Completing engineering degree programmes on-line during the Covid-19 pandemic: Australian international students' perspectives

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ABSTRACT: Engineering programmes require intensive mentor-peer interactions and industry-based internships. Engineering students traditionally need to receive their training on-campus to become skilled professionals. However, due to the Australian government's border policy and the recommendations of social distancing, international students outside Australia could not return for their university education. This study aims to understand the motivations and reasons why international engineering students decided to continue their degrees with Australian universities through the distance learning option. Based on 200 interview sessions with students from the Far East and South-East Asia, the researcher concluded that the participants enjoyed the flexibility and agreed with the trend to distance learning in engineering education. The results provide the blueprint for potential students to understand the advantages and challenges of distance learning. Also, university leaders and heads may take this study as a guide to reform and develop potential distance learning programmes and courses in order to meet the demands of international students.

INTRODUCTION

Australia is one of the most popular destinations for international students due to its location, quality of education, good university rankings and excellent career opportunities. Many secondary school graduates decide to apply to Australian universities. According to the Australian Trade and Investment Commission, the international student population has doubled in the last decade, increasing from 289,465 in 2013 to 582,696 in 2020 [1]. Although distance learning is a learning option available to domestic and international students who cannot attend traditional face-to-face lessons on-campus, most students select the latter option as their learning channel.

A recent report indicated that 70% of students in Australian higher education were pursuing their courses and programmes as traditional on-campus students before the Covid-19 pandemic. The other 30% were either following distance learning or blended learning programmes (i.e. involving both face-to-face and distance learning). While some universities have missions to provide distance learning options, such as the University of New England and Charles Sturt University, most Australian universities focus on face-to-face teaching and learning, particularly for taught degree programmes with intensive practical teaching components. However, there is a need for Australian universities to invest in distance learning courses and programmes for students from remote and regional areas who cannot travel to campus regularly [2].

Traditionally, the option of distance learning is a response to the difficulty of travel to campus sites. As most students decided to learn on-campus, distance learning programmes had not been adopted by most Australian universities pre-pandemic, particularly among research-focused urban universities. However, due to the Covid-19 pandemic, the Australian government encouraged social distancing, which led universities to offer teaching via distance learning. In late March 2020, the government announced the closure of the border to all non-residents, the closure of non-essential services and school activities, which would therefore have to be conducted remotely. Most university programmes and lessons began to be delivered via distance learning.

Significance

Although distance learning is not a new approach, many students wish to experience life on-campus with face-to-face interactions, and some subjects require intensive mentorship, mentor-student interaction, internships, and interaction between students. This is so for professional programmes and engineering subjects. As of early May 2021, the Australian

borders remain closed to all non-residents, including international students even with a valid student visa. Most international students cannot return to Australia for their university education. As a result, Australian universities introduced on-line learning platforms for domestic and international students who could not otherwise complete their degree programmes. However, distance learning is not appropriate for all programmes.

Engineering students may complete their general education and theoretical courses via distance learning lessons. However, their programmes' professional requirements, such as internship and practicum, mean that students need to learn industry practices and apply their theoretical knowledge during internships. Due to the government's policies and the Covid-19 pandemic, many international students who left Australia before the lockdown could not return to Australia for their blended courses and internship experiences.

Purpose of the Study

Engineering degree programmes require intensive mentor-peer interactions and industry-based internships. It is expected that engineering students need to receive their training on-campus and on-site to become skilled professionals. However, due to the Australian government's border policy and the recommendations of social distancing, international students who were outside the country were not able to return to Australia for their university training and education. This study aims to understand the motivations and reasons why international engineering students decided to continue their degree programmes with Australian universities through the distance learning option. Based on social cognitive career theory [3], the current study was guided by two research questions:

Research question 1: Why would international engineering students decide to continue their degree programme through the distance learning option?

Research question 2: How would international engineering students describe their learning in their home country provided by distance by an Australian university, particularly during the Covid-19 pandemic?

Theoretical Framework: Social Cognitive Career Theory

Social cognitive career theory was used to explore the learning motivation and experience of international students who are completing their degree by distance learning in their home country, particularly during the Covid-19 pandemic [4]. This theory was developed based on Bandura's self-efficacy theory to understand the career decision and sense-making process [5]. Due to the social, financial, economic and cultural development, the current study employed the enhanced version of the social cognitive career theory based on the development of a recent study [3]. The influential points of the social cognitive career theory included the following points:

- Interest in career development.
- Personal considerations.
- Financial considerations.
- Academic interest.
- Achievement of educational and career goals.

METHODOLOGY

The general inductive approach was employed to gain an in-depth and qualitative-based understanding and perspectives from a total of 100 international students who are currently studying remotely for their undergraduate engineering degrees at one of the Australian universities during the Covid-19 pandemic [6].

Participants and Recruitment

A total of 100 participants were invited via a snowball sampling strategy. First of all, the researcher contacted three participants who met the requirements for this study. After explaining the study's rationale, the participants signed agreements and read the interview protocol. Due to the Covid-19 pandemic, the interview was conducted via a distance based tool(s). After the interview session(s), each participant referred to at least one other participant. As a result, 100 participants were invited from South Korea, Japan, China, Hong Kong, Macau, Taiwan, Singapore, Malaysia, Brunei, Thailand, Laos, Vietnam, Mongolia and the Philippines.

Data Collection

Due to the recommendation of social distancing, the participants required distance-based interview session(s) with the researcher. None of the participants requested a face-to-face interview. Some researchers indicated that the interview tool is a useful qualitative data collection tool, particularly to capture an individuals' decision-making process and story sharing. The researcher arranged the interview session(s) with each participant via a distance-based interview tool. Each interview session lasted from 63 to 89 minutes. After the interview session, the researcher encouraged a brief follow-up interview session. All 100 agreed with the follow-up interview sessions. Each brief follow-up interview session

lasted from 15 to 32 minutes. During the interview session, the researcher used a digital recorder to record the session. However, no visual information was captured. After the researcher transcribed the voiced messages to written transcripts, the researcher sent the transcripts to each participant for written confirmation. All confirmed their material.

Data Analysis

The researcher re-read the written transcripts for the connections and themes, and employed the open-coding technique to categorise the similarities and themes from the interview data. The, 12 themes and 15 subthemes were merged as the first-level themes. The axial-coding technique was employed to narrow the data further. As a result, two themes and three subthemes were yielded as the second-level themes and subthemes.

Human Subject Protection

The signed agreements, contact information, e-mail addresses, university enrolment, personal information, voiced messages, written transcripts, computer and related information were locked in a password-protected cabinet. Only the researcher could read the information. Upon study completion, the researcher deleted and destroyed the material immediately. The research study received support from the Woosong University Academic Research Funding 2021.

RESULTS AND DISCUSSIONS

After 200 on-line interview sessions, the researcher analysed the transcripts and categorised the information into meaningful themes and subthemes. This qualitative inquiry into the themes and subthemes enabled response to both research questions.

Distance Learning Programmes have the Same Reputation and Academic Quality as On-campus Programmes

This theme and its subtheme related to research question 1. Although there are no statistics on how many international students abandoned their education due to the Covid-19 pandemic and the distance learning option, many continue their degree programmes through distance learning. All the participants interviewed stated that the teaching and learning tools, as well as styles involved in distance learning had not affected their results. They all wished to gain their degree, as soon as possible to pursue their career development and achieve their goals. Regarding university reputation, two significant opinions were captured:

…I want to gain my university degree with the name of my Australian university …I do not think the learning platform [on-campus and distance learning] …will influence my educational outcomes …I can learn my courses on-line …want to complete my degree as soon as possible… (Participant #45, Korean, 3rd year)

I think my university graduation, the university reputation, and degree parchment are more important than the ways of learning …although we received on-campus education before the Covid-19 pandemic, we still had a lot of on-line discussions …I could not see the major differences …but I can see that the reputation and name of the university …could represent my skills and knowledge… (Participant #56, Korean, 3rd year)

Besides university reputation, all the participants expressed their appreciation of Australian universities' reputation and the academic quality control exercised by the Australian government. All academic programmes, teaching and learning tools, and curricula must pass the evaluation and assessment procedures of university departments and government agencies. Although the materials and lessons were delivered through distance learning, the academic quality was assured. An interesting comment follows:

…the lesson plans, PowerPoint, textbook, reading, and project guidelines …should receive the approval from the university department …the degree learning plans …what courses should be learnt …should receive the green light from the government too …the learning tools over the Internet …do not make any differences …the quality is the same …my degree …is issued by the same university …the location should not …make any differences… (Participant #21, Chinese, 4th year)

In short, in line with social cognitive career theory [3], the participants continued their learning through distance learning mainly focused on the achievement of educational and career goals, particularly the reputation of the university, and how that reputation would aid them in achieving their career goals and development. As shown in a previous study, university reputation is one of the most important considerations in Asian international students' selection of a programme [7]. Here, all the participants expressed concern about their university's reputation rather than lessons and coursework. Therefore, the findings confirm the previous study [8].

Academic Rigour

Pozdnyakova and Pozdnyakov, have argued that distance learning programmes and courses may not have the same academic rigour as traditional on-campus programmes [9]. Others, e.g. Curran et al, have argued that employers may

look down on applicants with a distance-based university degree [10]. All the participants stated that the academic rigour of their distance learning was no different. They argued that the knowledge and skills they gained from the distance learning courses are as valuable as the traditional face-to-face courses. The biases of employers and the public are stereotypes due to misunderstanding. Two interesting comments were captured:

...we learnt the same courses ...the syllabus and lesson plans from the blended courses on-campus ...and our distance learning courses are the same ...professors need to use the same textbooks and materials for both lessons ...the computer system allowed us to share our ideas with other classmates ...even if we are in the classroom, we need to follow the two-metre guideline ...no differences... (Participant #82, Taiwanese, 2nd year)

...during the normal period, we also have on-line courses too ...we can complete some of our courses on-line ...I did that more than six times ...and now, we are doing the same procedures ...for some courses ...it is always better to have on-line learning ...as we are using the same books and submitting the same projects ...the same academic expectations and qualities ...are found... (Participant #99, Singaporean, 3rd year)

In conclusion, the researcher confirmed that the thoughts shared by the participants matched the tenets of social cognitive career theory [3], particularly how the achievement of education and career goals highly influences the decision-making process of international engineering students, leading them to decide to continue their degree programme through the distance learning option. With the reflection of a previous study, academic rigour and degree quality should not be compromised based on delivery styles, tools and location [11]. All the participants believed that the achievement of education and career goals outweighed the difficulties and factors caused by the Covid-19 pandemic.

Distance Learning is the Future of Teaching and Learning

This theme and its subthemes related to research question 2. Many studies indicate that distance learning and on-line education are the future of higher education [12][13]. For more than three decades, schools and universities have provided technologically assisted teaching and learning tools, paper-based completion plans, and self-paced learning models for students who cannot physically attend on-campus courses and lessons. Although these alternative teaching and learning models are established, most students and teachers prefer the traditional face-to-face experience.

Only with the Covid-19 pandemic did government agencies and universities widely introduce distance learning platforms for courses and lessons. It is plausible that the distance learning model will become a popular delivery tool in higher education. The participants echoed these ideas and shared their motivations and positive experiences of distance learning education, such as the following:

...we are in the school of sciences and engineering ...we should be open-minded for different technology and learning ways with technologies and computer systems ...I always develop different computer systems ...for the development of technology ...I think the university should understand and apply the technology in education and teaching... (Participant #2, student from Hong Kong, 4th year)

...I believe some university departments and leaders are not open to on-line teaching ...but as an engineering student ...I advocated that our society should merge with different technology ...the university is a good starting point ...students need to understand the advantages of technology ...after they finished school ...they can apply the technology and on-line ways to the communities and companies... (Participant #20, student from Macau, 3rd year)

In line with social cognitive career theory, many participants believed that their academic interest in technology and technologically assisted teaching and learning environments enhanced their positive experiences of distance learning [3]. With the reflection of a previous study, most believed that their university should establish additional technologically assisted courses and programmes as this is the future of higher education [14].

Distance Learning Education facilitates Advanced Development for Students

A recent study by Kocdar et al concluded that engineering education should be further developed, particularly in terms of flexibility, remote learning and distance learning [15]. In line with the ideas of the Fourth Industrial Revolution, engineering students and professionals should gain *global citizenship skills, innovation and creativity skills, technology skills, interpersonal skills, personalised and self-paced learning, accessible and inclusive learning, problem-based collaborative learning, and lifelong and student-driven learning* [15]. The researcher asked interview questions based on social cognitive career theory [3] and the ideas of the Fourth Industrial Revolution and captured the following comments:

...I agreed that the fourth industrial revolution is the key for us ...university students ...and science students ...to understand different skills and abilities ...the current on-line learning with the ideas of self-paced learning and

virtual discussions with classmates and teachers ...I think it is many steps forward ...we do not need to wait until our first job for these skills ...we are learning at the university... (Participant #94, Malaysian, 4th year)

University students and engineers should understand how to manage different skills ...from the university curriculum ...the on-line learning opportunities allowed us to learn all the fourth industrial revolution factors that you mentioned above ...this is uncommon for face-to-face learning ...we have to manage our projects and timetable... (Participant #8, Chinese, 4th year)

In short, the researcher confirmed that their interest in career development and determination to achieve their educational and career goals drove the participants' positive experiences. As found by some previous studies, when students cannot attend traditional face-to-face courses on-campus, their learning expectations and goals are determined by their own self-efficacy and behaviours, not the external environment [16][17].

Completing Internships in the Home Country

More than three-quarters of the participants expressed their interest in internship opportunities in their home country, as most will return home after university graduation. The study by Lambert et al indicated that although many international students enjoy their host country's living standards and environment, most want to contribute their energy and knowledge to their home country after graduation [18]. The following two comments capture the desire expressed by the respondents:

...I want to apply my skills to my city and region ...therefore, the current Covid-19 pandemic and on-line learning opportunities ...greatly allowed me to seek internship experiences and potential jobs in my country ...I can continue my education whilst working in my city ...this is unique and excellent... (Participant #80, Taiwanese, 4th year)

...I was thinking ...to do an internship in my country two years ago ...but I do not know how to apply for this international internship ...but I could do that now as I am in my country and working on my education on-line at my university ...I can approach my professor and supervisor with some professional questions and problems ...without waiting ...because we can chat on-line with Zoom and Skype... (Participant #75, Japanese, 4th year)

All the participants spoke positively of their distance learning experiences with Australian universities from their home country. Some minor complaints were captured. However, these comments concerned political issues and technological difficulties (e.g. due to the Chinese Internet restrictions) and had little influence on the results of this study. In line with social cognitive career theory, the participants' interest in career development and their focus on educational and career goals drove their positive experiences [3].

More importantly, all expressed personal and academic improvements (i.e. skills, time management and self-paced organisation). They stated that the traditional face-to-face courses and lessons could not provide such experiences. As shown by a previous study, high levels of self-efficacy always drive positive experiences, behaviours and learning outcomes [19]. As the Covid-19 pandemic offered them unique experiences during their university journey, they all spoke of positive and engaging experiences.

LIMITATIONS AND FUTURE RESEARCH DEVELOPMENT

The Covid-19 pandemic is an international crisis. Most schools and universities face the same problems concerning the international student population: falling enrolment, the challenges of technologically assisted teaching and learning tools, and the dissatisfaction of teachers and students. Due to this study's location and focus (i.e. Australian universities), the data may not generalise to other countries and regions. Therefore, future research studies should extend it to other populations and geographic regions to provide a more holistic picture of the current problems faced under the Covid-19 pandemic.

The researcher recruited participants from the Far East and South-East Asia; international students from other regions were neglected. As international students from other regions are also important, future research studies should collect data from international students worldwide to construct a more representative sample. Only the voices of engineering students were captured. As international students on different academic programmes may face similar situations, future research studies should collect data from students in other faculties to increase the density of the findings.

CONTRIBUTIONS AND CONCLUSIONS

This study has made two contributions. First, the current study outlined the development(s) of distance learning education for Australian universities, particularly during the Covid-19 pandemic. From the students' perspective, the distance learning programmes and courses offer the flexibility and opportunities to complete the coursework and internship on-line and in their home country. Although the in-person interactions were missing, the Internet-based

interactions and exchanges do not limit the knowledge exchange. Based on the participants' feedback, potential students may better understand how distance learning programmes and courses may be beneficial to their education [20].

Second, university leaders may take this study as a blueprint to develop additional distance learning programmes and courses. Although some professional programmes may require face-to-face internships and practices from their instructors, many liberal arts programmes, such as philosophy, can be completed on-line [21]. Therefore, this study provides some ideas to develop current curricula and instruction.

In conclusion, although the Covid-19 pandemic may end soon, the development of technologically assisted teaching and learning tools will continue to be key to learning. The experiences shared by international engineering students provide a blueprint and direction for school leaders, government agencies, and policymakers to reform and improve the current university curricula [22]. Schools and universities should continue to upgrade their distance learning programmes [21] to meet the needs of 21st Century students and employers [20].

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BIOGRAPHY

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