

English Background of East Asian Students in the College of Engineering

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ABSTRACT

This complete research paper describes different pathways that East Asian engineering students take to learn English before starting college and their impact on student's performance in an introductory engineering class. The language proficiency of students from East Asian countries and their adaptation to the active learning style of American classrooms is frequently questioned. However, a fraction of East Asian students has studied in English and has been emerged in American style classrooms before starting their first year of engineering. Here, we investigate how these previous experiences using English as a medium of instruction and in contact with the American culture impact the performance of East Asian students in the context of a mandatory introductory class in engineering.

INTRODUCTION

Year after year, it is more common for instructors to encounter non-U.S. students in their engineering classrooms. The last report from the Institute of International Education shows that for the academic year 2015/2016, there were over a million non-U.S. students enrolled in higher education programs in the U.S.¹ This is almost double of what they reported in 2005. Students from East Asia account for 41.9% of the population of foreign students, with China being the most popular country of origin¹. In 2015, U.S. undergraduate engineering programs enrolled over thirty thousand students from China, South Korea, Japan, Hong Kong and Taiwan².

The language proficiency of East Asian students and their adaptation to the active learning style of American classrooms is frequently questioned. Students from these countries seem to be very quiet and take some time to respond when participating in active learning activities such as discussions, hands-on activities, team projects, etc.³. Students reticence to speak in class has been associated with low language proficiency, students' attitudes towards the use of English, differences in classroom teaching styles, and student's individual personality³, among others.

Language and non-verbal communication differences between American and East Asian students can lead to difficulties in teamwork. Low English proficiency and lack of awareness about verbal and non-verbal communication rules hinder interactions and exchange of information among diverse people working in the same team⁴⁻⁶. Also, cultural differences in the perception of teamwork, and conflict can lead to misunderstandings and high levels of conflict in multicultural teams⁵⁻⁷.

East Asian students seem to adapt in different ways to their new cultural and academic environments and the challenges that they pose. Wang et al. identified four adaptation paths that Chinese students follow during their first semesters of college in the U.S. In their study, 80% of the students follow the well-adapted path or the Relieved path, in which students experience low levels of psychological distress upon arrival to the U.S. and during their first three semesters in college. Only 20% of students in Wang et. al.'s study followed the Culture-shocked or

Consistently distressed paths, exhibiting high levels of psychological distress and academic difficulties with language and communication such as the ones mentioned above ⁸.

The recent findings from Wang's study challenge the common perception that *all* East-Asian students greatly struggle with adaptation to U.S. academic system and bring awareness to the diversity among Chinese students enrolling in U.S. universities. They point to student's previous experiences, before starting college, as one of the reasons for such diversity. In the First-Year Engineering program (FYE) at Purdue University, we have observed the diversity among East Asian students, particularly in their English language background. In a previous study, we found that 45% of Chinese students enrolled in the FYE mandatory engineering class reported having studied in English before coming to Purdue University. ⁹

In this study, we investigate how these previous experiences using English as a medium of instruction and in contact with the American culture impact the performance of East-Asian students in their first year of engineering. This study will answer the following research questions: 1) What are the different pathways that East-Asian engineering students take to learn English before starting college? 2) What is the impact that these pathways have on students' performance in class? 3) What is the impact of these pathways on other aspects of college life?

METHODS

Quantitative study

Participants were 163 freshman students, originally from East Asian countries (China, South Korea, Hong Kong and Singapore), who were enrolled in a first-year mandatory introductory engineering class in a Midwest research university. Demographic information about students, including nationality, was collected from university records. Language information was self-reported by students, at the beginning of the term. Specifically, students were asked to self-report their previous language of academic instruction before coming to the university. Students reported this language to be English or different from English.

Students' performance in the class was assessed by quantitatively comparing average grades in individual and team activities. Individual activities consist of two exams. Team activities consist of a design project and an exam.

For team activities, students were placed in teams of 3 or 4 people in the second week of class and worked with the same team throughout the semester. Team formation was done using the CATME Team-Maker tool ¹⁰. We intentionally teamed together students with a different self-reported language of previous instruction. Other criteria for teaming included not outnumbering students based on gender or race. After the teaming process, all East-Asian students ended up in teams that had at least one American student.

Team-member effectiveness was measured using the CATME Peer Evaluation tool ¹¹, four times during the semester. CATME evaluates team-member effectiveness in five dimensions: 1) Contributing to the team's work, 2) Interacting with teammates, 3) Keeping the team on track, 4) Expecting quality, and 5) Having relevant knowledge, skills and abilities (KAS) ¹¹. For each CATME administration, an average score was calculated from peer evaluations for each student, as the arithmetic mean of the scores of the five CATME dimensions. An overall CATME score was also calculated per student, as the arithmetic mean of the previously calculated averages of each administration.

Qualitative study

One-on-one interviews were conducted with engineering students from East-Asian countries to further understand how they have learned and used English in academic settings before coming to the university. In the recruitment process, we contacted students from China and Korea, who self-reported English as their previous language of academic instruction when they took their introduction to engineering class. Five students responded and were interviewed. The demographic characteristics of the interviewees are shown in table 1.

Table 1. Demographics of interviewees

Subject	Gender	Country of origin	College level	Pre-college language of academic instruction
1	Male	Korea	Sophomore	English
2	Female	China	Senior	Different from English
3	Male	China	Junior	English
4	Female	China	Freshman	English
5	Male	Korea	Freshman	English

During the interviews, students were asked about how they learned English, and how their experience learning English impacted their college academic and non-academic life. We conducted a thematic analysis of the interviews to identify aspects of college academic and non-academic life affected by students' previous experience using English as a medium of academic instruction.

RESULTS AND DISCUSSION

A significant portion of East-Asian students have taken alternative paths to learn and use English before starting university

East-Asian students self-reported data about their language of instruction before college showed that not all East-Asian students were using English as a medium of instruction for the first time in their first semester of college. Out of the 163 East-Asian students taking the class, 82 of them responded that their previous academic instruction was in English. Most of the students taking the class are freshman in their first semester of college. Therefore, this result means 50% of East-Asian students enrolled in the class studied in English before starting their engineering studies at this university. These students do not follow the stereotypical profile of the "international-student", i.e. international students conduct their primary and secondary studies in their native language, and learn English by taking English lessons at school or elsewhere; therefore, their first semester of college is the first time they study in English. On the contrary, these students have taken classes taught in English, probably during high school or while studying in another college.

To further investigate how East-Asian students learn and used English as a medium of instruction before enrolling in this First-Year Engineering class, we interviewed 5 East-Asian students who reported to have studied in English before. Based on the interviews, we identified three different paths that East-Asian students follow to learn and use English, in academic settings, before starting college in the US. In the *first path*, the student – subject 4 – completed high school in a private American school located in the U.S. The student took all her classes – science, liberal arts and others - in English. The student's instructors and classmates were English-native speakers, with a few exceptions.

In the *second path*, the students – subjects 3 and 5 – completed high school in an American or Canadian (private) school located abroad, in a non-English speaking country. In this case, students took all their classes in English, except for the class about the local language, for instance, Chinese class, if the school was in China. The instructors were English-native speakers, but the students' classmates were a mix of local and foreign students.

In the *third path*, the student – subject 1 – completed high school in an English-native speaking country different from the U.S. or Canada. The student took all his classes in English, and his instructors and classmates were mostly native-English speakers.

Advantages and disadvantages of East Asian students who took alternative paths to learn and use English before college

1. Knowledge of the American educational system

Students taking any of the pathways described above were immersed in the academic system of an Anglo-Saxon country before starting college. Since there are common features of academic life shared by high school and college, these students were not unfamiliar with many aspects of college life that might otherwise be entirely new to them. For instance, the East-Asian students interviewed here reported to be familiar with the variable class schedules and the rotating classrooms system, typical of American schools. As subject 4 said *“In China, at least before I left, you have the same classes every day. You have the same schedule and you sit in the same room. In China, you have a homeroom and your teacher changed. You don't change classmates. Here it's your teacher stays in his room and different people go in. That was my high school too”*. Simple logistic aspects of college, for instance, having different classes every day, gaps between classes and classes in various rooms and buildings, can be overwhelming for students who have never had this experience before. A freshman student commented: *“[In high school] you have different classes every day, so it's basically a college schedule... That was really hard for me at first because I'm like, "What's going on?" Now it actually really helped get me for the schedule this year because I don't have my classes every day. I have to prepare different things for different teachers”*. The exposure to variable classrooms and schedules in high school prepared these students to be flexible and to manage their time to respond appropriately and promptly to the demands of classes once they start college.

Students were also exposed to active learning styles that promote discussion and teamwork. All of them reported having completed projects in teams, which they had not done before in their countries of origin. They also reported to be more prepared to participate in discussions in class: *“I guess the study system in the US taught me to brainstorm ideas very often. Very often your teacher would ask you, "What's your opinion on this?" I'm just like ... I think very often I was asked to brainstorm things, and that kind of helped. You have to come up with things or some things in a short period of time.”*

Another feature that East-Asian students in Anglo-Saxon high schools learned before starting college was the role of advisors, the academic and non-academic opportunities that they can take advantage of in high school and college. They were familiar with the opportunity to transfer AP credits from high school to college or follow their interest by joining clubs. As one

of the students mentioned: *“For high school, we are encouraged to learn like to follow our own interest, this is the same in college, so we have to follow our interest, our passion, that is just with more resources.”* Even small things like using the letter grading system or having a school ID during high school seemed to give these students an advantage in their transition to college.

2. Acculturation previously to start of university

Students reported experiencing elements of cultural shock early, during their years before university. Some of them struggled with the stress of not being proficient in the language. As one of them mentioned: *“I’m a pretty social person, so my first year here that I couldn’t talk to anyone really stressed me out.”* However, as time went by, all of them improved their English level and then they could communicate effectively in English: *“It was pretty hard the first time but, as time goes by, I started to listen. Started to hear and then, it got better.”* As an interesting fact, both Korean students interviewed in this study reported that after spending so many years using English as a medium of instruction, they feel more comfortable speaking in English than in their native Korean language.

Those who studied in an American high school reported that their high school experience encouraged them to learn more about American culture in general – literature, comedy, TV, sports, and music. A better understanding of these cultural issues opens the opportunity for conversations with English-native speakers during their first semester in university. *“I’m familiar with the sports, the TV programs they watch, so I think those popular topics are really good icebreakers, in terms of making friends.”* Those who completed high school in other Anglo-Saxon countries or American schools in East-Asian countries also report how their experience with a diverse group of professors and students prepared them to understand diversity, being flexible, and easily communicate with people from different cultures. *“Even though it was an American school, it was in Taiwan so there was more diverse culture. I think it prepared me to adjust here and meet lots of people from different countries”* The students with a previous background in English feel comfortable talking with Americans and therefore, it was easy for them to make American friends in the university. To establish a network of support with locals – in this case, Americans - is one of the most important steps to overcome cultural shock and it facilitates adaptation to the new culture ¹².

Lack of knowledge about the social norms and rules and the impossibility to properly interact with others socially are the primary causes of anxiety and stress found in culture shock ¹². By being immersed in the American culture for years before starting university, East-Asian students with an English background have begun to adapt or have reached the acculturation stage before starting their first semester at Purdue University. As one of them commented *“I think the transition between high school and college is consistent to me, so I don’t have much like, like a gap or something like that, or obstacle, I did very well in first year and I will say my high school really prepared me to get used to American education system.”*

3. Language proficiency tests scores

Students feel that completing high school using English as a medium of instruction does not help them to obtain a good score in their TOEFL exam. Many of them claim to know people from their home countries with a lower level of English, in their opinion, who obtained similar or better scores in the TOEFL test than them. For them, the assumption that using English in academic environments and social life will lead to a good score in an English proficiency test seems to be false. On the contrary, they claim that a very significant factor in scoring high in the Language Proficiency test is to extensively and intensively prepare to take that test. As one of them explains: “... *my high school didn't teach me how to prepare the test, but in terms of testing taking skills, lots of Chinese other, like other Chinese institutions do better job in terms of preparing exams, so, I'll say it doesn't help a lot.*” In general, high schools in Anglo-Saxon countries do not see the need to prepare their student to take the TOEFL. Therefore, international students in these schools find themselves taking the test with little and informal preparation compared to their counterparts in their home countries. A study by Liu investigating the relationship between TOEFL preparation and scores concluded that test-specific preparation strategies and English learning strategies can slightly increase TOEFL scores.¹³ This result aligns with the observation of students that intensive test preparation positively impacts test scores. Other studies have investigated how well TOEFL captures English proficiency of test takers, but the results are not definitive. For instance, Ockey et al. found that positive differences in the scores of the speaking section of the TOEFL test agreed with Japanese students' improvement in their ability to communicate orally.¹⁴ On the other hand, Brooks et al. results showed that students use more complex structures of language in the speaking section of the test than the ones they use when talking in real-life¹⁵. This result suggests that test results might overestimate students' speaking proficiency. The scores of the TOEFL test are frequently a matter of debate, mainly because they are used in American universities as cut-offs for admissions of international students. As clearly explained by Ginther et al., questionings of the test scores are usually founded on a misunderstanding of the meaning of the scores by university faculty, staff, and administration, rather than in the test itself.¹⁶

Academic performance of East-Asian students is not affected by students' language background

Table 2 shows the comparison between grades of East-Asian students who have studied in English before and those who have not. A Mann-Whitney statistical test for comparison of medians (95% level) revealed no significant differences in student's grades in exams – individual or teams – or in the design project. This result suggests that student's academic performance, in the first introductory engineering class in the university, is not dependent on whether the student had the opportunity to study in English or not before starting the university. Therefore, there is no advantage, when it comes to grades, in studying in English before the first semester in college. This is supported by students' interviews where they comment very little on academic impact of their experience but more in the high impact on early acculturation, which enables them to interact with others more easily.

Table 2. Medians of grades from individual and team activities for East-Asian students with and without an English academic background. Grades are in a scale of 0 to 100.

Activity	Individual vs. team	Language background	
		English	No-English
Exam1	Individual	91.0	91.0
Exam2	Individual	86.0	89.0
Exam 3	Team	86.7	90.0
Design project	Team	87.6	89.8

Students without an academic background in English struggle with certain aspects of teamwork

Working effectively in teams is a fundamental element in the first engineering class that students take in this university. We assessed student’s effectiveness as teammates using CATME peer-evaluations. Overall, students with a background in English have higher CATME scores than students studying for the first time in English (Table 3), as observed in all the administrations of the CATME evaluation. Mainly, we find significant differences in two CATME dimensions: Interacting with others and Contributing to team’s work.

Students with a background in English feel comfortable establishing conversations with their American classmates and in general, talking to them and expressing their opinions. As a result, they are better than students using English for the first time, at exchanging information and ideas with others, which enhances their performance in the “Interacting with others” dimension. Students with a background in English have previous experience working in teams, completing projects in high school. Most likely, these experiences better prepared them to be a productive member of the team and make significant contributions to it.

Table 3. CATME scores from peer-evaluations for East-Asian students with and without an English academic background. *: p-value <0.05. **: p-value <0.10. CATME scores are in a scale from 1 to 5 (5 being the best)

CATME dimensions	Language background	Administrations				Average across administrations
		1	2	3	4	
<i>Contributing to Team’s work</i>	<i>English</i>	3.71	3.96	3.92	4.13	3.93
	<i>No-English</i>	3.69	3.72*	3.81	3.91**	3.78
<i>Interacting with others</i>	<i>English</i>	3.81	4.01	4.05	4.15	4.01
	<i>No-English</i>	3.65	3.80*	3.86**	3.92**	3.80
<i>Keeping the team on track</i>	<i>English</i>	3.71	3.95	3.99	4.14	3.95
	<i>No-English</i>	3.68	3.79	3.87	3.98	3.82
<i>Expected quality</i>	<i>English</i>	3.89	3.98	4.09	4.21	4.04
	<i>No-English</i>	3.84	3.85	3.93	4.03	3.90
<i>Having the KASs</i>	<i>English</i>	4.07	4.18	4.19	4.27	4.18
	<i>No-English</i>	3.95	3.99**	4.00	4.09	4.00
<i>Average across dimensions</i>	<i>English</i>	3.84	4.02	4.05	4.18	4.02
	<i>No-English</i>	3.76	3.83**	3.89	3.99**	3.86**

IMPLICATIONS OF THIS STUDY

In this paper, we report three different pathways that East-Asian students take to learn English and/or immerse themselves in classroom styles like American classrooms before starting their engineering studies at an American university. East-Asian students who have studied in English before, and have been in contact with the American classroom culture, show more willingness to communicate with other students – Americans or non-U.S. – and seem to understand the dynamics of teamwork better. Their early transition into the culture and their ease to speak in English facilitate interactions with others, which positively impact their performance in the class, particularly when working on design projects in teams.

The characteristics of East-Asian students who have taken alternative paths to learn and use English make them ideal team-members in multicultural engineering teams made of American students and other East-Asian students. Since these students have knowledge of their culture and the American culture, as well as the ability to communicate in their native language and in English, they can bridge the cultural and language differences between American students and other East-Asian students in a team. These bridging across cultures might facilitate team building, and reduce conflict, by resolving potential misunderstandings and filling in communication gaps. Therefore, instructors of engineering classes can use the language background of East-Asian students as criteria for teaming students when working in projects.

University administrators and Language or English departments could consider the English background of East-Asian students and other international students as criteria for requiring additional English classes after admission. Some universities require students with low scores in the language proficiency tests to take additional English classes. The purpose of the classes is usually to accelerate students' acculturation process by improving students' English skills (usually verbal) and introducing the American culture. Due to their low TOEFL scores, some international students who have completed their high school in Anglo-Saxon countries might be required to take these classes, but their language needs might be different. For those students, these classes might be boring and pointless, since they have been exposed to the American culture and have used English before for academic and non-academic purposes. Their attitudes and abilities in the class might impact the class dynamic. In addition, from the administrative point of view, the university allocates resources to serve a population of students that might not need this service and these students might be occupying the seat for students who really need to take one of these classes. Therefore, using the English background of international students, together with their TOEFL scores, might allow for better criteria to select who must take additional English classes once admitted into college.

CONCLUSIONS

The findings of this research bring awareness about the existence of a subgroup of East Asians, non-U.S., students who have taken alternative routes to learn and use English before starting their engineering majors. These experiences separate them from other East-Asian students who are studying in English for the first time. Knowing who these students are and what their strengths and needs are, is instrumental for instructors of first-year engineering classes who

mix and match these students in engineering teams. It is also helpful for administrators and staff who advise these students and who design English supplementary classes to improve English proficiency of non-U.S. students.

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