Pedagogical differences in Engineering Education at Taiwanese and Australian universities

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CONTEXT

There is a clear dichotomy between western (Socratic) and eastern (Confucian) education philosophies (Gorry, 2011; Jin & Cortazzi, 2011). This dichotomy stems from cultural differences (Chan & Tsai, 2015; Marton, Hounsell, & Entwistle, 1984) and impacts the education of students at university. For example, in Taiwan, there is a deeply ingrained culture of respect for teachers and the knowledge they convey (Pratt, 1992) and hence students are generally unreceptive to, and unfamiliar with learning strategies that differ from traditional memorisation techniques (Ma & Kelly, 2009). As Australian universities seek to increase international student enrolment, predominantly from Asian countries, understanding Confucian pedagogy is critical to support and transition these students.

PURPOSE

This research aims to identify the key pedagogical differences between Taiwanese and Australian universities in terms of curriculum, teacher and student expectations, learning styles and delivery mechanisms.

APPROACH

Seven Taiwanese universities were visited in May 2016. Qualitative data was collected through interviews and class observations. The curriculum of each university was obtained though course profiles and university websites. These were compared with courses at The University of Queensland. Students and staff were asked for their opinions about the:

- knowledge and skills engineering students should have pre and post study,
- the lifestyle of an high-achieving versus an average university student in Taiwan,
- methods of learning and seeking help with learning, and
- the preferred method of content delivery.

RESULTS

The motivation of Taiwanese students to study was found to be generally low and this was highlighted by academic staff. There appear to be a number of causes including parental views and expectations, and Taiwan's low student numbers that has put pressure on universities to pass students and thus improve enrolment numbers. However, there is a high expectation for individual achievement that exceeds that experienced in Australian universities, and a corresponding focus on grades and knowledge as determined by examinations rather than graduate skills. This is seen through the lack of opportunities to develop teamwork skills in the both the high school and tertiary curriculum. The interviews also showed that most students employ rote learning study habits as their exams do not require them to demonstrate knowledge at the higher levels of Bloom's taxonomy. Individual expression and freedom to learn through inquiry are greatly diminished by the strict culture of respect (Pratt, 1992) with students penalised for voicing out in class.

CONCLUSIONS

Cultural and pedagogical differences give rise to study methods that are limited in effectiveness for Australian university assessment where students are asked to demonstrate graduate competencies, originality, and synthesis/application of knowledge (Engineers-Australia, 2011). In addition, the lack of opportunities to develop skills and competencies further hamper Taiwanese students' ability to adapt to pedagogies such as project-based learning that will be experienced in Australian universities. A support strategy is needed to ensure that these students are given the appropriate support they need to acclimatise to the Australian learning environment.

KEYWORDS

Taiwanese engineering education, engineering pedagogy, Asian education.

Introduction

There is a clear dichotomy between western (Socratic) and eastern (Confucian) education philosophies (Gorry, 2011; Jin & Cortazzi, 2011). This dichotomy largely stems from cultural differences (Chan & Tsai, 2015; Marton et al., 1984) which have a large impact on the education of university students. For example in Taiwan (Twn), there is typically a deeply ingrained culture of respect for teachers and the knowledge they convey (Pratt, 1992) and hence students are generally unreceptive to, and unfamiliar with learning strategies that differ from traditional memorisation techniques (Ma & Kelly, 2009) especially those that require them to question and challenge their superiors. In contrast, Australian (Ausn) students are trained to be inquisitive from a young age and to develop their own learning styles (Gorry, 2011). As Ausn universities seek to increase international student enrolment, predominantly from Asian countries, understanding Confucian-based pedagogy will be critical to better support and transition these students. Our experience shows that the majority of these students are at risk of failure due to their different approaches to learning (S. Chen & Kavanagh, 2013, 2014).

This paper details the results of a study of Taiwanese (Twns) and Ausn students enrolled in engineering as they can be loosely categorised as having eastern and western education philosophies respectively. It identifies key pedagogical differences between Twns and Ausn universities in terms of curricula, teacher and student expectations, learning styles and delivery mechanisms so that contextualised learning support can be provided.

EDUCATIONAL CLIMATE

Twn has experienced low birth rates for the past 25 years, reached the world's lowest birth rate in 2011, and since has continued to rank in the bottom 10 countries (Central Intelligence Agency, 2015; Jennings, 2011; Wu, 2015). This has caused a decrease in the number of students at all levels of schooling causing schools to either reduce class sizes from 42 to 35 students or close due to insufficient enrolments. This is in direct contrast with Australia (Aus) where large classrooms are becoming the norm in higher education.

Based on projected birth-trends and primary and secondary education data, it is predicted that up to 40% of Twn's universities will close by 2018, and that by 2028, Twn's tertiary student body will be half of what it is today (Wu, 2015). The situation is further exacerbated by the country's recent conversion of technical colleges and trade schools into tertiary institutions raising the total number from 105 to 163 with an average of 1546 new enrolments/institute/year; again in stark contrast to Aus's 43 institutes with an average of 9312 new enrolments/institute/year (Australian Government, 2016; D. S. Chen, 2010; Universities Australia, 2014).

For two countries that have roughly the same population, these differences significantly alter the way classes are taught, assessment is conducted and how institutions value their students.

CULTURAL DIFFERENCES

Five of Hofstede's cultural dimensions were used to describe the differences between Twns and Ausn culture (Hofstede & Hofstede, 2001; Hofstede, Hofstede, & Minkov, 1991).The sixth dimension 'indulgence' was omitted as data was not available for both countries. The scores (Table 1) represent the preferences of the each country relative to other countries globally.

Table 1: Cultural differences between Twn and Aus using Hofstede's Dimensions

Dimension	Twns score and summary	Ausn score and summary	Δ
Power Distance (PD): A higher number indicates a higher acceptance by society of an inequality of power distribution	**58** • Hierarchical structure • People holding senior positions are less accessible • Students/workers expect instruction by teacher • Large wealth gap	**36** • Hierarchies established for convenience • Informal communication • Information is shared and available	22
Individualism (IDV): A higher number indicates a higher likelihood that society functions as individuals rather than a collective entity	**17** • Collectivist mentality • Individuals belong to groups • Pride and public image valued for each group • Loyalty is rewarded • Larger families	**90** • Individualist traits • Individuals fulfil their own needs and have their own rights • Achievement is measured by personal ability	73
Masculinity/Femininity (MAS/FEM): A measure of how society achieves success; higher scores suggests MAS	**45** • Actions chosen to care and benefit others and improve society's quality of life • People in power make decisions that lead to equality	**61** • Competitive nature • Rewards individual achievement • Advancement though being the best in field	16
Uncertainty Avoidance (UA): A higher number indicates a society uncomfortable with uncertainty and unknown future events.	**69** • High number of laws/ rules • More reliant on religious beliefs	**51** A rigid social structure balanced with the ability to relax rules to develop new practice.	18
Long-term Orientation (LTO): A higher number indicates a society that fosters future outcomes. (Asian countries score highly in LTO.)	**93** • Willing to save and invest in the future • Makes choices that lead to long-term gains • High moral standards.	**21** • Focus on achieving immediate results and targets • Individuals strive for stability and avoid embarrassment.	72

Of note for this research are the significant differences in IDV and LTO as this will affect students' behaviour in classrooms and how education is viewed by society.

METHODOLOGY

Overview

Pedagogical differences were investigated qualitatively using data collected from engineering curricula and interviews with Twns students and academic staff in comparison with known behaviours and attitudes of first year engineering students and two first year engineering courses at The University of Queensland (UQ). Seven universities across the ranking spectrum (Cybermetrics Lab, 2016) in Twn were visited from May to June 2016.

Table 2: Twn University rankings

University	Ranking
National Cheng Kung University (NCKU)	3
National Twn Normal University (NTNU)	6
Ming Chuan University (MCU)	21
Asia University (AsiaU)	44
Southern Twn University of Science and Technology (STUST)	51
Chia Nan University of Pharmacy and Science (CNUPS)	78
Far East University (FEU)	116

Interviews

43 students and 10 staff were interviewed either individually (i) or as a focus group (g) depending on availability (Table 3). Interviewees enrolled in courses similar to UQ were selected when available; however volunteers from other faculties were also interviewed to give a broader perspective of Twn's educational culture. Volunteers were recruited through academic contacts and all participants were rewarded with a small gift. Students were interviewed for a maximum of 30 min and staff for 60 min. Interviews were conducted in Chinese (Mandarin) and while the first author is fluent in spoken Mandarin, assistance was required for advanced Mandarin, colloquialisms, and technical vocabulary. This help was provided by non-engineering educators.

Participants were asked for their views on:

- knowledge and skills engineering students should have pre and post study,
- the lifestyle of an high-achieving versus an average university student in Twn,
- the preferred method of content delivery,
- methods of learning and seeking help with learning (students only), and
- their teaching pedagogy (academics only).

Trigger questions were used to elicit responses when interviewees were reluctant to speak. Side bar responses were allowed, these are included in the results.

Table 3: Distribution of students and staff interviewed

University	Discipline	Session details: No., Gender (M,F), Group (g) or Individual (i)				
	Year	1st	2nd	3rd	4th	Staff
NCKU	General Eng.					1M,i
	Software Eng.			8M,g		
	Geomatics	3M,g				1M,i
	Business				1M,i	
NTNU	General Eng.					2M,i
	Mechatronic Eng.	6M,g	2F,g			
	Electrical Eng.	1M,i				3M,i
	Woodwork				1M,i	
	Multimedia		4M,1F,g			
			2F,g			
			1M,i			
MCU	Biotechnology		2M,g			
AsiaU	Information Eng.	2M,g				
		5M,i				
	English					1F,i
STUST	General Eng.					1M,i
	Business	1F,i				
CNUPS	Multimedia		1M,1F,g			1M,i
FEU	Product Design	1M,i				

Curricula

Course comparison was completed through information available on university websites and in-class observation. Data was collected on curriculum for general first year engineering, graduate attributes, aims and objectives, types of assessment and course delivery.

The list of courses for which data was collected is shown in Table 4. Only the two higher ranking universities have course information published on their websites, therefore all other institutions were omitted. Theory-based courses in Twn are worth more units (credit) than practical courses and all courses listed are compulsory. Twn also teaches across 18 weeks per semester in contrast to UQ's 13 weeks.

Table 4: Courses evaluated

University	Course	Course Description	Prerequisites	Year	Units
UQ	ENGG1100	Engineering Design	None	1	2
	ENGG1200	Engineering Modelling & Problem Solving	ENGG1100 Basic maths	1	2
NCKU	E511200	Introduction to Materials Science	Basic chemistry and physics	1	3
	E520110	Materials Experiment 1	None	2	2
NTNU	MTU0097	Materials Science	None	1	3
	MTU0024	Mechanical Engineering Experiments	None	1	1

RESULTS

Interviews

Table 5 details the responses from Twns students and staff which did not differ greatly and therefore have been paraphrased and aggregated.

Table 5: Twns responses to interview questions

<table>
<tr><td colspan="2">What skills developed in high school are transferable to university?</td></tr>
<tr><td>Positives:
• Group discussion and communication skills
• Learning from a textbook
• Problem solving</td><td>Negatives:
• Very few
• Little to no teamwork at school, mostly from extracurricular activities
• No critical thinking
• No research skills</td></tr>
<tr><td colspan="2">What knowledge gained in high school is transferable to university?</td></tr>
<tr><td>Positives:
• Mathematics
• Physics
• English (mostly reading and writing)</td><td>Negatives:
Very little transferrable/ retained knowledge; seen to be dull and specific to university entrance exams</td></tr>
<tr><td colspan="2">What skills/knowledge do you expect to learn at university?</td></tr>
<tr><td colspan="2">A selection of discipline-related knowledge (theory), mostly related to electronics as Twn has a strong industry in this field. Students were also keen on learning other languages to gain a competitive edge.</td></tr>
<tr><td colspan="2">What are the most important attributes to have to find a job once you graduate?</td></tr>
<tr><td colspan="2">Having several externally accredited certificates was of primary importance as these are highly valued in interviews. Of secondary importance was a student's alma mater and degree. Other notable attributes mentioned were work experience and communication skills (written and verbal). Referrals were not required when applying for graduate positions.</td></tr>
</table>

What is an ideal student and what does a day in their life look like?

The concept of an ideal student was described as either academically (grade focused) or well-rounded (grade, sports, social, club and family), the latter being the more popular of the two. There isn't much pressure in first year unless it is exam time or the student has strict parent. Even the ideal student would spend most afternoons enjoying leisurely activities.

Weekly breakdown

- attendance and active listening/participation in class (8am to 5pm)
- study in the library between classes,
- (academic) at home, revises content covered in class, read up tomorrows lecture
- (well-rounded) extra curricula activities after school, make friends
- weekends focused less on short-term happiness and more on family

Work commitments?

- necessary but seen as something that detracts from their education
- usually 1 or 2 days/ week if they are academically talented or a wage is needed.

Living at home or on campus?

- generally this made no difference to their day
- more friends on campus which was seen as a potential distraction from study

What do you differently from this ideal student?

Many students reported a lack of motivation from burn out due to the rigorous academic environment in high school. Students also lacked direction with no long-term goal for their education. As such, they skipped classes they were uninterested in or didn't pay attention/ were on their phones if they did attend.

Outside of university life, there was a lack of time management; in particular, students spent more time on leisure than an ideal student would. Male students played video games for long durations.

When compared to the well-rounded student, around half the students did not participate in extracurricular activities as either their friends weren't involved or they wanted to focus on studying. These students viewed learning specialised skills as something that would happen later in their degree and competencies as not that important and mostly already developed through compulsory high-school clubs.

Where do you go to find help with academic work (in order of preference)?

Nearly all students would consult their textbook/ search online first (most accessible). They would next ask family/ friends and as a last resort ask their teacher. Teachers were seen to be hard to track down and only available during class intermissions. The expectation was to learn theory in private and only consult the teacher about difficult concepts.

What method of study do you find most effective to learn and retain information?

Emphasis was placed on rote learning as students saw this as a way to achieve good grades. During exams, most students would learn content given through powerpoints or search online by themselves (weekdays). Once they had mastered this, they would ask friends for help on things they didn't understand (weekends).

When probed about retaining knowledge, students admitted to forgetting the vast majority of knowledge learnt this way. There was no reason to change however as rote learning achieved the required grades and they were accustomed to the method having been taught it early in their schooling.

What method of content delivery do you find most engaging?

Hands-on learning that allows students to learn from their mistakes was preferred but it was not always available because of requirements to cover content (i.e. classes tend to employ didactic lectures to ensure coverage in available time). There were split opinions on the

efficacy of didactic lectures as well as flipped classrooms. Students react positively to group discussion with peers and the teacher, especially if they are awarded assessment marks for participation.

Where would you study if you could (i.e. no financial or grade restrictions) and why?	
Overseas: (US, England, Germany, Japan) • Better/ different (more liberal) education allowing freedom in attending class and different teaching styles • Better career prospects • Well known universities • Personal interest in the country/ travel	Twn: • Important to learn basics in native language to gain a solid foundation • Doesn't matter which university as they all teach the same things • Prefer the university closest to home.

Ausn high school students appear to experience more team-based assessment without the intense final examinations that Twns students face. This concentrated effort at the end of high school in Twn causes many students to burn-out and lack motivation when they reach university. This lack of motivation may be compounded by the impact of adjusting to a new country and culture.

The ideal student image aligns with Ausn views; no conclusive difference was noticed. In addition, the preferred methods of study are also quite similar. However, there are polarising views on delivery methods and the ability to communicate with staff. The largest difference would be Twns students' reluctance to seek help from staff and engage in activities where they are required to overcome their shyness. Twns students in Ausn universities will therefore require acclimatisation to adjust to becoming active in their learning.

Other issues identified by Twns students

Discussions arising from relevant sidebar responses given by interviewees are as follows:

- Students experience burnout from excessive levels of stress in the final years of high school leading up to the tertiary entrance exams. Selection into the top academic universities is based on individual results in a national exam. These universities are well perceived by Twns society, resulting in students receiving heavy pressure from their parents. In Aus, tertiary entrance exams differ across states and are measured against the cohort. Academic success is valued but to a lesser extent, thus parental pressure is lighter on students.
- The Education system is not evolving as the drive for grades is embedded in the Twns culture. Parents demand grades for family pride, schools to impress parents and attract new students, and students want high grades to attract family and peer recognition. Although Aus operates on a grade system, there is not the same societal pressure to excel.
- Twns society expects all workers to hold a bachelor's degree, so students study to remain competitive in the job market. Even those who undertake menial jobs, such as a store clerk, are expected to have a degree qualification. This leads to motivation issues during tertiary studies and degrees that tend to be viewed as the norm rather than a useful higher level of education. As Ausn society does not have such requirements for menial jobs, students who attend university in Aus tend to have a life goal or reason for pursuing higher education.
- Flipped classrooms which require presentation and other discussion-based learning activities are not that effective as students tend to be shy and reluctant to make mistakes in front of their peers.

Curriculum Comparison

Six course profiles for first-year courses (2 x Aus, 4 x Twn) are reported in the appendix and summarised in Table 6. Table 7 summarises the findings of this research and includes in-class observations. Aus results are based on experiences of the primary author through 10 years of study at UQ as an undergraduate student, as a tutor, and as an educational researcher.

Table 6: Differences between first-year courses in Twn and Aus

Characteristic	Summary and key differences
Aims/objectives	Both include knowledge and theory Aus also lists skills developed (teamwork, decision making etc…).
Graduate attributes	Similar in both countries.
Assessment	Twn awards marks for attendance/ participation; Aus uses pass/ fail. Twn lecturers award bonus marks in class. Aus sticks to published assessment. Aus uses a combination of assessment types. Twn uses exams.
Delivery	Twn prefers didactic lectures whilst Aus has more classes with hands-on opportunities in which students work with their peers.

Table 7: Comparison of education systems based on in-class observations

Category	Aus	Twn
Delivery Method	PowerPoint presentations used by most courses. Document visualiser used for hand-written content (e.g. solving equations).	PowerPoint sometimes used. Black/white boards used for written content.
Learning style	Students take notes often on printed lecture slides. Textbooks are seldom brought to class and are used mostly for out of class study. Not all students purchase the textbook.	No printed slides, students purchase textbooks and bring to every lecture. Students write in pencil in textbook or take notes whilst following teacher's examples on the board.
University structure	Large class sizes (100 – 1000) mean teachers cannot know all students by name. Results therefore are not connected to an individual.	Teachers know students by name as classes are smaller (<40). Therefore students care heavily about their exam marks to save face.
	Tutors employed to aid teaching, and manage classes/ groups etc.	No tutors but teaching aides are sometimes used for marking.
University life	Clubs and societies are present but not aggressively advertised.	Student bodies are more active with greater exposure.
Skills acquisition	Taught through the university curriculum as part of the graduate attributes specified by the institution and accrediting bodies.	Learnt through compulsory club and cultural activities in high school. Limited at the tertiary level to extra-curricular activities.
Hierarchy	Students treated as adults.	Teachers placed on a pedestal; students show respect at all times.
Parental pressure	Parents explicitly not included in discussions unless the student agrees for them to be present.	Parents exert pressure on teaching staff and have been known to affect content delivery.
Other factors	-	Mobile phones are heavily used by students due to unlimited Wifi, a strong culture supporting mobile development and the local production of electronics.

DISCUSSION

As previously discussed, cultural differences described by Hofstede's five dimensions have a significant effect on higher education.

- Twn's higher Power Distance (PD) was seen during all Twns interviews as evidenced by students' reluctance to approach teachers. The hierarchical difference between students and staff was more pronounced in Twn where classes are taught by senior staff only. In Aus, this effect is less noticeable as the age gap between students and staff is lower due to the use of undergraduate and postgraduate tutors.
- Twn boasts a strong collectivist mentality and this is reflected in students' tendency to conform and abstain from questioning knowledge presented to them. In Aus, students are actively encouraged to ask questions in class and form their own connections between concepts. This corresponds to Aus' high individualism (IDV) score of 90.
- Twn's views on success in higher education do not match Hofstede's low Masculinity (MAS) rating of 45. Academic success in Twn appears very competitive in nature and focused on individual achievement. These traits are typical of high MAS scores.
- Uncertainty Avoidance (UA) did not appear to have an effect on education in Twn and in Aus, the UA score is balanced at the center of the scale (51) so no conclusions are drawn from this research.
- In terms of goal orientation, both Twns and Ausn students are grade driven and focused on achieving immediate results. This was especially true for Twn students as there is less of an emphasis on graduate competencies. Twns students also showed that they highly valued their pride and were likely to avoid actions that could lead to potential embarrassment. These traits suggest a low Long-term Orientation (LTO) score and did not match Twn's high score of 93. This is likely due to Hofstede's research measuring society as a whole, in particular, the working class and not the opinions of students.

CONCLUSION

Cultural and pedagogical differences give rise to study methods that are limited in effectiveness for Ausn university assessment where students are asked to demonstrate graduate competencies, originality, and synthesis/ application of knowledge (Engineers-Australia, 2011). In addition, the lack of opportunities to develop skills and competencies further hamper Twns students' ability to adapt to pedagogies such as project-based learning that is prevalent in Ausn universities.

Twns students and staff adhere to a hierarchical structure (high PD) in higher education favouring didactic learning styles. Aus lower PD allows for more communication opportunities and is explored in the different types of delivery mechanisms present in Ausn curricula. The stark contrast in IDV can be observed in students' tendencies to deviate from presented answers. Twns students are unlikely to present an answer against the norm. LTO traits for Twn did not match student interview results and is a likely indicator that this dimension is reflective of the working class and not of students.

A possible limitation of this research is that whilst Hofstede's dimensional analysis of cultures is widely accepted and practiced; individuals may fall outside the stereotypes expected by the model. This may indeed be the case for students travelling internationally as they possess different motivations and goals to consider the transition to Aus in the first place and will be unlikely to perform in the same manner as their peers at home. A support strategy that focuses on highlighting the differences in classroom communication, learning styles and the importance of skills development is needed to ensure that these students are given the appropriate support they need to acclimatise to the Ausn learning environment.

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Appendix: First Year course differences

Table A1: Comparison of first-year compulsory materials course

	UQ	NCKU	NTNU
Aims/Objectives	• Various material science theory, • Problem solving, • Software modelling, • Prototyping • Communication • Teamwork	• Various material science theory,	• Various material science theory,
Graduate attributes	• In-depth knowledge • Communication • Independence and creativity • Critical judgement • Ethical standards	• Fundamental Theory • Professional Competence • Innovation/ Implementation • Professional Ethics • International Perspective	• Not listed
Assessment	• 12% various scaffolds • 12% online quiz • 10% reflective writing • 26% team reports (2x) • 20% mid-sem exam • 20% prototype • P/F various	• 10% participation • 30% mid-sem exam • 30% mid-sem exam • 30% final exam	• 20% attendance • 40% mid-sem exam • 40% final exam
Delivery	• Online, 20% • Practicals, 65% • Workshops, 15%	• Lecture, 100%	Schedule not published but comprises of lectures and discussions

Table A2: Comparison of first-year compulsory project/ experiment course

	UQ	NCKU	NTNU
Aims/Objectives	• Design • Sustainability • Decision making • Prof. responsibilities • Teamwork • Project management • Communication	• Understand alloy solidification and microstructure changes • Understand metallurgical analysis • Understand thermal analysis	• To teach students materials experimentation, analysis, and reporting of results • Thermal treatment and solid forces
Graduate attributes	• In-depth knowledge • Communication • Independence/ creativity • Critical judgement • Social understanding	• Professional Competence • Innovation and Implementation • Interdisciplinary Knowledge • Communication/Teamwork • Professional Ethics	• Not listed
Assessment	• 6% various scaffolds • 14% logbook • 20% individual report • 30% prototype • 30% team report • P/F various	• 100% individual report	• 10% attendance and participation • 40% final exam • 50% lab report
Delivery	• Lecture, 20% • Practical, 60% • Workshop, 20%	• Workshops, 100%	Schedule not published but comprises of lecture, discussions and online materials