The Efficacy of Staircasing IT Programmes for the Benefit of Our Community

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ABSTRACT

In this paper, we describe the design of the Information Technology programmes at Whitireia Community Polytechnic. These include programmes for high school students, plus level 2 to level 9 programmes. This paper focusses on the students staircasing between the programmes. It describes the programmes at lower levels offered to upskill students so they are ready to enter the Bachelor of Information Technology, plus the programmes embedded within the Bachelor of Information Technology and Master of Information Technology used as both exit qualifications, and stepping stones toward the degrees. This paper presents an analysis of student enrolment data from 2012 to 2017, demonstrating how these programmes are used by students to take small steps to the higher qualifications in preparation to join the IT industry.

Keywords: Staircasing, Pedagogy, Information Technology curriculum

1. INTRODUCTION

The School of Information Technology at Whitireia Community Polytechnic has developed a set of overlapping staircasing programmes in Information Technology (IT) and Information Systems (IS) that enable students many points of entry into IT study and many points of exit with a range of certificates, diplomas and degrees from level 2 to level 9. These programmes provide the students with an agile approach to their tertiary study through the division of study in short qualifications enabling the students to reassess and adapt their plans as they progress through the programmes. Staircasing within programmes is supported as an effective mechanism for less accomplished learners to start their engagement in tertiary study (Frater & Grigg, 2015). The embedded staircasing design was first implemented in 2005, and has since been refined and expanded a number of times. The current design has been available to Whitireia IT students from 2012. This paper analyses student enrolment data from 2012 to 2017 demonstrating how these programmes are extensively used by students to take small steps to the higher qualifications.

2. WHITIREIA IT PROGRAMMES

Whitireia Community Polytechnic offers qualifications from level 2 to level 9 in IT and IS. Each programme is designed to allow students to staircase into higher levels of study, often students are able to transfer credits from one programme to another as a common set of courses has been used to build the qualifications.

In 2012 all the IT Programmes were reviewed and moved to a 15 credit course model. The programmes were aligned to the ACM IT Curriculum (Lunt et al., 2008) and the SFIA Skills Framework (SFIA Foundation, 2014). This was necessary to facilitate the ITPNZ accreditation (*ITP New Zealand Degree Accreditation*, 2015). In 2017, the four undergraduate certificates and diplomas have been replaced with four new programmes to meet the requirements of the New Zealand Certificate and New Zealand Diploma Programmes as required by the New Zealand Qualifications Authority Mandatory Review of Qualifications. These programmes utilise the pre-existing courses so have not altered the existing embedded staircasing design of the overall offering.

2.1 Whitireia Community

The programmes have been designed for the local community in Porirua. The Socio-economic Deprivation Index (Atkinson, Salmond, & Crampton, 2014) uses a variety of variables as a measure to interpret the socio-economic status of a community. Mawer, Arona, Meechan, and White (2017) report that there are some communities in Porirua that have high levels of deprivation while others have low levels. Within Porirua, there are no areas which have moderate levels of deprivation. The Porirua community has several characteristics on the Socio-economic Deprivation Index (Atkinson et al., 2014) that distinguish it from the national average. Porirua has a polarised profile where individual suburbs are either very high in the Socio-economic Deprivation scale or very low on the Socio economic Deprivation scale. The suburbs closest to Whitireia are very low on this scale (Mawer et al., 2017).

Mawer et. al. (2017) noted that 25% of Porirua's population is under 14 years old, this is 5% above the national average. Consequently there is a high dependency rate where individuals are dependent on someone else for provision of their basic needs. Porirua has a relatively large number of dwellings with six or more residents (7.6%). The high number of household residents may indicate a lack of affordable housing opportunities. Income is another issue, 24.5% of Porirua's population are in the low-income bracket. When compared with Wellington region, Porirua had a greater percentage of people who earned no income, 8.3% as compared to 7.0% (Mawer et. al, 2017).

The 2013 census ("Statistics New Zealand, Census of Population and Dwellings (Usual Residence data)," 2013) also showed that 35% of households in Porirua were reliant on some form of benefit from the government. The data showed that more people relied on the Domestic Purposes Benefit (now named Sole Parent Support) in Porirua than in the wider Wellington region. Unemployment is also an issue for the Porirua region, with an unemployment rate 9.3% in 2012, which is higher than the national average (Mawer et. al, 2017). The New Zealand unemployment rate is which is currently running at 4.8% ("Department of Statistics," 2017).

2.2 Staircasing in tertiary education

Staircasing has been identified as a critical mechanism to provide pathways for people who have not successfully met the entry criteria for degrees through their study in school. Staircasing facilitates progression from school to tertiary study (Frater & Grigg, 2015). Studies have reported that foundation and bridging courses need to be linked and contextual to be successful (Trewartha, 2008).

Staircasing models have been cited as a very good way to engage people outside the typical university student profile in tertiary education. This includes people from a broader demographic, wider socio economic backgrounds and those who did not focus on STEM subjects at school (Frater & Grigg, 2015).

The profile of the students enrolling in Whitireia programmes, include people with a wide range of backgrounds and age groups, the staircase programmes have been developed to cater to this broad spectrum of learners.

Access to flexible educational pathways that show a clear link to qualifications that have clear employment links provide an effective means to support learners (Higgins, 2010). Boyd (2006) describes a number of case studies where students who did not initially plan go on to a degree level study progressed to degree study. This study highlights the importance of having different pathways to degrees.

Nesbit and McCarthy (2007) reported that students staircasing through level 5 and level 6 diploma programmes did not do markedly worse than those that studied only the degree courses. However there was a 15% difference in the pass rates with the degree students performing better overall. In this case, the diploma programmes consisted of similar courses but not the same courses as the degree programme. Whitireia was also experiencing a similar phenomenon prior to 2005 as similarly the DipICT programmes were running with a transition pathway to the BInfoTech. The DipICT programmes had a different curriculum, pedagogy and assessment methods to the degree. This implies that the transition pathway has added an extra semester of study for the students. The transition students were dissatisfied and their pass rates were lower than those who studied in the degree pathway from the outset. The review in 2005, aimed to solve these issues, to improve the student experience and

success rates. The review in 2012 updated the curriculum expanding the breadth of the programme and aligned the programme with both the ACM Model Curriculum ("The Information Technology Discipline," 2008) and the Skills Framework for the Information Age (SFIA) (SFIA Foundation, 2014) to clearly link the programmes to the employment outcomes.

The staircasing programmes designed at Whitireia provide overlapping embedded qualifications to staircase students from a level appropriate to their educational background, clearly linked to employment outcomes and enabling students to achieve qualifications from level 2 to level 9.

2.3 Curriculum Design

The 2008 revision to the ACM IT Model Curriculum guidelines (Lunt et al., 2008) was used as a basis for the design of the Whitireia IT Programmes. This revision replaced the 2005 version of the curriculum and was reported to make it easier for students wishing to enter the IT Industry (Jackson, Hansen, Tang, Willemain, & Ellis, 2009).

One of the reasons for the 2008 changes included public demands for more applied technology education. An IT curriculum was described as requiring a pedagogical approach that is integrative and holistic rather than purely analytical to meet the public demands for a more applied technology curriculum (Said, Chaytor, et al., 2004).

The applied nature of IT is also emphasised by Ekstrom and Lunt (2003) who highlight the need for IT graduates to have a working knowledge of how technologies fit together and a deep understanding on how they integrate. The "hands on" pedagogy used for the delivery of Whitireia IT Programmes has been developed to emphasise the applied nature of the programmes.

In addition the move to revise the ACM Model curriculum in 2008 had been motivated by the expansion of the field with the introduction of new technologies and the emerging maturity of IT as a discipline (Said, McMahon, et al., 2004). These factors resulted in the 2008 Model Curriculum for IT reflecting the need for students to have a depth of knowledge in addition to a breath of topics. This curriculum is built on fundamental principles, which has five pillars and is capped with quality assurance and professionalism as shown in Figure 1.
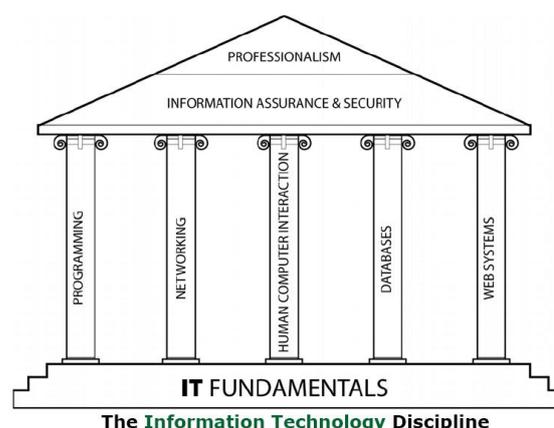

Figure 1. The above diagram depicts the academic discipline of Information Technology ("The Information Technology Discipline," 2008)

One of the reasons the Whitireia IT Programmes were based on the ACM 2008 Model curriculum was because it was

specifically designed to make it easy for graduates to enter the IT profession. This curriculum characterises IT as the most integrative of the computing disciplines. The IT graduate profile from this curriculum model says that the graduate will be "the one to select, create or assist to create, apply, integrate, and administer the solution within the application context" (Lunt et al., 2008).

The design of the degree programme also aligns with the requirements for ITP NZ Accreditation (*ITP New Zealand Degree Accreditation*, 2015). Accreditation through ITPNZ aligns the programme with the Seoul accord, as ITP is a provisional signatory of the Seoul Accord ("ITP Degree Accreditation," 2017). This accreditation was gained in 2015 and will facilitate the mobility of Whitireia graduates through the recognition of equivalency of accredited academic qualifications (Reif & Mathieu, 2009).

2.4 Programme Design

The Whitireia IT Programmes are designed as an overlapping staircase, with embedded entry and exit qualifications as shown in Figure 2. The lower level programmes are Secondary Tertiary Alignment Resource (STAR), level 2 and level 5 qualifications. The STAR programme offers the programming courses from the level 2 and level 5 certificate programmes.

There is one level 2 qualification and one level 5 qualification which cater to students who have not attained New Zealand University Entrance. Whitireia has offered the National Certificate in Computing (NCC Level 2) since 2013. This was replaced in 2017 with the New Zealand Certificate in Computing (End User Fundamentals) Level 2 (NZCC Level 2). The content and purpose has not changed significantly with the move to the New Zealand Certificate, as the new qualification utilised the existing courses. This programme is designed to build study, literacy, and numeracy skills through an introduction to IT as a professional field.

The next level, Certificate in Information Technology Level 5 (CertIT Level 5), was first offered in 2005 and has been updated three times then replaced in 2017 with the New Zealand Certificate in IT Level 5 (NZCertIT Level 5). This programme uses a holistic approach with a focus on core IT and technical skills, practices and tools to prepare students for further study.

Both these programmes are designed as a way for students to move up smoothly into the Bachelor of Information Technology (BInfoTech) or a level 5 diploma. At Whitireia. students who staircase into the BInfoTech from CertIT Level 5 gain 15 cross credits towards their degree as a result of overlapping courses between these programmes .The Whitireia Diploma in IT Level 5(DipIT Level 5) has been offered since 2005. It was updated in 2017 to the New Zealand Diploma in Information Systems Level 5 (NZDipIS Level 5). The Whitireia Diploma in IT Level 6 (DipIT Level 6) has been offered since 2005, and was updated in 2017 to the New Zealand Diploma in Information Systems Level 6 (NZDipIS Level 6).

The BInfoTech at Whitireia is a three year, full time programme designed to produce graduates who have a good grasp of the fundamental principles and theory of Information Technology, a familiarity with technologies commonly used in organisations, and the ability to learn new skills in a rapidly changing environment.

The BInfoTech is part of a group of programmes that are overlapped to assist students to staircase from level 2 study to Masters. Students can gain entry into the programme from NCC Level 2 (now NZCertComputingL2), CertIT Level 5 (now NZCertIT Level 5) or New Zealand University Entrance

as defined by the New Zealand Qualifications Authority (NZQA).

In addition to the above, students may gain entry into the BInfoTech from the DipIT Level 5 and Level 6 (now NZDipIS Level 5 and Level 6). While these are independent programmes, they also serve as exit qualifications within the BInfoTech for Students who wish to exit the programme with a DipIT Level 5 or Level 6 (now NZDipIS Level 5 and Level 6). All courses are able to be credit transferred between the diplomas and degree, some courses may be credit transferred between the Level 5 Certificate, and the BInfoTech.

The Graduate Diploma in Information Technology (GradDipIT Level 7) is another programme that runs in conjunction with the BInfoTech. This is a one year (full time) programme for those who have completed a degree from related disciplines or have equivalent Industry experience.

At postgraduate level (level 8 and 9), Whitireia offers a range of overlapping programmes that BInfoTech students can staircase to. These includes:

- Postgraduate Certificate in Information Technology (PGCertIT Level 8)
- Postgraduate Diploma in Information Technology (PGDipIT Level 8)
- Master of Information Technology (MIT Level 9)

The PGDipIT overlaps with the level 7 courses in the BInfoTech allowing credit transfer between the two programmes. All three postgraduate programmes have the same pool of level 8 courses allowing credit transfer between the three programmes. See Table 1 show the transfers of credits allowed from one level to the next level.

Table 1: Table showing the credit transfer from one level to the next

NCC L2 to	CertIT L5	0%
CertIT L5 to	Dip/Degree	15 credits
DipIT L5 to	BInfoTech	100% of credits
CertIT L6 to	BInfoTech	100%
GradDipIT to	BInfoTech	100%
BInfoTech to	PGDipIT	30 credits
PGCertIT to	PGDipIT	100%
PGCertIT to	MIT	100%
PGDipIT to	MIT	Up to 105 credits depending on the PG Dip papers
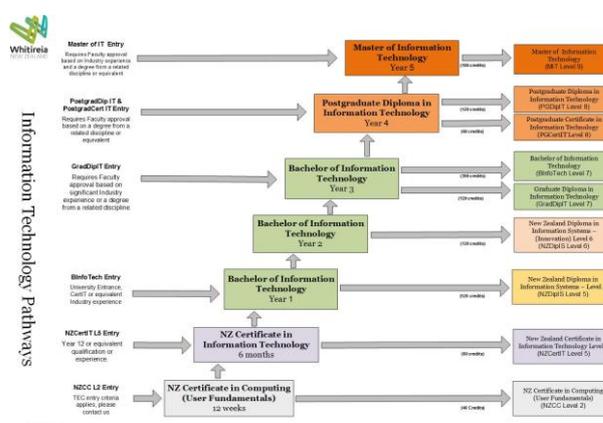
Figure 2. Whitireia Information Technology Pathways (see Appendix A for readable version)

3. METHOD

Data for this study have been extracted from the Whitireia enrolment system. All enrolments in IT Programmes at the Porirua Campus from 2012 to 2017 were extracted. The data for 2017 is estimated for the programmes that have not completed enrolment as at 31 July 2017. The data was saved into individual spreadsheets, then Microsoft Excel has been used to analyse the data, to identify the students who have enrolled in multiple IT Programmes during this period. The year 2012 was chosen as the first year for this study as that was when the last significant changes were made to the programmes. Data for the Level 2 programme and postgraduate programmes were not available prior to 2013.

4. STUDENT PARTICIPATION

The lower level programmes (Certificate Level 2 & Certificate Level 5) attract many students with a wide age range and diverse ethnicity. The design of the fee free level 2 programme allows students to investigate a broad range of technologies while learning study skills and improving literacy and numeracy skills, before committing to student loans. The programmes attract students with modern technologies and a broad introduction across the IT field, with hardware, programming and digital media using innovative technologies such as Android devices. The desire of students to choose a course that will allow them to continue onto higher level IT education is demonstrated by the number of students that continue on and enrol into higher level courses.

Data shown in Table 2, indicates that students progress through the programmes with 29.3% of the level 2 students staircasing into a higher IT qualification and 52.3% of the level 5 Certificate students staircasing into a higher level IT qualification and transferring credits to the higher level programmes.

Table 2: Students enrolled in Lower, Higher and Embedded Programmes

Programme	Previously enrolled (%)	Subsequently enrolled (%)	Previously enrolled embedded (%)
STAR	-	7.1	-
NCC L2	-	29.3	-
CertIT L5	12.9	52.3	-
DipIT L5	50.0	49.1	50.0
DipIT L6	70.6	47.1	0
BInfoTech	45.7	3.5	45.4
GradDipIT	3.4	3.4	3.4
PGCertIT	10.0	20.0	-
PGDipIT	9.4	10.9	9.4
MIT	65.0	-	40.0

A high number of students at Whitireia staircase through from the lower level programmes to enrol in the BInfoTech, with 45.7% of the BInfoTech students coming from a lower level IT Programme transferring their credits. In addition 45.4% of the BInfoTech students study an embedded qualification which is used for credit transfer to their BInfoTech qualification.

Table 3: Number of enrolments in other programmes

Programme	Number of other programmes students enrolled in (%)		
	1	2	3
STAR	5.9	1.2	0.0
NCC L2	16.3	10.9	2.2
CertIT L5	42.6	15.6	1.2
DipIT L5	44.9	27.6	2.6
DipIT L6	23.5	58.8	5.8
BInfoTech	33.0	14.2	1.1
GradDipIT	5.1	1.7	0.0
PGCertIT	30.0	0.0	0.0
PGDipIT	7.8	6.3	0.0
MIT	30.0	35.0	0.0
Overall	24.7	17.1	1.2

The postgraduate qualifications are showing a similar trend, with the PGCertIT and PGDipIT providing staircasing qualifications to the MIT. The data is also showing staircasing from the BInfoTech and PGCertIT into the PGDipIT. The PGCertIT and PGDipIT were first offered in 2013 and the MIT first offered in 2014 leaving a few years of data to demonstrate the use of the staircasing. The data show 10% and 9.4% of the PGDip students studying a lower level qualification before enrolment in the postgraduate diploma and 20% of the postgraduate certificate students going on to enrol in a higher qualification. In addition 10.9% of the postgraduate diploma students have progressed to the Masters, with 65% of the Masters students coming from a lower level IT qualification. In addition 40% of the MIT students have studied embedded programmes and are eligible to credit transfer courses from these embedded programmes. Only 9.4% of the postgraduate diploma students have studied embedded qualifications eligible for credit transfer.

Table 3 shows the number of additional IT Programmes students have enrolled in by programme. Overall 24.7% of IT students enrol in one additional programme, with Diploma in IT Level 5 students having the highest percentage of students who enrol in one additional programme. However only 17.1% of students enrol in two additional programmes, and Diploma in IT Level 6 students have the highest percentage of students, 58.8%, who enrol in two additional programmes. This analysis show that only 1.2% of students enrol in 3 additional programmes with Diploma in IT Level 6 students having the highest percentage in this group.

DipIT Level 5 and DipITLevel 6 programmes also have the highest percentage of students who enrol in lower level programmes as shown in Table 1. This demonstrates that students are effectively using the staircasing pathways to advance their study.

The number of students has steadily increased since 2012 as shown in Figure 3. The exact mix of students enrolled at each level has fluctuated each year. Some cohorts appear to be more hesitant than others and appear reluctant to commit to programmes that take longer than one year. Figure 3 shows the enrolments across all Whitireia IT Programmes by year from 2012. The enrolment figures for 2017 contain estimates for the programmes that have not completed enrolment for the year as at 31 July. However, the percentage of local students enrolled in the Whitireia IT programmes since 2013 has remained in the 80 to 90% range, as shown in Table 4.
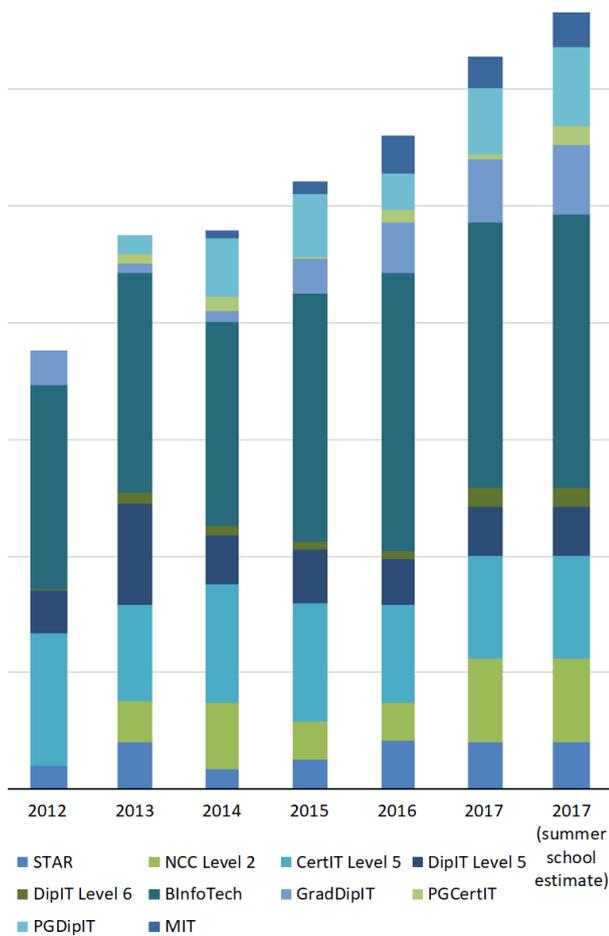
Figure 3. Enrolments in all programmes per year

Table 4: Percentage of students who are Local

	Total Local	Total Int	EFTS	Dom %
31st Dec 2013	108.99	11.67	120.6	90.37%
2014	124.33	25.54	149.87	82.96%
2015	123.96	29.22	151.93	81.59%
2016	135.17	32.65	159.83	84.57%
As of Sept 2017*	122.8	31.25	144.05	85.25%

*More students will be enrolling for Summer school

5. DISCUSSION

These programmes provide the Whitireia students with an agile approach to their tertiary study through the division of study into short qualifications. This enables students to reassess and adapt their plans as they progress through the programmes.

Efficacy means power or capacity to produce effects (Oxford English, 2017). One desired effect of the staircasing programme design, was to provide a pathway for students who do not have the academic background to be eligible to enter the BInfoTech. This pathway is provided through certificates and diplomas that act as stepping stones into the Degree. The data analysis has demonstrated that the design of the Whitireia IT Programmes has enabled these students to

staircase through to the BInfoTech. This is shown by percentage of BInfoTech students in this study who enrolled in lower level IT Programmes at Whitireia before enrolling in the BInfoTech which is 45.7%, and the percentage of the BInfoTech students who have enrolled in embedded programmes who are eligible for credit transfer to the BInfoTech which is 45.4%.

This paper identified that the learner staircasing strategy encourages learners, who do not meet entry requirements to degree qualifications can start their academic journey with short low level qualifications. They can then continue their academic journey often through multiple steps into a degree and postgraduate study.

With a student body comprising between 80% and 90% local students who are continuing to enrol in higher levels study, these programmes are positively contributing to the local community, as measured by the Socio-economic Deprivation Index measures, through the higher education levels being attained and increased employment opportunities available.

6. FUTURE WORK

This study only investigated 5 years of data, and in some cases less, as not all of the programmes have not been running for 5 years. The 2017 data contains estimates for programmes which have not completed enrolment as at 31 July 2017 as enrolments for 2017 were incomplete at this time the data was collected.

A student would need at least 5.5 years to complete all the programmes from level 2 to level 9, and longer if they start with the STAR Programme. The STAR Programme consists of two courses one in term 1 and another in term 2. Some Schools enrol students in these courses one per year. If a student takes 2 years to complete the STAR Programme and they then completed each IT qualification in the minimum time possible, enrolling in them consecutively without a break, a student will need 7.5 years to complete the entire programme from level 2 to level 9.

Expanding the number of years covered in the study will allow a more comprehensive analysis of the student's staircasing through the programmes, as students who studied IT Programmes prior to 2012 would be fully included in the analysis. A number of students who have enrolled in the Masters actually started their study in IT at Whitireia much earlier than 2012 and this is not reflected in the data analysed for this paper.

This study only included IT programmes, at the Whitireia Porirua campus. It would be valuable to ascertain whether other Whitireia programmes are used for staircasing into these programmes or and whether the IT programmes are used to staircase to other programmes.

Repeating the study at other Whitireia campuses and other institutes, with a similar programme design, will give insight regarding the experience and impact in other communities.

Future work should also include investigating the outcomes for students from these programmes using graduation and employment data.
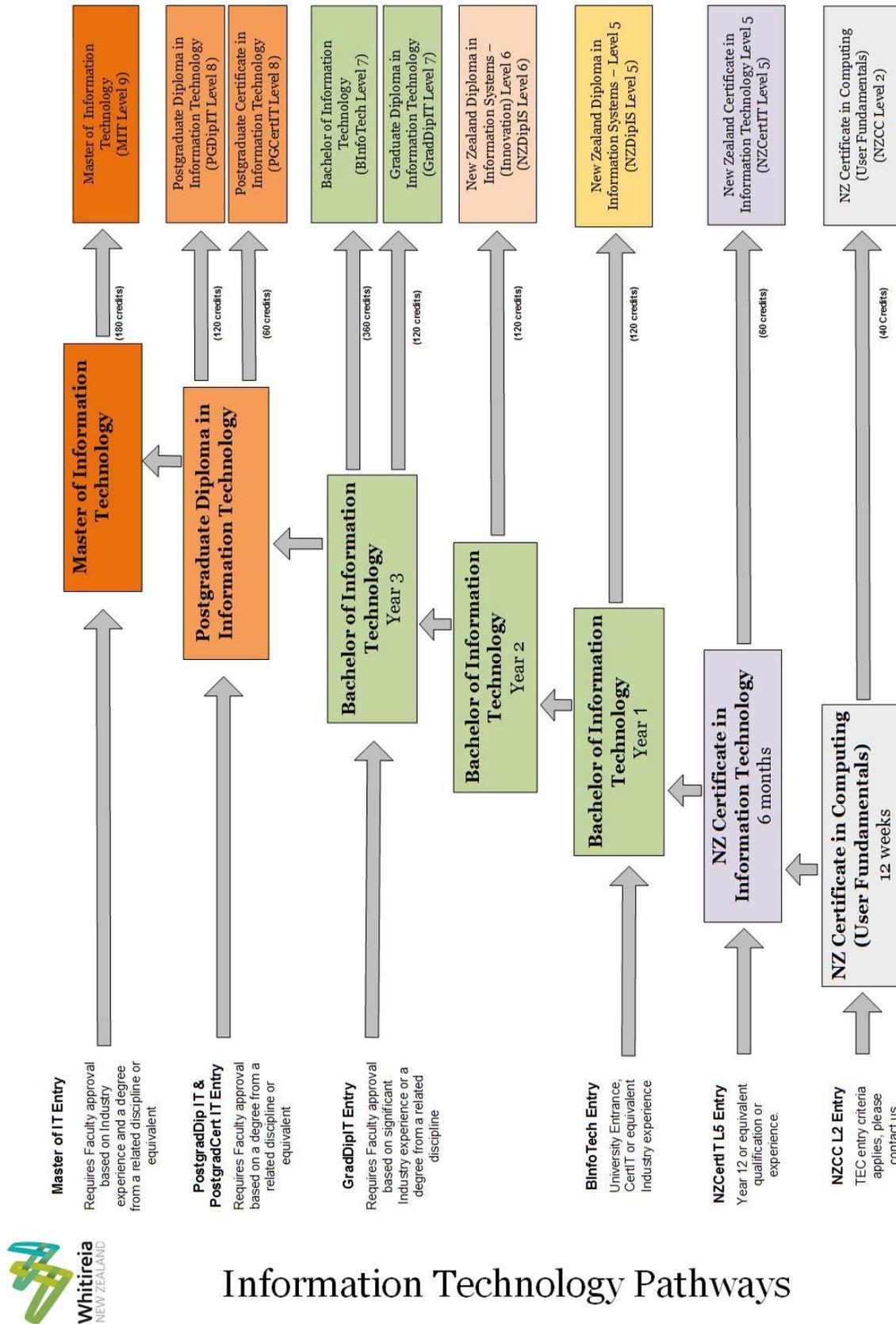
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Information Technology Pathways

Whitireia
NEW ZEALAND

Updated 17 Aug 2017

S:\FBIT NEW1 Faculty Administration\IT Pathways\2018

Master of IT Entry
Requires Faculty approval based on Industry experience and a degree from a related discipline or equivalent

Master of Information Technology

(180 credits)

Master of Information Technology (MIT Level 9)

PostgradDip IT & PostgradCert IT Entry
Requires Faculty approval based on a degree from a related discipline or equivalent

Postgraduate Diploma in Information Technology

(120 credits)

Postgraduate Diploma in Information Technology (PGDipIT Level 8)

(60 credits)

Postgraduate Certificate in Information Technology (PGCertIT Level 8)

GradDipIT Entry
Requires Faculty approval based on significant Industry experience or a degree from a related discipline

Bachelor of Information Technology Year 3

(360 credits)

Bachelor of Information Technology (BInfoTech Level 7)

(120 credits)

Graduate Diploma in Information Technology (GradDipIT Level 7)

Bachelor of Information Technology Year 2

(120 credits)

New Zealand Diploma in Information Systems – (Innovation) Level 6 (NZDipIS Level 6)

BInfoTech Entry
University Entrance, CertIT or equivalent Industry experience

Bachelor of Information Technology Year 1

(120 credits)

New Zealand Diploma in Information Systems – Level 5 (NZDipIS Level 5)

NZCertIT L5 Entry
Year 12 or equivalent qualification or experience.

NZ Certificate in Information Technology 6 months

(60 credits)

New Zealand Certificate in Information Technology Level 5 (NZCertIT Level 5)

NZCC L2 Entry
TEC entry criteria applies, please contact us

NZ Certificate in Computing (User Fundamentals) 12 weeks

(40 Credits)

NZ Certificate in Computing (User Fundamentals) (NZCC Level 2)