

Transformation of an Engineering Degree Program Suite – A Progress Report

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ABSTRACT: The increasingly competitive tertiary education market at the home front as well as Internationally, coupled with ever-decreasing government funding has led to the inevitable reformation of the high-cost and, at times and locations, low-demand engineering degree programs in many a university in Australia. The recent changes to the undergraduate and coursework masters program structures at Queensland's Griffith University are described herein in some detail. The negative effects of these changes especially in terms of market responses are analysed and remedial actions, identified. The problems and solutions discussed herein are peculiar to one university but the lessons learnt may be applicable to other institutions and in other times.

KEYWORDS: Engineering degree program, Degree structure reform, Griffith experience

1. Introduction

1.1 Griffith University System

Located in the southeast corner of the State of Queensland, Australia, Griffith University was founded on the Nathan campus in 1975. The Australian Labor Government implementation of the so-called Dawkins doctrine [1] in the 1980s had led to the amalgamation in various cities and regions around the nation of smaller universities with the institutes of technology or colleges of advanced education, to become bigger and purportedly more viable tertiary education entities. The then new and expanded Griffith University was formed by the Nathan campus joining with three older establishments all within the city of Brisbane, capital of Queensland, and a newer college of advanced education on the Gold Coast, the second largest city in the State and 80 km south of the capital or 25 km north of the New South Wales and Queensland border. The constituents of the five-campus University were

- Nathan
- Queensland Conservatorium of Music, South Bank (founded in 1957)
- Queensland College of Art, South Bank (founded in 1881)

- Mount Gravatt campus of Brisbane College of Advanced Education, Mt Gravatt (founded in 1969)
- Gold Coast College of Advanced Education, Gold Coast (founded in 1989)

In 1998 a new Logan campus which specialised in flexible delivery of non-laboratory based degree programs was founded in Logan City approximately half way between Brisbane and the Gold Coast.

As of mid 2008, the total number of Griffith students exceeded 37,000 with around 12,000 located on the Gold Coast, being the largest of the five campuses and around 10,000 at Nathan the founding campus.

1.2 Griffith Engineering

In the expanded Griffith University there were three schools of engineering on two campuses:

- School of Microelectronic Engineering (MEE) at Nathan
- School of Environmental Engineering (EVE) at Nathan
- School of Engineering (ENG) on the Gold Coast

As the names would indicate four-year Bachelor of Engineering (BEng) degrees and coursework masters, MPhil and PhD in Microelectronic Engineering and in Environmental Engineering were offered in the two respective Nathan Schools whereas Engineering on the Gold Coast offered BEng and postgraduate coursework and research degrees in Civil Engineering, Electronic Engineering and Coastal Engineering. There was also a BEng in Software Engineering offered at Nathan in the School of Information and Communication Technology.

The three Engineering Schools were run almost independently by three Heads of School each with a fully devolved student load-based budget [2]. There was obvious duplication of efforts for conducting two Bachelor degrees by two different Schools at Nathan.

The devolved budget funding model mandated each School to be responsible for all its expenditure including staff salaries. This model no doubt created the so-called silo mentality which aggravated the situation of duplicating staff efforts as all Schools strived to maximise their student loads by offering their own courses rather than outsource to other more appropriate Griffith Schools.

The Gold Coast School of Engineering on the other hand being the newest and with its much younger or more junior staff profile, under a financially stringent management thrived under the devolved budget system. The dominant Civil Engineering sector within the School grew from a handful of students in 1995 to become one of the larger Schools in Australia with over 500 students by 2005 [2].

1.3 Undergraduate Programs

The individually named BEng degree system had the advantage of being able to occupy a niche in the intensely competitive tertiary education market in Brisbane where they were two older and larger universities also offered BEng degree, albeit generic programs with common first year and some courses in other years. To exploit the niche market Engineering on the Gold Coast managed to offer many choices or majors within the Civil Engineering degree including Construction Engineering, Environmental Engineering and Coastal Engineering as well as double-degree programs with Business Management, Information Technology, and Environment Science. This intelligent degree branding was one of the main reasons for Gold Coast Engineering's phenomenal growth over a short period of time.

In its wisdom senior University management decided in 2006 to amalgamate the three engineering Schools on the two campuses into a single entity purportedly to minimise course-offering duplication and improve administrative efficiency. It followed after the amalgamation that there should only be a single BEng degree with common first year courses on both campuses.

Management also believed that it was time to take on the two other older metropolitan universities head-on and on their battle ground i.e. giving up the Griffith niche brands viz individually named programs and opted for the generic program market which was and still is dominated by the two older universities in the Brisbane catchments.

As a result, Engineering student numbers at Nathan were decimated. However the numbers on the Gold Coast still continue to grow unabated especially in Civil Engineering. This was attributed to the fact that Civil Engineering over the last decade has become a well recognised brand in the market. Further the so-called "Work Integrated Learning" system originally developed for Microelectronic students at Nathan was adopted on the Gold Coast as part of the single BEng degree system.

1.4 Coursework Masters Programs

Like the BEng programs, a range of individually named Masters degrees of one and two-year durations were available within each of the three engineering disciplines viz Civil, Environmental, and Microelectronic Engineering. Given the seriously competitive coursework postgraduate market in the Brisbane-Gold Coast region and internationally, these niche programs as a whole competed reasonably well vis-à-vis other Australian universities. It was particularly true for Engineering Gold Coast where the number of International fee-paying students grew from two in 1998 to over 80 in Semester1, 2008.

Again following the dictum of generic degree nomenclature, the suite of individually named masters programs was restructured to become a single MEng program with named majors that reflect specialisations. Significantly, the duration for the two-year programs has been reduced to 18 months. For migration purposes, this supposedly efficient curriculum could have detrimental consequences in the competitive International student market.

1.5 Scope

The change process from a collection of niche and individually named degrees – an established Griffith

Engineering brand – to a new untested brand viz the single generic BEng program is detailed herein and the positive and negative effects on the domestic market, the staff and the students are analysed. The process and conduct of the new compulsory Industrial Affiliates Program (IAP) – a form of Work-Integrated-Learning (WIL) – are also critiqued with suggestions for improvement.

A similar process to render the well recognised individually named coursework masters programs to a single MEng with majors is also discussed, and the negative effects of such a change on the marketability of the program in the International market are assessed.

The paper concluded by articulating the actions needed to rectify the many shortcomings of the new and believed to be more modern BEng program structure. Remedial efforts at several fronts already under way are also described.

2. Original Program Structures

2.1 BEng Degrees at Nathan

From the very beginning i.e. early 1990 Engineering Nathan faced strong competition in the Brisbane and Southeast Queensland market from the well established engineering faculties of the two older metropolitan universities. To compete well in the market, senior management at Griffith adopted a wise strategy to cut a niche market for its innovative programs in areas not available in the market. In 1988 from the then Faculty of Science was splintered the School of Microelectronic Engineering and the BEng in Microelectronic Engineering; from the Faculty of Environment Sciences, the School of Environmental Engineering and the very first BEng in Environmental Engineering in Australia.

The two niche and strongly competitive programs over the years underwent improvements and updating following each of the accreditation reviews (in 1990, 1995, 2000 and 2005) by The Institution of Engineers Australia now known simply as Engineers Australia, the national professional accreditation body. The contents of the two Nathan programs by 2005 [3] each comprised 320 credit points (CP) of coursework which can be categorised into: (a) Fundamentals (42%), (b) Generic Skills and Management (4%), (c) Professional courses (35%), (d) R+D skills (8%), and (e) Professional Experience (11%).

Note that the unique 40 CP IAP aimed at developing the student's R+D skills, found popularity and applause in the product-oriented Microelectronic discipline and industry. For the Environmental

Engineering degree, students might choose IAP in lieu of the 20 CP Thesis and two professional courses. Note also that, as a mandatory course specified by Engineers Australia, Industrial Experience carries a zero CP.

2.2 BEng Degrees on the Gold Coast

Following each Engineers Australia Accreditation round, improvement and updating were made to the contents of the three Gold Coast Engineering programs in Civil Engineering, Electronic Engineering and Coastal Engineering. Note in particular that Civil Engineering students could specialise in Construction Engineering, Coastal Engineering or Environmental Engineering. With continuing support from the Federal Government since 1999 and the University, the Civil Engineering students could also choose to obtain their Industrial Experience in an overseas country. Such 12-week overseas sojourns were funded partially by the School and University, or fully by the Government for specific countries under the University Mobility in the Asia Pacific (UMAP) scheme. The specialisation options and overseas experience features were concluded to be some of the main reasons for the phenomenal growth of Civil Engineering [2] – and with it the other Engineering activities on the Gold Coast.

2.3 Masters Programs

Up to 2007, the suite of one and two-year coursework masters programs on the two campuses included

- Master of Environmental Engineering – 1½ years at Nathan
- Master of Environmental Engineering with Honours – 2 years at Nathan
- MEng in Very Large Scale Integration (VLSI) System Design – 1½ years at Nathan
- MEng in MEMS (MicroElectroMechanical Systems) Design – one year at Nathan
- MEng in Structural and Construction Engineering – 1 year on Gold Coast
- MEng in Coastal Engineering – 1 year on Gold Coast
- MEng in Engineering Management - 1 year on Gold Coast
- Master of Construction Engineering and Management - 1 year on Gold Coast
- Master of Civil Engineering - 2 years on Gold Coast
- Master of Engineering and Project Management - 2 years on Gold Coast

Such professional top-up degrees as MEng in Environmental Engineering attracted good number of home students each year in the Brisbane region from practising engineers already at work in government instrumentalities as well as in the private sector.

The well-tailored and individually named degrees on the Gold Coast found great popularity in such International student markets as those in the Subcontinent and East Asia. In particular the 2-year programs were attractive to those International students wishing to settle in Australia as a fulltime 2-year degree is one of the mandatory qualifications for migration.

3. Generic Program Systems

3.1 Single BEng Degree

In an attempt to improve efficiency thereby reducing costs of operation, a major academic reorganisation was conducted in 2006 which saw the amalgamation of the three engineering Schools on the Nathan and Gold Coast campuses into a single cross-campus Griffith School of Engineering. The what was believed to be the logical follow-up of this restructuring was the foregoing of the niche market strategy by introducing a single generic BEng degree with specialisations which reflect the disciplines of the three former Schools.

The single BEng program structure with a common first year has the aim of achieving better contents, uniformity and flexibility with the common courses. Note that the 40 CP IAP is now compulsory for all Griffith Engineering students including those in the highly project-oriented Civil Engineering discipline. Note also that the popular overseas Industrial Experience option has now been extended to all the Engineering students. The new program structure was adopted from 2007.

3.2 Single MEng Degree

The purported cost savings also demanded programs streamlining that resulted in the offering of generic coursework masters degrees with specialisations inherent to the three former Schools:

- Master of Engineering (80 CP)
- Master of Engineering with Advanced Studies (120 CP)

Note that the 80 and 120 CP programs are of one- and 1½-year durations respectively. As per the current Australian immigration regulations, graduates from these programs alone would not meet one of the mandatory requirements for permanent

settlement. These new programs will be on offer from 2008.

3.3 Hindsight

The fundamental concepts of streamlining and reducing duplication of coursework offering by different Schools leading to cost savings are laudable. However the program restructuring should have been conducted with full consideration of the Brisbane and Gold Coast market situation for the Government funded undergraduate degrees, and for the full-fee-paying postgraduate programs, the International market demands. It should also have been careful not to diminish let alone ignoring the competitive edge of Griffith's well-established niche market brands. The already established 2-year MEng programs should also not have been abolished in such a mechanistic and hasty way.

4. Ramifications

4.1 Domestic Market

With the old individually-named undergraduate program offerings, Griffith Engineering at Nathan has been for two decades cut for itself a niche market. The Microelectronic degree for its unique title, and the Environmental program being the earliest established brand competed well in the very competitive Brisbane market. Even better the Civil Engineering degree with three different specialisations managed to corner a major portion of the Gold Coast market viz many well qualified, local potential Civil Engineering students preferred Engineering Gold Coast to similar programs offered in Brisbane by the two older metropolitan universities.

In 2008 the first year of implementation of the new single program structure has seen drastic drops in new student numbers on the Nathan campus. The situation was aggravated by the two older metropolitan universities lowering their entry standards in recent years. The main reason for the poor performance at Nathan was simply that for the aspiring engineering students the new Griffith generic program was simply one of three choices in the Brisbane area.

The new intake numbers on the Gold Coast especially for the Civil Engineering degree continued to grow in 2008 despite the change. This strong performance was attributed to the fact that Civil Engineering as a brand has been synonymous to Engineering Gold Coast. This positive factor was further complemented by the rapid population

growth due mainly to internal migration, and lack of competition in the immediate catchments.

4.2 International Market

Griffith Engineering masters programs like their parallel in other Australian universities are offered mainly to attract full-fee-paying-overseas (FPOS) or International students. In particular on the Gold Coast the currently enrolled MEng students in various named programs are overwhelmingly FPOS students. Many of these students came with the plan or at least the option of gaining permanent residency in Australia. The fact that neither of the new one- and 1½ -year masters programs will qualify the graduates to apply for permanent residency, will no doubt turn potential International students away to other Australian universities. Unofficial reports by Griffith International marketing and related staff have confirmed that at some overseas marketing Expos or similar events many potential students attracted by the previously available 2-year programs turned their enquiries away the moment they discovered that such programs are no longer available. It appears certain that a drop in postgraduate FPOS numbers is inevitable should remedial measures not taken in a timely manner.

4.3 Industrial Affiliates Program (IAP)

The reasons for making the IAP a compulsory 40-CP course for all Griffith Engineering students were the following real and perceived merits:

- helping to implement the University policy of having 70% of all degree programs to have a work-integrated-learning (WIL) component of not less than 8.3%;
- being highly regarded by Engineers Australia (EA) and suited very well EA accreditation requirements;
- providing a channel for students' entry to the professional workforce;
- allowing students better understand the industry context and developing "work-ready" skills.

The IAP since its inception in 1993 has been popular and successful in the product-oriented discipline of Microelectronic Engineering. It has a rigid process underpinned by unbending rules for

- project initiation, formulation and evaluation
- project topics selection
- appointments of industry and academic supervisors

- initial, continuous and final assessments of student outcomes

Some of these rules have turned into fundamental and detrimental flaws when transplanted to the project-oriented Civil Engineering discipline. These are the inability to

- provide for all students projects of equivalent quantity, depth and breadth of contents (as Civil Engineering projects to which the students are assigned can vary from small design tasks to enormously complex and costly endeavours);
- pre-assess the quality and dedication of the industry partners (who may be the staff from a small design consulting firms to multibillion dollar construction conglomerates) leading to some very low quality student outcomes;
- address the concerns of the academic advisers having to assess student outcomes over extremely short timeframes in areas far from their own expertise (noting that Civil Engineering has many sub-disciplines and that few specialist academics can master more than one);
- nurture special talents into new research frontiers as almost all projects to date are devised for practical-solution outcomes;
- guarantee that IAP student outcomes are equivalent to a 20 CP final year Thesis plus two 20-CP professional courses undertaken by former students;
- industry partners rarely have research experience but each acting as primary supervisor of project resulting in poor quality research outcomes from some projects;
- students' preparedness for research higher degree (RHD) study is poor due to lack of exposure to research experience in undergraduate program;
- academics are no longer learning along with the students which greatly diminishes the learning and teaching outcomes for the students and staff.

In addition some students have registered the following dislikes of the IAP work

- paper work and reporting overload throughout the placement period;
- extensive assessment items;
- more of internship nature rather than academic learning;
- lack of research content and some projects require little intellectual and technological input.

IAP in Civil Engineering if not by design but by outcome provides more vocational training than the training of the intellect. The long term negative effects on the graduate body should not be underestimated.

5. Adjustments and Improvements

5.1 Undergraduate Programs

In view of the poor reception for the generic BEng program in the Brisbane market, the named degree in Microelectronic Engineering has been revived almost at the same time as it was abolished. This was the first attempt to arrest further decline in that sector of Griffith Engineering.

The new program development strategy is to judiciously and in a financially sustainable manner introduce over time modern and innovative niche degrees. In the meantime the Civil Engineering sector is required to help sustain Griffith Engineering in providing revenue beyond its fair share of the burden.

5.2 Masters Programs

The urgent adjustment needed to negate the anticipated downturn in postgraduate International students, no doubt is the reintroduction of the abolished 2-year masters programs with improved contents and an enhanced research component. Such should have and could have been done in the just completed program restructuring.

5.3 Industrial Affiliates Program

The obvious shortcomings of the current IAP process are enumerated in the earlier section. A review committee has been set up with the aim of rectifying these defects. In particular it aims to

- improve the current IAP structure and enhance quality of student learning outcomes;
- develop an intelligent management and administrative process.

6. Conclusion

Any structural change to professional degree programs at a university especially if imposed by senior management for some strategic reasons or otherwise, inevitably entails challenges. If the responsible academic managers did not rise up to the task, immediate and long-term ill-effects would befall the establishment in terms of poor student market responses especially in today's intensely

competitive environment both at the home front and Internationally.

The pitfalls of such changes, their negative effects and remedies described herein are peculiar to one Australian university viz Griffith. The experience gained in this saga on the other hand may be applicable to other institutions and in other times.

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