350 Presentation Software
- AP340 Desktop Publishing
- AP370 Accounting Package*

3.1.3 Computer Technologies 1

- HS310 Hardware
- HS320 Software
- BS230 Mathematics for Computing*

3.1.4 Soft Skills and Communications

- EC320 Email and Internet
- BS320 Interpersonal Skills
- BS325 Professional Practice

This course also became compulsory for all students at both levels.

*After the first offering of this arrangement it was decided to replace the two modules marked with asterisks above. There is further mention of this in section 8.1 Second Thoughts

Students can enrol in the above four courses and complete CIC in one semester but most choose to enrol for a whole year to gain two certificates, one at Level 3 and one at Level 4.

4 The Level 4 Certificate in Computing and Communications Technology – 120 Credits

4.1 Core components

It was decided to make mathematics a compulsory component of the qualification but not wanting to devote a whole 15 credit course to mathematics it was combined with an introduction to programming in Visual Basic .Net and made a core Level 4 course for the certificate. The elements of multimedia and web development were becoming essential knowledge for anyone who aspired to be a computing professional, so a course combining these was created as the second compulsory Level 4 course. Along with the basic office skills and communications courses from Level 3, these made up the four compulsory

courses for the certificate leaving students to choose four options.

This certificate then consisted of up to 60 credits from the CIC and the remainder from the following list of courses. The learning outcomes are listed below each course title:

4.1.1 Multimedia and Web Development (sub modules IN500 and MA500)†

On successful completion of this course, the student will be able to:

- Describe recent developments and security issues which relate to the Internet and describe the concepts of Internet culture and etiquette.
- Describe the main features of current Internet components.
- Use current Internet tools in order to send mail and locate and retrieve resources.
- Create simple web documents.
- Describe the features of computer graphics, multimedia and web pages.
- Create presentations from graphics packages and authoring tools.

4.1.2 Programming Basics – includes Maths for Programming (sub modules PP490)†

On successful completion of this course, the student will be able to:

- Use appropriate (manual) mathematical techniques to calculate with and convert between different number systems.
- Describe different coding systems and design an appropriate coding system for a given situation.
- Solve realistic problems using mathematical equations in order to solve for different variables.
- Use logic principles, symbols and terms to develop and represent logic statements and to check the validity of such statements .
- Apply a number of different ways to document programme logic.
- Design structured logic solutions.
- Desk check the design using test data.
- Translate logic solutions into a selected programming language.
- Document a simple computer program.

†The two courses above have also undergone changes since their first conception. See section 8.1 Fine Tuning.

4.2 Optional Components

This certificate program was to be innovative in responding to stakeholder demand and the needs of other

programmes at Waiariki while retaining the true character of a genuine computing qualification.

The Computer Aided Design course was developed in response to requests from the public and also other disciplines within Waiariki. During development it became more of an introductory course in 3-D drawing than CAD but as such may eliminate the need for a full blown AutoCAD course at a higher level. (Murphy).

The practical parts of the Introduction to Robotics course was based on the Lego Mindstorms kits. These have proved to be very useful in helping to teach the basic structures in programming as well as giving student's insights into the use of sensors for controlling programs.

The inclusion of the Computer Technologies 2 course was essential. The programme needed to cater for those wishing to follow a career in the technical side of computing.

The Contemporary Technologies for the Mobile User was originally developed to cater for part-time students and older students who were not familiar with the current crop of mobile devices that are flooding the market. In practice younger students are also enrolling to fill in their gaps about current technologies.

To cater for the many students who are keen on multimedia the options of Graphic Design and Digital Photography were added. Once again these would hopefully also appeal to the part-time market.

4.2.1 Introduction to Robotics

On successful completion of this course, the student will be able to:

- Describe the various components of a robot.
- Build model robots.
- Use simple programming techniques.
- Programme robot movement.
- Describe current robotic devices.

4.2.2 Computer Technologies 2

On successful completion of this course, the student will be able to:

- Troubleshoot a range of simple computer hardware problems with various computer peripherals (input, output, processing and storage).
- Install and configure a range of contemporary computer network operating systems (client and server).
- Troubleshoot a range of simple computer network operating system problems with various system software utilities.

4.2.3 Contemporary Technologies for the Mobile User (Wired and Wireless Gadgets)

On successful completion of this course, the student will be able to:

- Name and describe current wireless technologies for voice/video communications and data capture, organisation and transfer.
- Demonstrate an understanding of the functionality and limitations of devices currently available for:
 - Photographs and videos.
 - Sound files.
 - Address book and contact information.
 - Scanning documents including OCR.
 - Other purposes may become current.
- Transfer of information between wired and wireless devices.
- Use the Internet for displaying data stored on mobile devices.

4.2.4 Computer Aided Design

On successful completion of this course, the student will be able to:

- Create simple graphical objects in a virtual three-dimensional space.
- Use appropriate software tools to apply a range of graphical techniques for a variety of simple graphical objects.
- Select, justify and use relevant graphic file and display formats for a range of different graphical objects.
- Deliver a completed presentation graphical solution to accepted industry standards for a prescribed written brief.

4.2.5 Digital Photography: Still and Moving Image

On successful completion of this course, the student will be able to:

- Describe the basic functions of a digital camera
- Use a digital camera
- Take good photographs
- Capture good images
- Describe how to print digital photographs
- Describe the relevant terminology associated with video photography.
- Develop a shot plan and use camera functions.
- Frame a shot and use good shooting techniques.
- Capture a video sequence.
- Edit a video sequence.

4.2.6 Graphic Design

On successful completion of the course the student will be able to:

- Understand and apply design principles
- Design using the design lifecycle
- Manipulate type to resolve design briefs
- Design using computer software and digital images

4.3 Unspecified Credits

15 Unspecified Credits from any Waiariki Level 4 course/s may be credited to this certificate in place of any of the above options.

5 Assessment

As the CIC modules had to be assessed by mastery, it seemed logical to create the new Level 4 computing courses using the same philosophy. As a guide to assessing mastery, 80% for each assessment constituted a Pass mark and 95% or above a Merit. Students needed to pass all the courses in order to gain a certificate. However, allowing achievement based courses from other disciplines, such as the Graphic Design course from the Arts department caused some difficulties. The problems arose when it came to creating the academic transcript. The transcript would have grades such as M for a Merit or P for a Pass alongside, As, Bs and Cs for achievement.

The CIC modules were part of an external qualification but the 15 credit courses were part of a Waiariki qualification and Waiariki's Academic Statute for 2008 allowed for achievement based and competency based courses only. The competency grades were a C for competent and a Y for not yet competent and the achievement grades were based on a set of percentages which translated a mark of 50% to a C grade. Theoretically a student could have a transcript showing a 'C' for competency in one course and a 'C' for a poor pass in an achievement based course. If a course is classified as achievement based then a mark of 80% mastery in CIC would translate to an 'A' grade on the transcript. This issue has yet to be resolved. It is mentioned here as it may well occur at other institutes and a joint solution to this problem may be eventually required. See 8.0 Conclusion and Recommendations

6 Timetabling Issues

The Certificate in Computing, Technology and Communications had to be available to students who enrol in February and those who enrol in July. Since CIC is a one semester programme, all the Level 3 courses needed to be offered twice a year. Similarly the compulsory courses at Level 4 also needed to be run each semester. This left six Level 4 options which were split so that three of the options were offered in the first semester and the other three in the second semester.

Students were initially given the choice to opt for any combination of courses across the two semesters but this became a timetabling nightmare with students having clashes across the Level 3 and Level 4 timetables. Fortunately, during the first offering, there were enough enrolment to offer two streams of the Soft Skills course and so by aligning its timetable carefully against the Level 4 options all students were able to attend their chosen classes.

For the next offering, each compulsory Level 4 courses will be timetabled at the same time as one of the two Level 3 options and the same will happen in the second semester, but with the alternate combinations.

7 Fine Tuning

In planning the new, there are always problems of time constraints and staffing considerations. Staff need to feel confident in tackling new courses and comfortable about embracing change, and developers need an in-depth understanding of all components. There needs to be wide consultation and an awareness of all considerations. In practice the process tends to have to be completed in a very limited time span and consultation on all aspects may be cut short. For these reasons it is not always easy to get it right first time. Time constraints mean that the paperwork needs to march on through the committee structures and there are always deadlines for prospectus entries and entry into the institutional calendar.

During the first iteration of this programme a review revealed one or two aspects that needed further consideration. Mathematics appeared twice, once in an optional course at Level 3 and once in a compulsory Level 4 course. Although most of the contents differ, it may be better to resolve situation. The accounting package module had always been offered when the school was allied to the Business school but it no longer seemed to be of such importance to our computing students at Level 3. The new communications tutor stressed the need for a written communications module. With the removal of AP370 (Accounting Package) it was possible to fill in the gap with EC320 (Email and Internet) and removing BS230 (Mathematics for Computing) allowed for the take up of another module in the Computer Technologies course. The obvious contender was HS330 (Networks).

7.1 Changes

The proposed changes will be implemented as seen below:

7.1.1 Desktop Computing Skills 1 (Compulsory)

- AP310 Word Processing
- AP330 Spreadsheets
- AP320 Databases (flat-file)

7.1.2 Desktop Computing Skills 2

- EC320 Internet and email

- AP350 Presentation Software
- AP340 Desktop Publishing

7.1.3 Computer Technologies 1

- HS310 Hardware
- HS320 Software
- HS330 Networks

7.1.4 Soft Skills and Communications (Compulsory)

- BS320 Interpersonal Skills
- BS310 Written Communication
- BS325 Professional Practice

7.2 Changes to Level 4 Courses

It was originally envisaged that the NACCQ modules, IN500 Internet and MA500 Multimedia Principles, would be embedded within the Multimedia and Web Development Level 4 course. The programme developers were then admonished for including Level 5 content within a Level 4 course. The course could have just been renamed as a Level 5 component of the Level 4 certificate but the Waiariki philosophy meant that this course should be available to other qualifications and as it is core for the certificate, so, even before the first offering, the sub modules were removed.

At this point there was only one DipICT5 module left in this certificate – PP480 (Programming Concepts and Tools). For consistency in the programme this sub module was also removed.

8 Conclusion and Recommendations

At this stage the new Certificate in Computing and Communications Technology is attracting a lot of interest and fulfilling the need for a preparatory course that stands between school and degree study. It caters for students who are not the most academically able at school and those whose studies were interrupted during their school years. Whilst giving students a broad base of computing skills this certificate offers a width of options that appeal to many different personalities and age groups.

8.1 Mastery

One of the most difficult problems to resolve has been that the assessment philosophy of mastery within this qualification. Those who have been using NACCQ qualifications over a long period are quite accustomed to the mastery concept which, for most, has involved:

- Apportioning set number of marks for each answer
- Adding up those marks
- Converting these to a percentage
- Then converting to a Pass or Merit depending on the percentage gained

It is purported that Unit Standards and the competency philosophy have not been entirely successful in the Computing sector and the success of the NACCQ qualifications, historically has borne this out. There is however the ongoing problem with mastery, of having to pass everything with at least 80% in order to come away with a certificate at the end of the year.

At this stage Waiariki is torn between supporting the CIC modules, the national qualification with its extra advantage of a national moderation system or going alone with this qualification using achievement based assessment. It is likely other institutes may be at this same crossroads.

8.2 Recommendation 1

That NACCQ consider the option of updating the CIC modules to make them available for achievement based assessment. This could be achieved by having two sets of module content for each module. One of these for mastery based and one for achievement based assessment.

8.3 NACCQ qualification

The KiwiQuals website currently lists eight certificates at Level 4 in Information Technology or Computing. The CCCT4 Waiariki qualification is the only one that combines Level 3 and level 4 into one, 120 credit, qualification. NACCQ has a few Level 4 modules which can be mixed in to a Level 5 diploma, but no Level 4 qualification. Many ITPs have are now doing the same as Waiariki and moving to a standard 15 credit course across all levels and disciplines. Waiariki would be happy to donate their new Level 4 15 credit course descriptors to NACCQ in the first instance as a start towards a bank of such courses that would be available to ITPs across New Zealand. A national moderation system could then be put in place and together ITPs could work towards a national collaborative Certificate at Level 4.

8.4 Recommendation 2

That NACCQ take this Waiariki qualification and use it as the basis for a new NACCQ national Level 4 qualification.

9 References

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