Full Paper

Introduction

The importance of pathways for upskilling the workforce and bringing more people into Higher Education (HE) system that wouldn't normally have the opportunity from the traditional entry is paramount to the continuous growth of the modern industrial economy. It is widely accepted that there is a shortage of trained professionals and tradesmen across a wide spectrum of engineering occupations in Australia (King, Dowling and Godfrey, 2011; McIntyre and Watson 2011; Yu, Bretherton and Buchanan, 2013). The future Australian economy depends on smart technology or innovative engineering development due to the small population, diminishing manufacturing and consumer market economy. The shortage of technical staff with para-professional qualifications (i.e. Associate Degree, Advanced Diploma and Diploma – level awards) is acute for the skills in demand. Employers are leading interventions to address skills shortages, their efforts are predominantly focused on the re-development of technical occupations at the para-professional level' (McIntyre and Watson 2011) and importing overseas labour for urgent operation and development.

As Australia is embedded in the Asia economy region, future engineering education curricula should be based on the production of innovative engineers employed in the Asian region. Our future engineers need to be enlightened, innovative and research able (Moyle, 2010). It is critical for Australia to have enough highly skilled people able to adapt to the uncertainties of a rapidly changing global economy in the highly interconnected world market. (Bradley et al., 2008). To meet this demand, there is a need to increase the number of students pursuing higher education in engineering. The pathway from Vocational education & training (VET) to higher education is one way to accelerate and meet this demand. This also meets the government's desire to increase the participation of more students from different backgrounds in higher education (Wheelahan, 2009). Many providers are now offering both higher education and VET programs (Karmel, 2011). However VET is distinguished from higher education by different funding and regulatory arrangements, and teaching and learning styles (Karmel, 2011, p5).

While there has been a lot of research on pathway programs, very few have focused on the transition experiences of students, from their perspective. In particular, a lot of focus has been on support programs while there has been little about the effect of the actual formal classes and in particular the mismatch between where the pedagogy students have come from and are now experiencing in their education.

VET uses competency based educational program where the outcome is very descriptive towards employability skills, and where educators must follow the training package (TP) rules of the qualification for their delivery. Higher education uses Curriculum based educational program where the outcome is defined by the faculty, internal accreditation and the Engineer Australia (EA) competency (similar professional organisation). TAFE based pedagogies revolve around classroom based activities involving small classes with personalised instruction and facilitation. Higher Education based pedagogies revolve around didactic instruction in a lecture, tutorial mode, with large classes and generalised instruction. Another large pedagogical difference is the notion of assessment, the curriculum for the higher education courses is based on the notions of knowledge and changing world where as the VET courses are based mostly on skill sets competency and these are specified in the training packages. (Karmel, 2011, p5, NCVER). In Australia, an example of VET model is the Technical and Further education (TAFE). In this paper, TAFE and VET are used interchangeably due to the Australian context.

The three education models at the heart of this paper are Vocational education pedagogies (an example is TAFE in Australia); Pathway pedagogies and Higher education pedagogies. The VET education pedagogy gives different names by different organisations around the world as presented in Table 1.

Table 1: Various Names for VET Practices

Country / World Body Organisation	Vocational Education & Training (VET) various names around the world	Region
UNESCO & EU	Technical and Vocational Education and Training (TVET)	European and united nations
Australia & Asia-Pacific	Technical and Further Education (TAFE) or Vocational and Technical Education (VTE)	Australasian
United Kingdom	Further Education (FE)	England
USA	Career and Technical Education (CTE)	America

Note: UNESCO (United Nations Educational, Scientific and Cultural Organization)

Hopkins (2007) describes the connections between teaching strategies, relationships, reflection and models of learning, which provides a useful platform for describing vocational education pedagogies. This model was further enhanced by Faraday *et. al.* (2011) when the framework for developing effective vocational teaching and learning was presented in their research report. Faraday's research added the teaching context to the Hopkins model and used teaching reflection to encompass all the other boundaries. The comparisons of the two models are presented in Figure 3 and Figure 4.

The framework offered by (Lucas, Spencer & Claxton, 2012) for designing vocational pedagogies is compelling, and is shown in Figure 5. This model highlights the student-centered learning model on the left side and the teacher-centered model on the right side. Current VET practices use a heavily student-centered learning model, but could easily end-up using a mixed model when the content with a unit of study with a course is large.

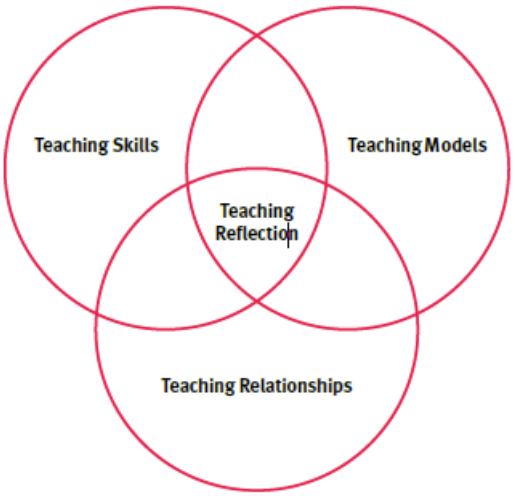

Figure 3: Hopkins Four ways of thinking about teaching

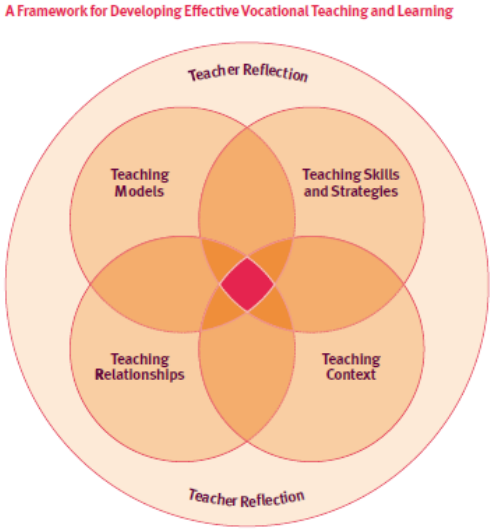

Figure 4: Faraday et al's Developing effective vocational teaching and learning

The Pathway education pedagogy represents innovation in education and training. This is the process of finding a new, an innovative method of delivering education system from the established current systems or practices. As an example, in Australia, at Swinburne University of Technology (SUT), a foundation year subjects of Bachelor Degree of

Engineering was used to set up a curriculum to deliver the same units as part of an Associate Degree of Engineering. This innovative method of delivering foundation units of Bachelor degree allows the graduate of Associate Degree of Engineering to achieve two objectives, namely, (a) gain significant credit towards a Bachelor degree program, if there is a desire to follow pathway system and, (b) provides solid preparation for vocational career in engineering industries as an Associate Engineer, if there is a desire to exit study for a job.

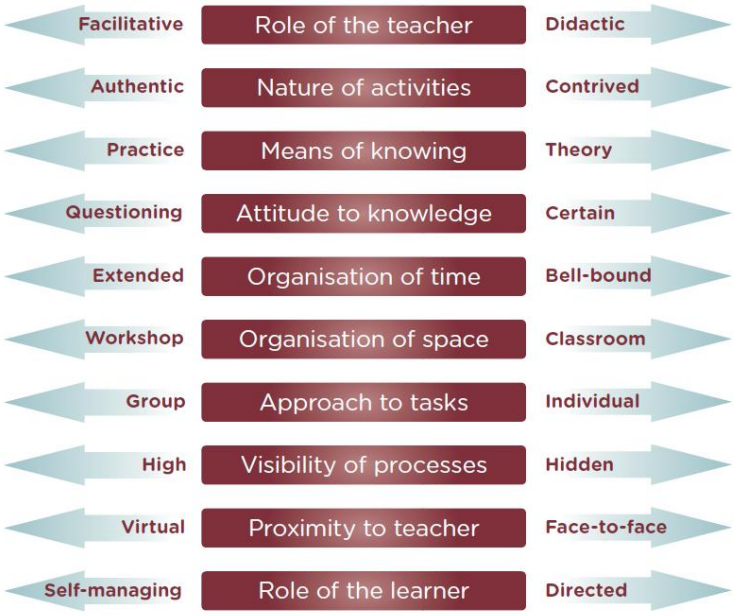

Figure 5. 21st Vocational education pedagogy – ten dimensions of decision-making

There is a loosely defined line between Transition pedagogy and Pathway pedagogy and different interpretation between different literatures. Kift *et. al.* (Kift, S., Nelson, K. & Clarke, J., 2010) looked at a Transition Pedagogy as an induction program for the first year undergraduate students and King *et. al.* (King, R, Dowling, D and Godfrey, E, 2011) considered Pathway Pedagogy as a standalone education qualification with a top-down approach for successful integration of VET system to HE system. In both literatures, there is an interchangeable usage of transition and pathway.

The existing models on Transition pedagogy in (Kift, S., Nelson, K. & Clarke, J., 2010) and Pathway pedagogy in (King, R, Dowling, D and Godfrey, E, 2011) need unification. There is a need for interrelationship model between the two models. This study proposes an interrelationship model between Pathway pedagogy and Transition pedagogy where the focus is on the GAPS between the different education systems.

The main focus of this study is the transition of Vocational Education students doing Pathway engineering or science programs in the Vocational Education system and going into the Higher Education system for Bachelor degree programs in Engineering. We are looking at the practices in the overlapping gaps between the different systems. This means the study encompass both Transition Pedagogy and Pathway Pedagogy.

A Gaps model was developed for the proposed overlaps for this study of the Transition and Pathway Pedagogy. This proposed model is in Figure 6.

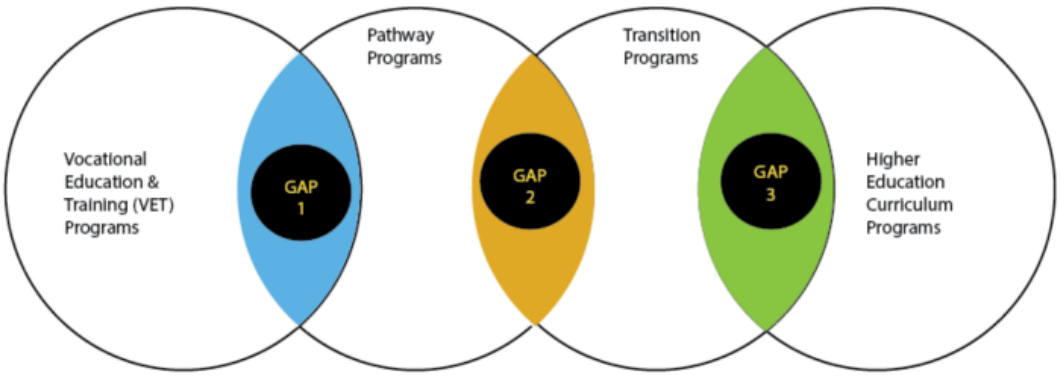

Figure 6: Gaps model

Gap 1 represents a community of practice where the trade and advanced trade students are encouraged to pursue para-professional education, Gap 2 is the community of practice where the Diploma and Advanced Diploma students are encouraged to complete their pathway additional study and Gap 3 is the community of practice where Advanced Diploma and Associate Degree students are encouraged to do some university electives as a preparation for transition to Higher Education environment.

This project is driven by the following research question:

What are the mismatches between VET and Higher Education Pedagogies and how do these impact students' academic transitions?

This research paper present findings from a survey of students about their experiences during their academic transition from a TAFE based Associate Degree of Engineering into a Higher Education based Bachelor (Honours) of Engineering in a dual sector university in Australia. Our aim is to give an account of the transition experiences of students from their perspective with a focus on their academic transition.

Methods

A survey was designed to give the participants an opportunity to quickly compare and contrast their academic transition experiences between the TAFE system and the HE system. The surveys were used to collect initial feedback from the past graduates of an Associate Degree (AD) program in engineering that are currently doing BE (Honours) at SUT.

The online survey included multiple choice and Likert scale questions with an open-ended question at the end of each. This was designed to provide the participants the opportunity to comment further if desire immediately after providing their feedback for a specific question. The survey questionnaires were divided into five major sections:

1. Reason for selecting to do the vocational education based Associate degree
2. Academic experience during recently graduated AD course at TAFE
3. Academic experience during the current BE (Honours) course at HE
4. Academic transition experience from AD to the BE course at SUT
5. Transition support from SUT as an organisation

Once ethical clearance was obtained, the thirty past graduates of the AD were emailed and invited to participate in the survey. Ten participants gave their consent and responded to the survey. The survey was designed to allow the participants to skip any questions they felt they could not answer or did not want to answer. In the data presented below for each question, the number of participants that either answered or skipped the question is provided.

Our result section presents all the findings from this survey, including the rationale for each question, the actual question, Answered/Skipped response number and the open-response box comment for each question. As described in result section, the highlights of our findings showed that the open-response box comments and the open-ended questions indicate that further research is required.

Results

Section 1: Reason for selecting to the vocational education based Associate degree (AD)

It has been known that the HE entry requirements for BE programs creates a barrier for some groups to gain entry into HE. This is sometimes due to the low ATAR score obtained for their Australian secondary school examination or due to mature age issues or other social-economic reasons. The VET sector provides the opportunity for these groups to gain entry requirements to HE and thereby use pathway agreement between VET providers and HE to gain access to BE programs at HE (Wheelahan, 2009). However, (Dowling 2010) cited that there is a large variety of the pathway elective requirements from different HE providers that it makes it very difficult for individuals to negotiate their own admission requirements from VET qualifications. This is the advantage of a dual-sector university in simplifying the pathway agreement for individuals, where there is one organisation running both VET and HE programs. This provides a rationale why we have asked the question 2 and question 3 in this section.

Q2: What was your main reason for undertaking an Associate Degree of Engineering? Answered: 9 Skipped: 1

Answer Choices	Responses	
To get into Bachelor Degree of Engineering or Science study at Swinburne University	**78%**	7
Total	**9**	

Q3: Why did you choose Swinburne University of Technology to do your Associate Degree of Engineering study? Answered: 9 Skipped: 1

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Applicable	Total
SUT is a dual sector university and this would provide the best integration between Vocational Education and Higher Education systems.	**11%** 1	**0.00%** 0	**22%** 2	**56%** 5	**11%** 1	**0.00%** 0	9

#	Additional comment (pleasespecify)
1	Swinburne seemed more hands on and physically involved than other theoretically based universities
2	I liked SUT at the open day, I got an offer (1st round) and so I took it. Simple as that :) I also didn't have a high enough ATAR to go straight into the Bachelor of Civil (I needed 75, but only got 74)

These questions show that most students undertaking the AD were indeed using it to pathway into a BE, and that they felt SUT would provide an integrated pathway for them to follow.

Section 2: Academic experience during recently graduated AD course at TAFE

The rationale for question 4 and question 5 was to collect evidence on the academic experiences received from the vocational education by the recent graduates of AD that are currently doing BE at SUT. This highlights the disparity between two different pedagogies, VET and HE.

Q4: How would you rate your experiences of the following aspects of the Associate Degree of Engineering? Answered: 8 Skipped: 2

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Applicable	Total
My instructors had a thorough knowledge of the subject content	**0%** 0	**0%** 0	**12.5%** 1	**50%** 4	**37.5%** 3	**0%** 0	8
My instructors provided opportunities to ask questions	**0%** 0	**0%** 0	**25%** 2	**37.5%** 3	**37.5%** 3	**0%** 0	8
My instructors understood my learning needs	**0%** 0	**0%** 0	**37.5%** 3	**12.5%** 1	**50%** 4	**0%** 0	8
My instructors communicated the subject content effectively	**0%** 0	**0%** 0	**12.5%** 1	**62.5%** 5	**25%** 2	**0%** 0	8

Q5: How would you rate your learning experiences in the following aspects of the Associate Degree of Engineering? Answered: 8 Skipped: 2

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Applicable	Total
My Associate Degree of Engineering developed my problem solving skills	**0%** 0	**0%** 0	**12.5%** 1	**37.5%** 3	**50%** 4	**0%** 0	8
My Associate Degree of Engineering helped me develop my ability to work as a team member	**0%** 0	**0%** 0	**0%** 0	**50%** 4	**37.5%** 3	**12.5%** 1	8
My Associate Degree of Engineering helped me to develop the ability to plan my own work	**0%** 0	**12.5%** 1	**0%** 0	**50%** 4	**37.5%** 3	**0%** 0	8
My Associate Degree of Engineering has helped me think about new opportunities in life	**12.5%** 1	**0%** 0	**0%** 0	**50%** 4	**37.5%** 3	**0%** 0	8

#	Comment on other learning experience not listed above (please specify)
1	It is a great way to develop people's team working skills, due to the closer classroom environment as opposed to the higher ED structure of Lectures & Tutorials. From it, I also gained friends that are still with me doing the bachelor of Civil and still great friends to this day:)

This section highlight is the following responses within the two questions that were ranked high by the participants.

- My instructors understood my learning needs
- My instructors communicated the subject content effectively
- My Associate Degree of Engineering developed my problem solving skills

The evidence from this result indicates that vocational education instructors of AD at SUT are practicing student-centered learning theory. This is possible due to small class size and classroom delivery model combined with personalised instruction and facilitation.

Section 3: Academic experience during the current BE (Honours) course at HE

The rationale for question 6 and question 7 was to collect similar evidence as collected in Section 2 on the academic experiences of the past AD graduates from their BE study at SUT. This would allow the researchers to further compare the disparity between two different pedagogies, VET and HE for this study.

Q6: How would you rate your experiences of the following aspects of the Bachelor of Engineering? Answered: 7 Skipped: 3

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Applicable	Total
My instructors have a thorough knowledge of the subject content	**0%** 0	**0%** 0	**14.3%** 1	**14.3%** 1	**71.4%** 5	**0%** 0	7

My instructors provide opportunities to ask questions	0% 0	0% 0	42.75% 3	42.75% 3	14.3% 1	0% 0	7
My instructors treat me with respect	0% 0	0% 0	0% 0	66.7% 4	33.3% 2	0% 0	6
My instructors understand my learning needs	0% 0	0% 0	16.7% 1	66.6% 4	16.7% 1	0% 0	6

Q7: How would you rate your learning experiences in the following aspects of the Bachelor of Engineering? Answered: 6 Skipped: 4

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Applicable	Total
The Bachelor of Engineering is helping me develop my ability to work as a team member	0% 0	0% 0	0% 0	50% 3	33.3% 2	16.7% 1	6
The Bachelor of Engineering is helping me to develop the ability to plan my own work	0% 0	0% 0	0% 0	50% 3	50% 3	0% 0	6
The Bachelor of Engineering is making me more confident about my ability to learn	0% 0	0% 0	33.3% 2	33.3% 2	33.4% 2	0% 0	6
The Bachelor of Engineering is helping me think about new opportunities in life	0% 0	0% 0	16.7% 1	50% 3	33.3% 2	0% 0	6

The highlight in this section has the following interesting results:

- My instructors provide opportunities to ask questions (48.86% neither agree nor disagree)
- The BE is helping me develop my ability to work as a team member (50% agree)
- The BE is helping me to develop the ability to plan my own work (50% agree)
- The BE is helping me think about new opportunities in life (50% agree)

Overall result indicates that the BE program and the instructors are practicing teacher-centered learning theory. The participants' evidence suggests that there was less of a direct opportunity to ask questions in a lecture where there are a large number of students.

The result's evidences also shown that the students are expected to develop their own ability to plan their own learning strategies without direct support. This is important to the students' self-development in a university academic development as an independent learner. The science of goal setting is a primary tool required by students in any pedagogy setting. It is argued that the art of goal setting is a skill that should be taught in higher education to the transition students from VET to HE. This cohort is coming from the VET environment where the teachers are performing the task of goal setting and planning their learning strategies for the students. Further study needs to be done to gather evidence on what support is available to the students, in particular, the transition students, to assist them in developing their skills in learning strategy planning, since this is the key to their academic success in the HE environment as suggested in Dowling, D. (2010) and Australian Workforce Productivity Agency (2012) report.

The participants also mentioned that the opportunity given to articulate into BE study provides them new professional and career life opportunity that would not have been available without it. This is an important evidence in support of VET to HE pathway and our society's goal to train more professional in high technology industry of the future.

Section 4: Academic transition experience from AD to the BE course at SUT

In this section, the researcher asked the participants to compare and contrast the academic transition experience from the AD course to the current BE course at SUT. Question 8 and Question 9 were used to collect evidence for this section.

Q8: Rate the following statements about your transition from the Associate Degree of Engineering (AD) to the Bachelor of Engineering (BE). Answered: 8 Skipped: 2

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree	Total
I found the transition from the AD to the BE easy.	**12.5%** 1	**0%** 0	**25%** 2	**25%** 2	**37.5%** 3	8
I knew what to expect in the BE before I transitioned from the AD.	**12.5%** 1	**12.5%** 1	**37.5%** 3	**25%** 2	**12.5%** 1	8
I found the transition in teaching practices from the AD (e.g. Small classes, workshop style) to the BE (e.g. Large classes, lecture style) to be easy.	**0%** 0	**12.5%** 1	**37.5%** 3	**25%** 2	**25%** 2	8
I felt that the BE gave enough advanced standing for what I had done in the AD.	**0%** 0	**12.5%** 1	**12.5%** 1	**62.5%** 5	**12.5%** 1	8
I felt well supported by Swinburne to make the transition from the AD to the BE.	**12.5%** 1	**0%** 0	**12.5%** 1	**50%** 4	**25%** 2	8
I feel well supported in the BE as a prior Swinburne student.	**0%** 0	**25%** 2	**37.5%** 3	**25%** 2	**12.5%** 1	8
I feel I've missed out not being a first year student in the BE.	**25%** 2	**12.5%** 1	**25%** 2	**37.5%** 3	**0%** 0	8

#	Please explain your responses
1	This is true that I don't have a large group of friends that are in my course, either because I wasn't with them at the start or I haven't pushed myself to make a lot of friends, I tend to associate with people that I've met in the associate degree
2	I do not feel strongly about the transition of the course, but felt it was a good experience.
3	I found the transition from the AD to the BE was different going from classrooms to lectures and tutes.
4	The transition was nice and easy. Would have been nice, however, to be able to actually do the additional 2 and a half years of study over 2 and a half years, instead of being forced to do it over 3 years, due to certain subjects only being available in one semester.

Q9: How would you describe your transition experience from the Associate Degree of Engineering to the Bachelor of Engineering? Answered: 6 Skipped: 4

#	Responses
1	It was fine. I had no major issue with the transition.
2	OK, very good
3	It took about a year to get used to the lecture and tute structure.
4	Ok, lost a few subjects which were kind of a waste.
5	Nice, and smooth. Having Fluid Mechanics as a higher ED subject in the last year of the Associate degree was a great idea, and will serve to properly prepare future Associate degree students for the transition as well.

The highlights in this section come from the participants' high rank responses to the following

- I felt that the BE gave enough advanced standing for what I had done in the AD.
- I felt well supported by Swinburne to make the transition from the AD to the BE.

And the following direct comment from the participants to the please explain in Q8 and open question in Q9.

- I found the transition from the AD to the BE was different going from classrooms to lectures and tutes.
- Nice, and smooth. Having Fluid Mechanics as a higher ED subject in the last year of the Associate degree was a great idea, and will serve to properly prepare future Associate degree students for the transition as well.

We can make the following conclusion from this evidence:

The level of credits awarded for the AD program to BE program is very important factor for the students. In SUT case, this level is right.

It is important to the students to have a gap transition program. In SUT case, this was provided by asking the AD students in their last stage to take one unit of study from the BE program as an elective. The students considered this very important as commented by the participants in our result. We need to do further study to find out if doing more than one elective would be beneficial to the AD students are not.

Section 5: Transition support from SUT

Q10: How could Swinburne have helped make your transition easier? Answered: 4 Skipped: 6

#	Responses
1	I can't see a way for improvement. But I believe the entire university needs to adapt better to modern and future learning styles including what they teach in terms of it's getting to the point that a degree is almost a waste of time. getting a job in engineering, working and studying sort of like an apprenticeship at the moment seems like a much better option for a high school graduate as the time spent at Uni is not achieving much in terms of the industry and the learning of hands on skills and workplace skills
2	There isn't really anything that the Uni needs to do.
3	Would have been better if every student got a one on one with an adviser to talk us through our future course.

This section indicates that the organisation support is very important to the successful transition from the AD program from the VET system to BE program. The comments provided by above the participants provide the evidence for this argument.

The students transiting from AD to BE have special academic support requirements. These students need a course specialist that understood the two programs to assist them with their study plan and timetable for their BE. In SUT case, we need to collect more evidence to understand the level of support the pathway students is getting.

Conclusions

The evidences for this research paper shows that it is a necessity for VET qualification to be used as a pathway entry requirement for those individual within our community that would not have access to HE study without. The participants said, they are expected to develop their own ability to plan their own learning strategies without direct support in HE system. They mentioned that, the opportunity given to articulate into BE study provides them with new professional and career life opportunity. There was a distinct statement given by the participants that a gap transition program is very important for their successful transition into HE system. Finally, there was evidence that there is a need for a course specialist that understood the two programs to assist them with their study plan and timetable for their Bachelor degree program. These outcomes are very important issues for all the participants in this research paper.

Further examination of the result in this research paper shows that the participants, the graduates of Associate degree of engineering from VET system, that are transiting into the Bachelor degree at dual-sector University such SUT need a voice. They have so much more to say that our structured research instrument could not capture. We are unable to capture their entire academic transition story and we will do further study as required in the future to give these participants a voice to tell their academic transition story.

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