

## **The On-going Status of The 3+1 Dual Degree Program in Electrical Engineering and Computer Engineering between Northern Arizona University and Chongqing University of Post and Telecommunication**

### **Dr. Xi Zhou, Northern Arizona University**

Dr. Zhou is an Assistant Professor of Practice in the School of Informatics, Computing, and Cyber Systems at Northern Arizona University and is primarily focused on the NAU/CQUPT dual degree program. He completed his Ph.D in Material Science and Engineering in 2014 at Norfolk State University in Virginia. Dr. Zhou's research interests are in semiconductors and electronics. He also possesses several years of industry experience as a device engineer in a leading semiconductor company in Shanghai, China.

### **Prof. Fang Lei, Chongqing University of Posts and Telecommunications**

Fang Lei (1972-), female, from Jingtai, Gansu province, China, associate professor, School of Communication and Information Engineering, Chongqing University of Posts and Telecommunications, deputy director of Communication Technology and Network Lab Center, mainly teaching EDA and electronic system design.

### **Dr. Delbert D Willie, Northern Arizona University**

Delbert is an Assistant Professor at Northern Arizona University in the School of Informatics, Computing and Cyber Systems. A part of his time is spent teaching in China as part of the unique transfer program between NAU and Chongqing University Posts and Telecommunications referred to as NAU/CQUPT 3+1 Program. Research interests include precipitation analysis from ground based radar and International programs. He received his PhD in electrical engineering from Colorado State University in 2015.

### **Dr. Andrew Chrysler, Northern Arizona University**

Andrew M. Chrysler (M'13) is an Assistant Professor of Practice in the School of Informatics, Computing and Cyber Systems at Northern Arizona University in Flagstaff, Arizona. He supports a 3+1 dual degree program delivering electrical engineering courses in Chongqing, China. He received his B.S. in chemical and biological engineering in 2011 from Colorado State University in Fort Collins, Colorado. He received his M.S. in electrical and computer engineering from the University of Utah in Salt Lake City, Utah in 2017 and his Ph.D. in electrical and computer engineering in 2018.

He has worked at IM Flash Technologies in Lehi, Utah as a Semiconductor Manufacturing Engineer and as a Co-Op at the NASA Glenn Research Center in Cleveland, Ohio. He has also conducted research at Daegu University in Daegu, South Korea. His research interests include implantable antennas, millimeter wave antennas, and international engineering education.

Dr. Chrysler is an NSF EAPSI Korea Fellow ('15) and received the IEEE APS Doctoral research award ('13).

### **Dr. Liangbo Xie, Chongqing University of Posts and Telecommunications**

Dr. Xie is an associate professor in the School of Communication and Information Engineering at Chongqing University of Posts and Telecommunications. He is a co-Faculty in the NAU/CQUPT 3+1 Program. His research interests are in ultra-low-power analog circuits, low-power SAR ADC, low-power digital circuits, anti-collision Algorithm for RFID and indoor-localization.

### **Dr. Phillip A Mlsna, Northern Arizona University**

Dr. Mlsna is a retired Associate Professor in the School of Informatics, Computing, and Cyber Systems at Northern Arizona University. He has served as Faculty Director of the NAU/CQUPT 3+1 Program. His research interests are mainly in the areas of image processing, computer vision, engineering education, and academic ethics. He has extensive experience as a computer hardware engineer at Hewlett-Packard.

**Dr. Jie Yang, Northern Arizona University**

Dr. Yang is an assistant professor of practice in the School of Informatics, Computing, and Cyber Systems at Northern Arizona University. She serves a coordinating role in the NAU/CQUPT 3+1 Program. Her research interests are in wireless communications, signal processing, and engineering education.

# **The On-going Status of The 3+1 Dual Degree Program in Electrical Engineering and Computer Engineering between Northern Arizona University and Chongqing University of Post and Telecommunication**

It has been five years since the first cohort of Chinese students was accepted into the 3+1 dual-degree Bachelor's program in Electrical Engineering (EE) and Computer Engineering (CE) in 2014. The program was started jointly by Northern Arizona University (NAU) in Flagstaff, USA and Chongqing University of Posts and Telecommunications (CQUPT) in the People's Republic of China. According to the program blueprint, enrolled students spend their first three years in CQUPT, taking courses that are taught by both CQUPT and NAU faculties. In their fourth year, qualified students transfer to NAU campus in Flagstaff, Arizona. Successful students receive two Bachelor's degrees: one from NAU in EE or CE and the other from CQUPT in Electronic Information Engineering. As of Spring 2018, 27 students from the first cohort who went to NAU in their senior year have successfully graduated, and another 29 students from the second cohort are studying in NAU right now. In this paper, the current state of this joint program is presented, including course setup & planning, student transfer data, student performance during the senior year at NAU, differences in teaching methodologies, and student learning styles. The successes as well as the challenges are summarized, and some future development plans are addressed.

## **Introduction**

Over the last two decades as the economy of China expands, there has been an increase in the desire of Chinese parents to expose their children to international education opportunities. In the current job market in China, an overseas study experience can greatly increase a student's ability to obtain good employment after graduation. It offers students an option to begin a careers outside China after graduation, possibly even remaining there permanently. Since the cost of a typical four-year undergraduate program in many western countries are very high and beyond the capability of many middle-class families in China, collaborative programs jointly run by foreign and Chinese universities have become a popular means in which to mitigate the overall expenses. Tuition in China is overall much lower, and the students have the opportunity to obtain a degree from the US or other non-Chinese country.

Sino-British joint programs were among the first established Sino-foreign programs and still comprise the biggest portion, amounting to about one fifth of all the Sino-foreign joint programs<sup>1</sup>. Sino-US joint programs, especially in engineering field began later, but have increased dramatically over the past twenty years<sup>2,3,4,5,6,7</sup>. The NAU/CQUPT 3+1 dual-degree program in electrical engineering and computer engineering was initiated in 2013 by both universities. In this program structure, students spend the first three years at the CQUPT campus in Chongqing, China. During this time period they must complete all core and elective courses based on the curriculum agreed upon by both universities. This includes nine NAU core engineering courses that are taught face-to-face by NAU faculty at CQUPT. In the fourth year, qualified students have the transfer option to attend NAU campus to complete their senior year. Upon graduation, these qualified students will receive a bachelor-of-science (BS) degree in either Electrical Engineering (EE) or Computer Engineering (CE) from NAU, and a BS degree in

Electronic and Information Engineering (EIE) from CQUPT. For those students who choose to stay at CQUPT for their fourth year, they receive a BS degree in EIE from CQUPT when they meet all of the graduation requirements of the international college of CQUPT.

The first cohort of students in the NAU/CQUPT 3+1 program have graduated, and the second cohort of students are completing their senior year at NAU. The third and fourth cohorts are continuing their study at the CQUPT campus, and the fifth cohort are entering the CQUPT campus as first-year students. The purpose of this paper is to discuss the current state of this dual degree program, that includes course setup & planning, student transfer data, student performance during the senior year at NAU, differences in teaching methodologies, and student learning styles. The successes as well as the challenges are summarized, and some future development plans are addressed.

### Course setup and planning

The core courses that the students need to take each semester during their first three years on CQUPT campus are listed in table 1. Beginning with the fall semester of the freshman year and continuing through the spring of the junior year, NAU faculty are responsible to teach nine core courses on the CQUPT campus. All of these NAU courses are taught in China and are administered using the same instruction format as is done at NAU Flagstaff campus. There are some minor differences due to the specific teaching environment at CQUPT. For example, in course EE 215, both NAU and CQUPT use the TI MSP430 microcontroller as the lab device, but the specific models differ. In this instance, the instructor has adjusted the lecture and lab materials to account for this. Another case occurs with EE380, where the lab materials are amended to match the available software at CQUPT.

As the students enter their third year at CQUPT, the students can then apply for a transfer to NAU to complete in their fourth year. These nine courses given by NAU faculty plus all other core courses taught by CQUPT instructors, are transferred and accepted into NAU credits.

Table 1: List of core courses by semester that are taught in CQUPT campus

Years in College	Semesters	Faculty that teaches the course	Course number (NAU only)	Course name and number (if available)
Freshman	Fall	CQUPT	--	C Programming
	Spring	CQUPT	--	Data Structure and Algorithm
Sophomore		Fall	NAU	EE110
	NAU		EE188	Electrical Engineering I
	NAU		EE188L	Electrical Engineering Lab I
	Spring	NAU	EE215	Microprocessors
		CQUPT	--	Embedded System design
		NAU	EE280	Introduction to Electronics
Junior	Fall	NAU	EE348	Fundamentals of Signals and Systems
		CQUPT	--	Digital Signal Processing
		CQUPT	--	Technology for Information Networks
		CQUPT	--	Software Development and Design
		NAU	EE380	Fundamentals of Electronic Circuits
	Spring	NAU	EE310	Fundamentals of Computer Engineering
		CQUPT	--	Principles of Telecommunications
		CQUPT	--	Principle and Application of DSP
		CQUPT	--	Electrical Systems Design and Simulation
		NAU	EE364	Fundamentals of Electromagnetics

As shown in Table 1, there are always five NAU courses taught each fall, and four NAU courses taught each spring at the CQUPT campus. Each course is assigned to one NAU faculty member with the exception that EE188 and EE188L are taught by the same person. This faculty assignment is based on several factors, such as, the request by CQUPT, that one NAU faculty instruct only one course per semester in order to insure high quality for these NAU courses. Another is, there are typically around 100 students per cohort and each course is taught in multiple sections. The students from each cohort are divided into 4 groups and identical lecture and lab sections are given to the groups. Essentially there needs to be four NAU faculty members that are required to travel to CQUPT every semester. For each course, CQUPT allocates two co-faculty, that are CQUPT professors with very good student evaluation scores and have overseas study/work experience. They are assigned to assist each NAU faculty member with course schedules, labs, classrooms and exam proctoring etc<sup>8</sup>.

Other adjustments and considerations that occur, are that NAU and CQUPT semesters have different durations and start/end times. To accommodate this, the class schedules of NAU courses are adjusted to coincide with the CQUPT semester. The semester at NAU begins in January for spring and August for fall and extends for sixteen weeks. At CQUPT, the semester typically begins in late February for spring and mid-September for fall with a period of nineteen weeks. Another consideration was the duration of time allowed to work in China before additional tax amounts are imposed by the Chinese tax authority. Therefore, both universities arranged to conduct the NAU semester course content within a twelve-week timeframe while at

CQUPT. This arrangement also provides sufficient overlap of the NAU and CQUPT semesters allowing faculty to administer the courses during the active semesters at NAU and CQUPT. NAU faculty use the shortened semester duration to have additional time to arrange living abroad, travel preparation, and organize courses for work in China within the 16-week NAU semester timeframe.

Within the twelve weeks, all course content is carried out while at CQUPT with the exception of the final exam. NAU faculty prepare the final exams and CQUPT co-faculty along with the university administrative office distributes and grade them. This usually occurs between week 17 and 19. In order to keep the students active in the subjects outside of the twelve-week window, CQUPT further requests NAU faculty arrange additional labs/projects for students to work on.

One major concern of the program students during their learning process is their ability to understand the technical terms & expressions in the core courses, and their ability to communicate efficiently with NAU professors. Table 2 lists all the compulsory and optional English courses in current curriculum. All these courses are taught by foreign English teachers working in CQUPT except Engineering English, which is taught by CQUPT faculties who have engineering background and are fluent in English. It can be seen that the students receive intensive English training in their first semester in CQUPT. In the following two semesters, no English course is arranged, which is partly because there are four NAU taught courses that the students need to take. Another reason for this schedule is that most students tend to study English at a third-part institute outside campus in order to prepare for TOEFL or IELTS test. Both NAU and CQUPT agreed not to add extra English courses during this period. After the students are transferred to NAU in their senior year, they would take two more English courses focusing on improving their writing skills, which are EGR386W-Engineering Design Method and ENG100-English Composition.

Table 2: List of English courses by semester that the students need to take in CQUPT

Years in College	Semesters	Course name	Course type
Freshman	Fall	English Listening and Speaking	Compulsory
		Comprehensive English	Compulsory
		Engineering English	Compulsory
Sophomore	Spring	Academic English	Compulsory
Junior	Fall	Critical Thinking	Optional
	Spring	Western society and culture	Compulsory

#### Transfer requirement and student data

In order for CQUPT students to successfully transfer to NAU, they must satisfy the NAU grade requirements for international student transfer and pass the English competency exams. According to NAU's current program curriculum (revised in 2016), the students from CQUPT must satisfy the minimum grade requirements in order to be accepted. First, their overall GPA cannot be lower than 2.5 out of 4. Since CQUPT uses the 100-point grade system, the student

transcripts are sent to NAU every March to be translated into the NAU grade system. Second, there must be no D's or F's in the transcripts. Any coursework with a grade lower than a C needs to be repeated at CQUPT before the students will be allowed to transfer to NAU under this 3+1 program. However, if the students receive D's or F's in the spring term of the junior year, which is after the transcripts are sent. They will be allowed to transfer to NAU if all other requirements are satisfied, but they have to repeat those courses at NAU. This may result in a delayed graduation date and additional expenses to these students and their families.

Students must also achieve a minimum TOEFL or PIE (Program in Intensive English) score of 80. The PIE is an NAU English test equivalent to TOEFL. This exam is given to the 3+1 program students every March at the CQUPT campus. It should be noted that the score requirement for the 3+1 program exceeds the admission requirement for other international students who apply to any other 4-year undergraduate program in NAU. The main reason is to ensure that the CQUPT transfer students have better success as they integrate themselves into a new academic environment and communicate effectively with their NAU professors and classmates. If the student cannot pass the PIE test, they have the opportunity to retake the test in July after their junior year. However, this exam takes place at NAU Flagstaff campus and thus provides another alternative for students to be admitted into NAU. If the students are still unable to pass the July English test, they have two options: 1. return to CQUPT for their senior year and forego the NAU degree; 2. Remain at NAU and begin the PIE language program in the subsequent fall semester.

In most circumstances, the student is able to meet all the 3+1 transfer requirements. However, each year there are cases of a student with a high GPA and a TOEFL score just below the English test minimum. For those students, a NAU faculty recommendation committee (FRC) is formed to evaluate each student and decide on their potential for success within the program. The FRC members include the department director, the associate director for undergraduate programs, and NAU faculty members who taught or know the candidates directly. In this faculty recommendation process, the student must have a GPA higher than 3.5, and the TOEFL/PIE test score must be higher than 70. During the recommendation process, the teaching faculty verbally interview the candidates in person to evaluate effective communication on specific topics, and assess the possibility for the candidates to succeed in NAU. Then a report is compiled to the department director and the associate director for undergraduate programs, so a decision can be rendered.

Table 3 lists data collected from the first and second cohort of students. In the first cohort, a total of 32 students transferred to NAU in the fourth year. Among them, fourteen students transferred through the normal process, fifteen were accepted through the faculty recommendation process, two students registered for the PIE program in the fall and one student was transferred into a 2+2 program because the student had several courses that need repeat and couldn't graduate in one year

For the second cohort, a total of 29 students transferred to NAU in the fourth year, where 21 of them satisfied the minimum 3+1 transfer requirements. Four students were accepted through the faculty recommendation process, two students opted for the 2+2 program, and two students began the PIE program in the fall semester. Comparing the first and second cohorts, the transfer

rate of the second cohort is lower by about 11% (29% vs. 40%), where the transfer rate is defined to be the ratio of students that transfer versus the total cohort number. Some possible reasons for this decrease may be attributed to safety concerns of the students by their parents. Common concerns are often related to incidents such as the NAU gun shootings in 2015 and other publicized gun shootings<sup>14</sup>. Table 3 also indicates that there are more transfer students from the second cohort that met the minimum English requirements. This appears to be a result of efforts by CQUPT, such that they have increased the English skill requirement for admittance into this program.

Table 3: Comparison between 1<sup>st</sup> and 2<sup>nd</sup> cohorts

Cohort	1 <sup>st</sup>	2 <sup>nd</sup>
Start semester	Fall 2014	Fall 2015
Total number of enrolled students	80	100
Total number of students transferred to NAU in senior year	32	29
Transfer rate (No. of transferred/No. of enrolled)	40%	29%
No. of transferred students who met the minimum requirement to transfer to NAU	14	21
No. of transferred students whose TOEFL $\geq 80$	4	3
No. of transferred students whose PIE $\geq 80$	10	18
No. of students enrolled in fall PIE	2	2
No. of students admitted to 2+2 (70+ English)	1	2
No. of students transferred through faculty recommendation process	15	4

### Student performance at NAU

An important goal of this joint 3+1 dual-degree program is to ensure that all transfer students can succeed at NAU. According to the data collected from the first cohort, 27 students graduated from NAU in May 2018. Two students delayed their graduation to August 2018, because they needed to make up the required courses. There were in total five students who didn't graduate in year 2018. Three of them had more than two courses that needed to be repeated, and the other two students enrolled in the fall PIE program as mentioned before.

Among those who graduated, the average GPA was 3.54 out of 4. There were three students who achieved 4.0 GPAs, and only one student had GPA lower than 3.0. Furthermore, seven students were accepted to the NAU accelerated graduate program in EE, which is another program that allows students to receive a master degree one year after graduation with a BSEE or BSCE degree. To qualify for this accelerated masters graduate program, the students must have a cumulative NAU GPA of 3.25 and a 3.5 GPA in their major prefix coursework. Another nine students were accepted into regular NAU graduate programs in EE or CS. For the remainder of the students, some of them were accepted to graduated programs from other U.S. universities, or they decided to return to China to pursue career or graduate school there. In addition to high GPA, these students were evaluated highly among NAU faculties, including those course instructors and Capstone project mentors. In particular, a group of the 3+1 students developed an



instrumented bike and cell phone applet for their Capstone project. This work was then submitted as a conference paper and received the Best Student Paper Award in the smart sensor section at the 2018 International Symposium in Sensing and Instrumentation in IoT Era (ISSI) in Shanghai, China<sup>9</sup>.

### Comparison of teaching methodologies and students learning style

For most NAU faculty, teaching in a Chinese university is a very special experience. There are also well-known differences between the Chinese and U.S. education systems<sup>10,11,12</sup>. It is of interest to illustrate some of these distinctions between higher education systems.

First, to a certain degree, the CQUPT education is still very much final exam-oriented, and this is reflected by comparing the course syllabus from both universities. In most CQUPT courses, the student's performance is evaluated through a mid-term exam and final exam. It is very common that the final exam grade accounts for at least 50% of a student's total grade and in many cases as high as 70%. On the contrary, the NAU or U.S. teaching philosophy emphasizes that the students should attain their knowledge through gradual and consistent activities where multiple evaluation methods are used to monitor the student's progress during the course of a semester. For instance, Table 4 shows the evaluation methods and grading criteria for the EE110 course, which is the first NAU course the Chinese student experience. From the student perspective, it was illustrated that grading is a combination of exams and other activities. One of the adjustments students needed to make was the requirement of continual activity, so that they understand the accumulation of points required for the desired grade. The first cohort of CQUPT students made regular complaints at the beginning of the course, as they believed the workload to be too heavy comparing to regular CQUPT courses. However, based on the data collected from course evaluations, most students eventually felt this was an effective way to push them to study actively, and that they were better able to understand the topics.

Table 4: Grading System for EE110-Introduction to Digital Logic

Evaluation method	Description	Weight in final grade	Grading criteria
labs	One lab per week	20%	A >= 90.0 % B >= 80.0 % C >= 70.0 % D >= 60.0 % F < 60.0 %
Online quizzes	Quizzes on specific topics, open-book quizzes	10%	
Pop-up quizzes	Random quizzes in classroom, closed-book quizzes	10%	
Assignment	Homework or take-home exercise	10%	
Exam 1	First mid-term exam	10%	
Exam 2	Second mid-term exam	15%	
Final exam	Cumulative and comprehensive exam	25%	
	Total	100%	

Second, most CQUPT classrooms still follow the traditional teacher-centered education model, where the instructor lectures for the majority of class time without any halt, and the students listen and take notes. An interesting observation of Chinese students is that they seldom ask any questions during the class, but they tend to gather around the instructor after the class and ask

questions about the lecture. We believe this is related to the way students are expected to behave during lecture, which is to listen and not interrupt. As for NAU taught courses in China, the classroom follows the more student-centered approach. Every NAU faculty would combine one or several interactive class activities with traditional lectures to keep the students engaged in class. Some typical activities include:

- a) Short Q & A sections: the roles are interchangeable as either the instructor or students can be the one to give questions.
- b) Asking students to answer short questions with a neighboring student
- c) Assigning practice problems for students to solve, and share with classmates.
- d) Giving topics for small group discussion.
- e) Mini presentation: students are asked to prepare a short presentation concerning the course material and present to the whole class.

However, there have been challenges in applying these activities to CQUPT students especially for the freshmen and sophomores. First, the students have difficulties understanding the engineering terminologies in English. Second, many students are reluctant to speak in English in front of their classmate, and they are concerned that they are not fully prepared to present their English skills. To solve these issues, NAU faculty worked closely with the fluent CQUPT English teachers (US citizens) to encourage the students that imperfection is acceptable. NAU also has an Engineering English course which is comprised to help students with the terminologies that are commonly used in the NAU delivered courses. It has been crucial that NAU faculty collaborate with these English teachers to emphasize the need for the 3+1 students to gain confidence in their presentation skills.

Aside from English skills, the CQUPT students are well prepared with the fundamental subjects such as math, physics and chemistry. It is observed that most students tend to work in groups as opposed to independent study. For example, during the labs NAU faculty find that the Chinese students tend to form “huddles”, where a small number of students will work closely with each other. This usually happens more so when the students are given a difficult task. If a group of students, find the solution first, or the instructor/co-instructor has explained something to a particular group. The other groups of students will notice and come closer to listen. As a result, many students can have very similar or even same work. This is also noticed with homework and take-home projects. Therefore, strategies are being considered on how to best handle these issues and give the students awareness of academic ethics, independent study, and plagiarism before they transfer to NAU.

### Summary of successes

Overall this program is running very smoothly. Both universities are pleased with the progression of the program. There was much communication between NAU and CQUPT to identify issues during the early phase and propose solutions. The greatest achievement thus far has been the successful graduation of the first cohort of students and a steady and functional model that appears to be functioning well.

Another aspect to illustrate the program’s success is in the positive feedback from the Chinese government and the CQUPT administration. Earlier this year, the Ministry of Education (MOE)

of the People’s Republic of China announced closure and cancellation of 234 Chinese-foreign joint education institutions and programs at undergraduate level or above, due to regulation and quality reasons<sup>13</sup>. The NAU/CQUPT 3+1 dual degree program has passed the MOE evaluation successfully in 2018 and got the approval to keep operating for another 4 years. According to the feedback from CQUPT, our program has achieved a very good reputation among Chinese universities. Beginning with the second cohort each year there are about 100 students enrolling into this program, which is also the enrollment cap set by MOE.

### Existing challenges

As a unique joint program, the NAU/CQUPT 3+1 dual-degree program faces some specific challenges. First, the transfer rate is of great interest, since it is still yet determined as to the factors that might deter student interest. Table 5 lists the recent survey results for the third and fourth cohort concerning the students’ inclination to go to NAU in their fourth year. For the Third cohort, about 17 students have high probability to go to NAU in the fourth year. Another 16 students have no preference right now, and more than half of the students may not want to go. For the Fourth cohort, only a few students have clear preference to go and about half of student can’t decide whether to go or not.

For the students from the third cohort, one of their main concern is that if they go to NAU in the fourth year, they would not be able to take the Postgraduate Entrance Examination (PEE), which is only administered in China. Similarly, for the students who want to start their career in China after undergraduate study, the perception is, that it may be difficult to find jobs if they go to NAU in the fourth year. These conflicts are very hard to resolve for students who have made up their minds. But for some students who are hesitating, the program administrative teams on both sides are committed to work closely with the students and their parents to help them make the most suitable choice. Other students decide not to go as they want to apply for graduate programs at other U.S. universities or universities in other countries.

Although for the fourth cohort, the survey results are not promising, NAU believes this is reasonable because these students are sophomore students and they have not gone through the important application orientation yet. Application orientation happens in the fall semester of their junior year and during the orientation, the Program Academic Coordinator from NAU visits the CQUPT campus to give the students detailed instructions on the application requirements and procedures. The students are shown possible options they will have before and after graduation, and coordinator is able answer any questions from the students. Usually this is the point where most students can make their final decisions. Another factor that influences the choice of the students is their English scores. Many students may not get high enough score in the TOFEL/PIE test until their junior year. A second survey will be given to the fourth cohort during fall 2019 and it is expected to obtain a more accurate result.

Table 5: Student survey results for the 3<sup>rd</sup> and 4<sup>th</sup> cohort

Possibility to go to NAU in the 4 <sup>th</sup> year (Probability)	Number of students	
	3 <sup>rd</sup> cohort	4 <sup>th</sup> cohort
Definitely (90%+)	7	1
Probably (70%)	10	4

Maybe (50%)	16	44
Probably Not (30%)	34	30
Definitely Not (10%)	15	4
Number of students took the survey	82	83
Total number of students in the cohort	96	97

Other challenges from the NAU standpoint is in faculty recruitment. According to the original model, six NAU faculty members would be assigned to teach at CQUPT and NAU on a rotational basis. Currently there are four existing assistant professor of practice and one tenure-tracked assistant professor. Currently there is a search for another two assistant professor of practice positions. It has been difficult to find candidates for this program since they must meet the unique job responsibilities and travel requirements. Specifically, candidates must obtain enough college-level teaching experience in engineering, be able to live and teach in Chongqing, China at least three to six months out of a year, and for the tenure-tracked positions, the hired person also has a research responsibility. In order to attract qualified candidate, NAU offers additional stipends for the time spent in China. Despite these challenges, progress is being made and it is likely there will be at least one more faculty by fall 2019.

Third, there are uncontrollable factors that greatly affect the teaching efficiency in CQUPT. One example is internet connectivity. At NAU, the Blackboard Learn (BBL) system is one of the most important online tools for both the instructors and the students. It allows the instructor to post course materials, give online tests, assign homework and record student grades. It also is used by the students to upload their homework, project documents, and generate online discussions. Because of the long distance and the firewall settings in the two countries, the access to BBL can be extremely slow and unstable at times. Thus, it becomes difficult for the students to use BBL for any effective online activities. Another issue commonly encountered is that the regular class or lab meeting times can change during the middle of the semester due to various reasons. For instance, whenever there are big holidays, such as the International Labor Holiday in spring and Chinese National Holiday in fall, the class schedule is adjusted to accommodate these events. In the Chinese system, the University-wide schedule is typically announced one or two weeks in advance of the change. This is much different than the NAU system where holiday changes are determined years in advance for planning purposes. In some other cases, there are CQUPT courses that begin in the middle of the semester and can result in conflicts with NAU taught courses. Some of these issues can be addressed ahead of time, but some of them are unexpected.

#### Future development plans

In order to improve the quality of the program and strengthen the collaboration between the two universities, several future actions are under discussion.

First, NAU is looking to offer short-term one-credit courses to the CQUPT students in addition to the nine core courses, to better prepare the students who transfer to NAU. These courses

would be taught by NAU faculty either online or on the CQUPT campus. The topics include Engineering English Writing, American Culture, and Capstone Preparation etc.

Second, to improve the English skills of these CQUPT students, NAU will encourage the students to take the summer PIE training program in NAU in their sophomore year, and CQUPT will provide financial support to cover the travel expenses for qualified students. At the same time, CQUPT will start a TOEFL training program to help the students prepare for TOEFL test.

Third, both universities are interested in expanding the program in several ways. One idea is to offer interested NAU undergraduate students the opportunity for international study at CQUPT for one or two semesters. These students will undergo the courses taught by NAU faculty at CQUPT, as well as they would experience courses taught by CQUPT faculty. Upon their return to NAU, these credits can be transferred directly to NAU credits, so these students would not delay graduation typically associated with other study abroad programs. Secondly, NAU also strives to engage CQUPT faculty and train them in the American style of teaching. The idea is that interested qualified CQUPT professors will be invited to NAU campus to teach for one semester or two, and NAU will assign co-faculty and TA's to assist them while they are at NAU.

The last plan is that NAU and CQUPT looks to further strengthen the relationship by committing to goals of collaborative research in education or academic field, as well as research in science and technology. The broad idea is that the professors from the both universities can jointly apply for grants, publish papers, or mentor graduate students. The possibility and extent of this is still under exploration.

### Conclusion and recommendation

After five years of operation, the 3+1 dual-degree program between CQUPT and NAU has succeeded in graduating transfer students. Most of the significant issues were identified and addressed. A robust model has been established to keep the program running efficiently. The students so far have successfully transferred and adapted to the NAU teaching environment, and have made some remarkable achievements. Even though there are still challenges, the program is moving forward on a positive track, and it opens windows for other cooperative opportunities. More importantly, all the experience and data accumulated in this program can be used as reference for development of future programs in similar or different fields.

Below are some recommendations for those who are interested in starting a similar program:: 1. Careful comparison of the curriculums from both universities is crucial for the smooth transfer of students. It is highly recommended that the curriculum committee from both universities have more direct face-to-face conversation instead of solving all issues through emails or skype meetings. 2. The English communication skills of the students is a big concern, so high standard should be set when enrolling the students, and the teaching faculties should work closely with the English teachers to help the student improve. One good time to give students extensive English training is the summer break. 3. Both universities should form strong support teams for the students and establish a strong relationship with them, letting them know that it is the program's top priority to help them succeed. 4. Most importantly, the two cooperative universities must be committed to make continuous investment in the program. Besides the investment in finance,

more efforts should be put to maintain a strong relationship between the two universities, which is very important when cooperating with Chinese universities.

This work is partially supported by the International Education Research Project of Chongqing University of Posts and Telecommunications (No. GJJY16-2-07).

#### References

- [1] B. Council, "Research on Current UK-China Transnational Education: From the Perspective of Administrators and Students," British Council, 2017.
- [2] J. K. Y. C. Cedrick Kwuimy, "A first time flipped classroom experience: Measure of outcomes and challenges," in ASEE Proceedings, Southeast Section Conference, Columbus, Ohio, 2017.
- [3] S. H. P. B. L. D. G. Z. J. Jeongkyu Lee, "Toward Success of Collaborative Program In School of Engineering Between the US and China," in ASEE International Forum, New Orleans, LA, 2016.
- [4] S. I. Segalewitz, "Seven Years of Success in Implementation of a 3 + 1 Transfer Program in Engineering Technology Between Universities in China and the Unites States," in 120th ASEE Annual Conference & Exposition, Atlanta, GA, 2013.
- [5] J. Z. B. Y. Qunqun Liu, "Impact of International Collaborative Engineering Education upon the Epistemological Development of Chinese Engineering Students," in 122nd ASEE Annual Conference & Exposition, Seattle, WA, 2015.
- [6] L. Z. D. D. K. B. X. G. James Zhang, "Collaborating With Chinese Universities on Engineering and Technology Education: Potentials and Issues From a Curriculum Perspective," in ASEE Annual Conference & Exposition, Fayetteville, AR, 2005.
- [7] M. E. C. Q. L. Xiang Gong, "Comparative Study of First-year Engineering Honors Programs between US and China," in ASEE Annual Conference & Exposition, Vancouver, BC, Canada, 2011.
- [8] F. C. D. R. S. J. Y. G. L. X. Z. Phillip A Mlsna, "The NAU/CQUPT 3+1 Program in Electrical Engineering," in ASEE International Forum, Columbus , Ohio, 2017.
- [9] P. Qiu, X. Liu, et al. "The Development of an IoT Instrumented Bike: for Assessment of Road and Bike Trail Conditions", International Symposium in Sensing and Instrumentation in IoT Era, 2018, IEEE.
- [10] T. Heng, "Different Is Not Deficient: Contradicting Stereotypes of Chinese International Students", Studies In Higher Education, 1-15, 2016.
- [11] X. Feng, "On American and Chinese Higher Education", Asian Social Science, Vol. 4, No. 6, 2008.
- [12] J. Li, F. Guo, et al. "Study Abroad during College: Comparison between China and the United States", Current Issues in Comparative Education (CICE) Volume 19, Issue 2, 2017.
- [13] "Notification of approval to the formal termination of some joint institutes and joint programs", General Office of the Ministry of Education of People's Republic of China, 2018  
[http://www.moe.gov.cn/srcsite/A20/moe\\_862/201807/t20180705\\_342056.html](http://www.moe.gov.cn/srcsite/A20/moe_862/201807/t20180705_342056.html) .
- [14] <https://www.cnn.com/2015/10/09/us/northern-arizona-university-shooting/index.html>