Implementing and Evaluating a Framework for Industry-Focused ICT Education

Alaa Aljanaby
Faculty of IT
Aspire2 International
Auckland, New Zealand
alaa.aljanaby@aspire2.ac.nz

Md. Athar Imtiaz
Faculty of IT
Aspire2 International
Auckland, New Zealand
athar.imtiaz@aspire2.ac.nz

Chris Mitchell
Director
Axcel Institute
Auckland, New Zealand
chrismitchell@axcelinstitute.com

ABSTRACT

The fundamental relationship between industry and education affects the development and delivery of tertiary level programmes. Successful tertiary programmes incorporate industry-focused components in their delivery and involve industries as key stakeholders. This paper describes a framework for industry-focused ICT tertiary programmes based on the experience of developing such a programme. Additionally, this approach has been measured in terms of students' performance, satisfaction, perceived benefit and employability. The Graduate Diploma in IT (GradDipIT) at Aspire2 International has been considered as a case study.

Keywords: ICT education, industry-focused education.

1. INTRODUCTION

ICT industry-focused education programmes go beyond just offering a suite of online courses or traditional learning materials. Industry-focused programmes should offer a complete set of learning resources aligned to a predetermined curriculum with practical activities and assessments, as well as collaboration platforms with industry and learners' exposure to the industry certification (Herrera & Selinger, 2014; Lucas, Spencer, & Claxton, 2012).

The Graduate Diploma in Information Technology (GradDipIT) currently being delivered by Aspire2International was first offered in 2002 by Information Technology Institute Ltd (ITI), a PTE created for the specific purpose of delivering this programme in response to the stated needs of industry. In 2000 there were a limited number of graduate diplomas in IT offered by New Zealand universities. These were usually structured as a one year (120 credit) programme comprising papers from a selection of stage three (level 7) undergraduate papers and available to those with a degree in areas other than IT.

The views expressed by Peter Nathan, the President of the New Zealand Software Association (NZSA) in 2001, reflect the view of many other employers at that time. *"We find that if we take students straight from university it takes so long to make them have any value as employees"* (Middlebrook, 2002).

ITI's GradDipIT, approved in 2001 by the New Zealand Qualifications Authority (NZQA) and the newly created Tertiary Education Commission (TEC), was the first graduate diploma specifically designed to address industry needs at that time (Middlebrook, 2002).

The programme operated at ITI Campuses in Auckland, Wellington and Christchurch for two years from 2002 to 2003. ITI closed at the beginning of 2004 because, despite strong support from stakeholders, the business model was unsustainable. The intellectual property associated with the programme was purchased by Axcel Institute Ltd. and the

business model changed to enable Axcel Institute to offer the programme to other providers under a licence agreement, which it did from 2004. Since 2015 the programme has been provided by Aspire2International (formerly Ntec Tertiary Group) to international students under an exclusive licence agreement with Axcel Institute.

With more than 17-year history much has been learned in the process. Major learnings from the operation of the programme since 2002 are:

1. **Applied learning from Day 1**. Students need in-class projects to apply their learning of project management and systems development for the duration of the programme prior to their final project for an industry partner. Early attempts to have students move straight from classroom learning to industry projects proved problematic, delaying the success of the industry project and requiring a structure to apply a Systems Development Integration (SDI) set of courses across all three terms (SDI I, SDI II and SDI III)

2. **Entrepreneurs work best**. The initial expectation for some students was that they would undertake their project with a large multinational software and systems development company. However, the best projects are undertaken for start-ups and entrepreneurs. Senior managers in large companies are 'time poor' and have funds available to undertake approved projects. Start-ups and entrepreneurs are 'cash poor' and open to using and providing appropriate supervision for talent. Some projects being provided in 2017 are for entrepreneurs who starting their involvement with the GradDipIT with ITI in 2002.

3. **Short feedback loop.** Projects tend to be non-mission critical. Entrepreneurs are looking to try out new areas for future development. These future-focused projects provide academic supervisors and teachers with immediate feedback on what technical skills employers are looking for which can then be incorporated back into

the teaching programme. Student presentations of their projects informed staff and consolidated learning for new students.

4. **Finger on the pulse of industry**. Related to the short feedback loop is the ability to engage the industry advisory group who respect that all involved in the GradDipIT are open to their input and do not need to be persuaded to take note of their advice. This mutual respect leads to a virtuous cycle that further improves the relationships between all stakeholders

The GradDipIT implemented by Aspre2Interantional has not only continued to focus on the original industry needs but also the learning gained over the past 17 years. This paper focuses on the outcomes for stakeholders of the GradDipIT, with specific reference to delivery at Aspire2International since July 2015.

The rest of this paper is organised as follows. Section 2 describes a framework for ICT industry-focused education and how it has been used to develop the GradDipIT programme. The methodology used to conduct this research is described in section 3. Section 4 discusses the results of implementing the GradDipIT using the industry-focused framework. The conclusion is then presented in section 5.

2. A FRAMEWORK FOR INDUSTRY-FOCUSSED IT EDUCATION

Figure 1 (on the last page) shows a framework for industry-focussed education that has been used to develop the GradDipIT programme. The framework shows that the evidence-based course development begins with the needs of both industry and students (Domain 1). In Domain 2, the high quality design of the GradDipIT aims to meet these needs and in Domain 3 high quality provision ensures these needs are met. The effective combination of Domains 1 to 3 is integrated as 'evidence-based course development and delivery' and together lead to high quality outcomes for both students and industry (Domain 4).

The GradDipIT programme has been designed with three strands as follows

- GradDipIT Standard strand

  Candidates have degrees or equivalent in areas other than IT but want to transfer to an IT career without going back to square one.

- Internet Development and Digital Media strand

  Candidates have degrees or equivalent in IT and/or experience and want to build a career in this area.

- Mobile and Pervasive Technologies strand

  Candidates have degrees or equivalent in IT and/or experience and want to build a career in this area.

Table 1 shows the general structure of these strands. The core courses are system development integration courses that help the student to gain real experience by focusing on 'practice and integration' as the students apply what they have learned in other courses as part of a project. These courses are also preparing the students for the industry project in the final term.

In the final term students work in teams on real projects provided by IT industry partners. For students, the industry project gives them an opportunity to gain real IT-related experience while gaining their qualification whereas for employers, it enables them to access IT-skilled students to undertake projects and to 'try before they buy' if they wish to employ students beyond the duration of the project.

Table 1: GradDipIT Structure

Term 1	Strand-related course 1
	Strand-related course 2
	System Development Integration 1
Term 2	Strand-related course 3
	Strand-related course 4
	System Development Integration 2
Term 3	Industry Project
	System Development Integration 3

2.1 Acceptability of the programme

Support for the GradDipIT programme has been demonstrated by the feedback received from academics and industry experts, as summarised in Table 2 and Table 3 (below).

Table 2: GradDipIT Academic Reviews

Reviewer	Designation	Excerpts from response
Academic1, PhD	Head of School, Science and Technology of a New Zealand Institute of Technology and Polytechnic (ITP)	"The strength of the programme is the Industry Project which I believe will help and train the students to ease themselves into a real working environment."
Academic2, PhD	Head of Information Technology Programmes of a Private Training Provider (PTE) in New Zealand	"Employers find the industry project component of this type of programme useful and it helps the students find employment"
Academic3, PhD	Associate Professor at Faculty of Engineering and Information Technology at a university in Sydney, Australia	"There is certainly a market in Australasia for graduates from this programme I am pleased to see optional papers included that will bring some attention to bear on aspects of contemporary user interface design, such as Web and Mobile Human Computer Interaction."

Table 3: GradDipIT Industry Reviews

Reviewer	Designation	Excerpts from response
Industry expert 1	CIO at a leading software development firm with offices in NZ, Australia and UK	"I think extending the options from just traditional IT to include Internet and Mobile specialisations makes a lot of sense, and would appeal to industry." "We struggle to hire web developers who have the requisite programming skills so I think graduates from this course would have real appeal."
Industry expert 2	Senior manager at a leading recruitment firm in NZ	"The main development shortfalls we have in NZ are being covered. We have a need for a lot of niche development skills especially in javascript."

3. METHODOLOGY

Education research can be carried out in several ways, depending on the purpose of the research. Keeping in mind the aim of our research and that GradDipIT is an ongoing programme, we found action research to be the most suitable methodology for this study. Action research is widely used in educational research where the aim is to formulate a solution or guideline (Carr & Kemmis, 2003), as is the aim in our study.

Different researchers have defined action research in slightly different ways, however we adhere to the following definition by Zuber-Skerritt (1992): "Action research is defined as collaborative critical enquiry by academics themselves into their own teaching practice, into problems of student learning and into curriculum problems."

Our aim was to critically evaluate and reflect on the impact of GradDipIT programme on students. Hence, we used action research as it allows academics to reflect on their practices and evaluate the programme (Carr & Kemmis, 2003).

To measure our programme's effectiveness the following surveys were conducted:

1. Students' performance in the programme
2. The students' feedback regarding the course
3. Industry partners' feedback
4. Current students' perceived benefits of the course
5. Graduate employment survey

Surveys 1, 2 and 3 were conducted on students in the year 2016, thus they encompassed students in four of our terms. Survey 4 was conducted on the students from 2016 and the ones who completed in the first term of 2017. Survey 5 was conducted on our 2016 graduates.

4. RESULTS AND DISCUSSION

To show the effectiveness of the industry-focused learning approach adopted in developing and running the GradDipIT programme, data have been continuously and consistently collected about different aspects related to the programme. The data collection tracks issues in four main categories which are the students' performance, the learners' and industry partners' feedback, perceived learners' benefits and employability data.

4.1 Students' performance

Figure 2 shows the students' performance over the year 2016, These results are for 40 courses with 522 learners enrolled in these courses. The majority of the students' results were above the average, with about 80% gaining A's and B's. This is a clear indication that students have performed very well in their studies.
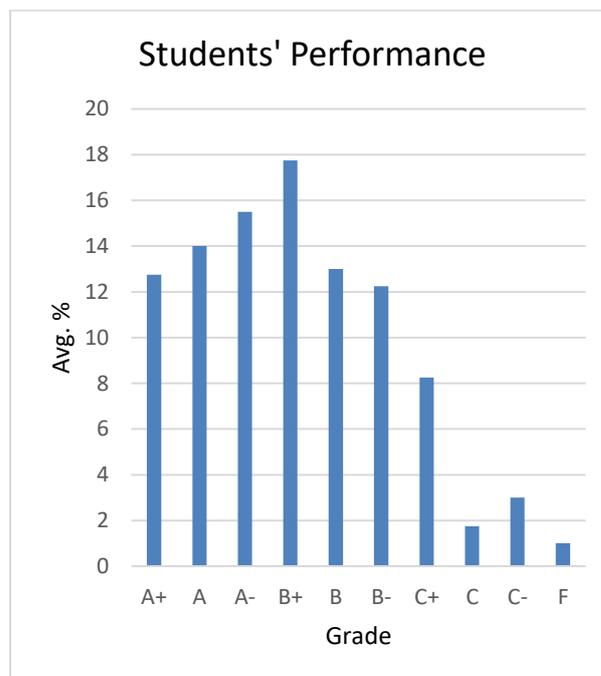

Figure 2: Students' Performance

Other achievements that demonstrate students' excellent performance over the year 2016 were that 20 students gained a variety of industry certifications such as Microsoft Technology Associate and Android Developer Certificate, 35 students participated in the Microsoft Student Accelerator programme and one student gained the inaugural Aspire2 Succeed Award. This award includes a significant cash prize and is granted to only one student among all Aspire2International graduates. This award is given to a student who has shown not only a high academic performance but also a clear contribution to the learning environment by going above and beyond what is needed. Additionally, one GradDipIT student was selected among 20 successful applicants from all New Zealand PTEs for the Bootcamp programme.

4.2 Learners and Industry Partners satisfaction

Gathering learners' and graduates' feedback is an essential and continuous process. Figure 3 shows the feedback gathered from 45 graduates. The feedback shows a high satisfaction of graduates about the programme with the overall rating of the content of the programme being 4.4 out of 5.
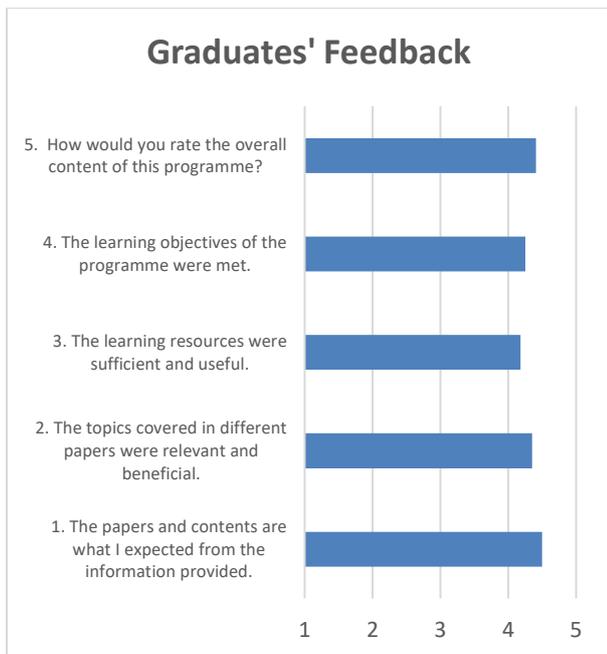
Figure 3: GradDipIT Graduates' Feedback

Feedback from the learners about the course delivery also shows a high satisfaction of the learners about the teaching and delivery methods used in the programme. Figure 4 shows that the ratings for all survey questions are above 4 on a 5-point scale.
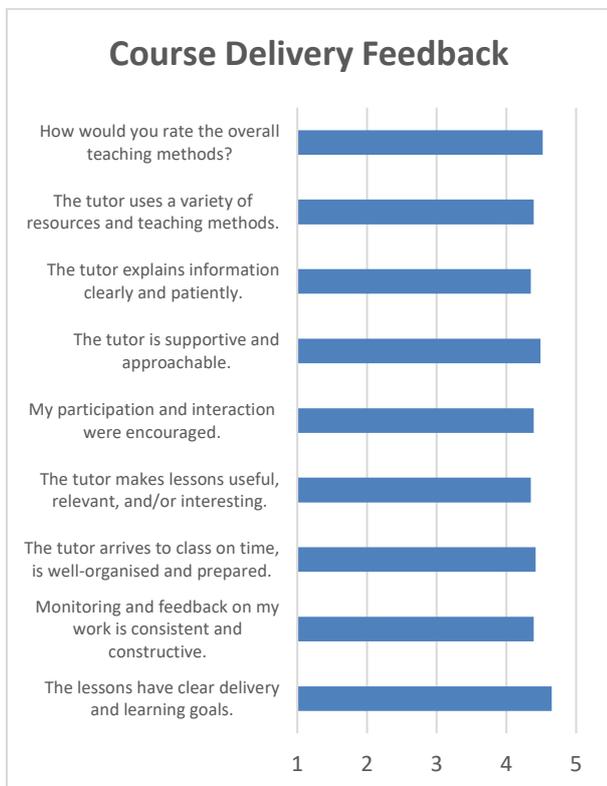

Figure 4: Course Delivery Feedback

GradDipIT students have worked on a number of projects for different NZ companies. The feedback received from our industry partners shows that they are highly satisfied with project outcomes and very confident that our graduates are work-ready. New companies are approaching us every term to provide us with new projects for our students to work on. Five students have been offered full-time employment directly with our industry partners after completing their industry project with them. Other students have got references from our industry partners that help them to secure a job. Table 4 summarises the feedback from three industry partners.

Table 4: Industry Partners Feedback

Industry Partner / Observer	Feedback
Industry Partner 1 Founder of IT company (Web Development and Data Mining)	Our company has had an ongoing working relationship with NTEC for the past 2 years. As the projects have progressed during the semester the students have all grown in confidence and ability producing very good work. I highly recommend these types of industry projects with the team at NTEC and it is also a great way to recruit new employees via the student projects.
Industry Partner 2 Founder of a Building Management System (BMS) company	We have done several industry projects with NTEC over the past 12 months and are very pleased with what has been achieved. Over the past 10 years we have done maybe 60 student projects across various PTEs and the mainstream Auckland universities and Polytechnics from Level 7 course projects right through to PhDs so have a very good feel for the likely outcomes and success rates. The results that we have seen from these NTEC projects is definitely in the top tier for us.
Industry Observer 1 Manager of UI/UX company	I have to say I was very impressed with the quality of the work that the students produced and having been in the academic world for a number of years, I can comfortably say that they were among the best I have ever seen.

4.3 Perceived Learners' Benefit (PLB)

The aim of this survey was to understand how our current students perceive the course they are undergoing. Mainly the aim was to answer the question: Do the students think GradDipIT will help them in their ICT career? To answer this question, we formulated questions PLB1 to PLB11 described in Table 5. Additionally, we added another question PLB12 which deals with further education. Questions PLB1 to PLB11 look into a students' self-assessment of the course with respect to two main points: industry exposure and job readiness (Culkin & Mallick (2011); Finch, Peacock, Levallet, & Foster (2016)). Our aim with the GradDipIT is to provide students with industry exposure while they are still studying. For this purpose, the students undergo a 14-week industry project. The results of the survey shown in figure 4 indicate show a positive response from the students and indicate that a majority of them

feel that they get adequate industry exposure while still studying. Additionally, questions PLB1 to PLB11 also measure job readiness. This is another of GradDipIT's objectives. We would like to equip our students with the best possible ICT education so that they are confident enough to hit the ground running as they enter the ICT industry. The results in figure 5 indicate that a majority of our students feel job ready.

Pathways: The ICT Graduate Schools at the University of Auckland and the University of Waikato invite applications from GradDipIT graduates directly into their Master of Information Technology (MInfoTech), confirming the academic quality in addition to employer commitment. Massey University has also agreed to invite applications from our graduates into their Master of Information Science and we are currently in the process of signing agreements with other NZ universities for entry into their postgraduate programmes. PLB12 indicates that student satisfaction with these further education pathways is high.

These positive results are encouraging; however, as can be seen from figure 5, some students gave a neutral reply to some answers and at least one student gave a negative answer. We will investigate these neutral and negative answers and see what and where our programme is lacking and we will then formulate a course of action to fill those gaps.
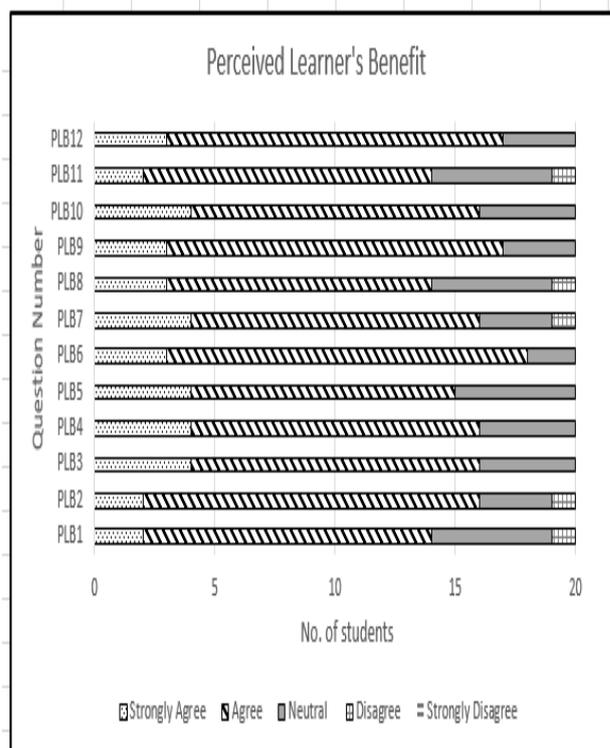
Table 5: Perceived Learners' Benefits Survey Question

Question Code	Question
PLB1	I believe that the Graduate Diploma in IT programme makes me IT industry ready
PLB2	I believe that the Graduate Diploma in IT programme provides me with the relevant technical skills that make me IT industry ready
PLB3	I believe that the Graduate Diploma in IT programme provides me with opportunities to improve my communication skills
PLB4	I believe that the Graduate Diploma in IT programme provides me with opportunities to learn and exercise team management
PLB5	I believe that the Graduate Diploma in IT programme provides me with opportunities for self-learning
PLB6	I believe that the Graduate Diploma in IT programme provides me with opportunities for research
PLB7	I believe that the Industry Project in Graduate Diploma in IT provides me with an opportunity to work on real world IT problems
PLB8	I am satisfied with the opportunity provided in the Industry Project to work with real clients
PLB9	I am confident that the Industry Project will help me improve my client interaction skills
PLB10	I am confident that the experience gathered in the Industry Project will help me at an actual workplace
PLB11	I believe that having an Industry Project as part of the course with real clients will increase my possibility of getting an actual IT job
PLB12	I am satisfied with the further education pathways available after the completion of my programme

Figure 5: Perceived Learners' Benefits

4.4 Employability

The data gathered from GradDipIT graduates show that the employment rate of students who graduated more than a year ago (T1 and T2, 2016) was an average of 88% (90% and 86% respectively). For T3 and T4 2016 graduates the complete data are not available as students still have their valid one-year job search visa.

Table 6: GradDipIT Graduates' Employability

Term	No. of Graduates	Employed	One year Job Search Visa Starts	Employed within the first 3 months	Employed within 3 to 6 months	Employed within Last six months
T1 2016	11	10	April 2016	4	5	1
T2 2016	22	19	July 2016	4	7	8
T3 2016	35	18	Oct. 2016	6	12	NA
T4 2016	10	4	Jan 2017	4	3	NA

5. CONCLUSION

This study has a unique significance in the New Zealand's ICT education context. The structure of the programme shortens the feedback loop between employers and Aspire2International as provider of the programme. Employers' requests for project

deliverables reflect the current and immediate future trends that are important for their future needs. The project requests are future-focused rather than 'mission critical' which provides a more supportive environment for students to learn. Industry feedback is invariably very positive.

The results of this study have confirmed that students performed very well and always above the average and they were highly satisfied with the knowledge and skills they gained. The employment data collected over a year showed that 88% of GradDipIT graduates have been employed in the year they completed their study.

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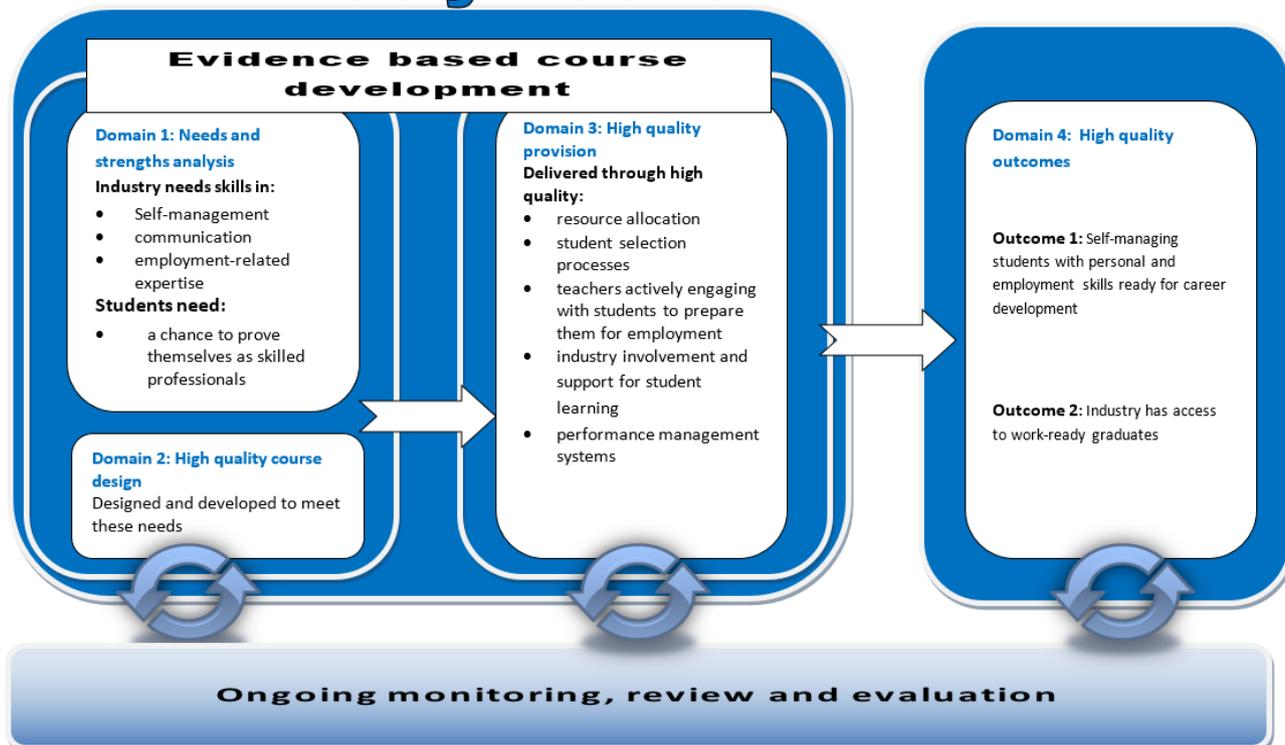Zuber-Skerritt, O. (1992). *Action research in higher Education: Examples and reflections*. London: Kogan Page.

Figure 1: ICT Industry Focused Framework