©2017 Published in 5th International Symposium on Innovative Technologies in Engineering and Science 29-30 September 2017 (ISITES2017 Baku - Azerbaijan)

Teaching Engineering Curriculum for Non-Native English Students: Challenges and Possible Solutions

Atef A. ATA
Department of Engineering Mathematics and Physics
Faculty of Engineering, Alexandria University
Alexandria (21544), Egypt
atefa@alexu.edu.eg

Abstract

Teaching engineering and technology in English is spreading in non-English speaking countries. Nowadays, many countries and universities are teaching engineering in English language in new programs. The students are willing to learn and read textbooks in English to prepare themselves for their practical future. Also multi-national companies with better working conditions and attractive salaries are the motive force for students to learn in English. There are some problems arising when teaching non-native English speaking students. It is the main objective of this paper to present an experiment of teaching technical engineering courses in English for non-native English speaking students. This study is the output of teaching mechatronics engineering curriculum for different non-native English students in different countries such as Egypt, Malaysia and Turkey for long time. So, the main objective of this paper is to share the author's experience. This study is carried out at Mevlana University in Konya for third and fourth year mechatronics engineering students. Surveys are designed and planned for teaching two courses to reflect this approach and the analysis of the results is presented and discussed. The total number of students in the first course is 32 students and for the second course is 7 students since it is private relatively new university. Challenges, possible solutions and recommendations are also investigated.

Key words: Engineering Education, Technical, English, Approaches and solutions, Challenges

*Corresponding author: Address: Faculty of Engineering, Department of Engineering Mathematics and Physics, Alexandria University, Alexandria (21544), Egypt. E-mail address: atefa@alexu.edu.eg,

1. Introduction

In academic life, engineering students have to deal with the countless lectures, tutorials, laboratories project reports and assignments. So mastering English language is of utmost importance for the engineering students in their time of studying and their practical career later on. Without a good command of English, engineering students find themselves being unable to understand the underlying concept or idea that the instructors are trying to convey to them [1].

On the other hand, in engineering education, specific English language skills are needed to enable engineering students to succeed in academic settings ([2-6]). Some higher education institutes force the students to study English for academic purposes during the first year of study to enhance their communication skills for the rest of the curriculum. In some university professional English teachers are taking care of these courses to get the maximum benefits. Some other universities are offering a percentage up to 30% of their curriculum to be taught in English while the rest of the curriculum is being taught in their national language. It should be mentioned that teaching technical courses in English is easier than teaching humanity courses since the students will be familiar with all of the technical terms few weeks after the beginning of the course. This is in addition that many internet websites are providing presentations and animations in English and these websites attract the attention of the engineering students. Teaching in English is always referred as English Medium Instruction (EMI).

English Medium Instruction (EMI) means to mix the instruction of subject contents with foreign language teaching as well as learning instead of first language, a foreign language is used as a vehicle for communication in different subjects. Implementing EMI at the level of higher education means that the medium of instruction will be in English, so that students can be taught according to international standard [7].

Nowadays, most private universities provide EMI to their students. In many state universities (with Turkish medium instruction) students are offered one year of intensive English program (preparatory classes) to become proficient in English. After that, students need to take a course "Reading and Speaking in English" aiming to improve general knowledge of English in the third semester of four-year degree program, and it is followed by "English for Specific Purposes I and II" intending to terminology of their own field. "English for Business" aims to advance students' oral and written communication skills that will help them do business with foreign people and companies [8]. In addition, European Union plays an important role in higher education so; some universities adopt English medium instruction at some of their faculties [9]. Another example from South Korea where by 2011, 30% of all classes offered by universities in the Seoul metropolitan area and 10% of those in other areas were EMI classes [10]. The last example is from the Arab world, Netherlands, Korea and Indonesia where an investigation was carried out from the available literature to find out possible ways of implementing EMI in engineering education. They concluded that pursuing the internationalization of the EMI system will achieve a world standard level, not only in engineering but also in communication skills for engineering graduates [11].

Some important aspects need to be identified for the students to allow them to understand and participate in the course efficiently and effectively. These items are summarized as follows:

1.1 The importance of the course in their career as mechatronics engineering graduates:

It is essential for the students to understand the importance of any of any course in the curriculum in their practical future. Some of the students are always asking (especially in mathematical-background courses such as the modelling and simulation, system dynamics and signals and systems) why we are studying these subjects. Some of the important topics, for example in robotics and system dynamics are based on very basic subject such as partial derivatives and when the students understand this, they appreciate what they are learning.

1.2 The awareness of the objectives of the course:

It is very important for the students to know the course objectives and what they are going to gain as soon as they pass the course. It is also essential to inform them about the distribution of marks especially when there is a course project's marks at the end of the semester. When the students know they have to make presentation by the last week of the semester, they are going to pay attention to the lecturer to select their topic for their projects. Also they are trying to search the Internet for possible videos or similar presentations which improves their language and performance.

1.3 The required level of English proficiency for effective learning:

Some of the students feel that their level of English proficiency is not enough for them to understand and digest the course materials. Some of them are even shy to ask or to inform the instructor about their problems. Offering a course project at the end of each semester and communicating with the students during the whole semester to prepare for the project presentations help the students a lot. Through my experience, some of the students are reluctant to present their projects in front of their colleagues but after many trials they are happy to do such presentations. This allows the instructor to concentrate on the scientific issues without worrying about the level of English of the students.

1.4 Improving the level of English proficiency through course materials:

Student's trust in the course materials in improving their level of English is also an important factor. Building the trust of the students about the course materials allow them to recommend the course to their colleagues which reflects their satisfaction. The course instructor has also a positive effect in motivating the students to study and practice since applying interactive learning approach with continuous assessment during the whole semester improves the student's attitude towards learning.

It is the main objective of this study is to share the experiment of teaching engineering curriculum in English for non-native English speaking students.

2. Methodology and Approach

A survey was planned for this study and it was applied for two courses conducted by the author for the third and fourth year students. The first course under consideration is ME 316 Robotics offered for third year Mechatronics Engineering students which implies that they are mature enough to understand and answer the questions. The author have been teaching this course in English for almost 15 years in different countries for undergraduate and postgraduate students such as Egypt, Malaysia and Turkey. The analysis was done for a batch of 32 students which represents the total number of students in my class and some of them (5 students in question 3 and 7 students in question 5) did not answer the questions. The questions as well as the students' feedback of the questionnaire is presented in Table (1)

Table (1) Results for the Robotics ME 316 course questionnaire

statement	strongly agree	agree	disagree	strongly disagree	don't know	Votes
1. This course is important for your career	21	7	0	2	2	32
2. You know clearly the objective of this course	12	11	7	2	0	32
3. Your level in English allows you to understand the contents of the course	12	11	1	3	0	27
4. Do you have previous experience about the course material	5	12	9	2	3	31
5. The instructor effectively directs and stimulates discussion	16	11	4	1	0	32
6. This course helps you improve your English language proficiency	7	15	1	2	0	25
7. You would like to recommend this course to other students	13	14	3	1	1	32

In order to analyze the questionnaire, the answer for each of the questions is presented in the following Figures (1) till (6):

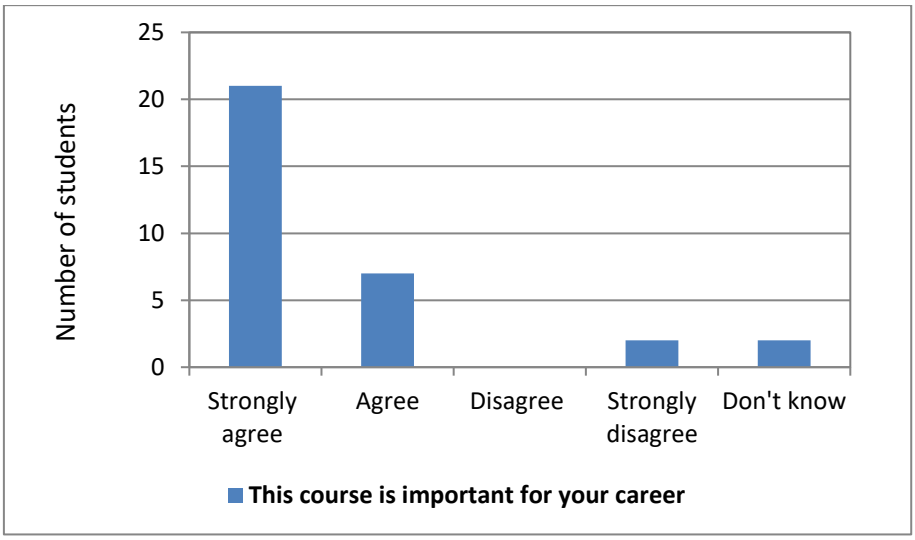

Figure (1) Analysis of the first question

It can be seen from Figure (1) that the majority of the students (87.5%) understand the importance of this course in their career as mechatronics engineering graduates. Only 6.25% of the students disagree and the same do not know. This analysis of the first question gives us trust about the rest of the questionnaire. Regarding the awareness of the objectives of this course as shown in Figure (2), 71.8% of the students agreed that they know the objectives of the course while the remaining percentage (28.2%) are not aware. If we combine the analysis of the two Figures (1 and 2) we can conclude that although almost 28% of the students are not aware of the objectives of the course, almost 88 % feel the importance of the course in their industrial and academic career. This may be due to the rapid and widespread robotic applications in industry ranging from car industry to even medical applications. On the other hand, some of the students lack the knowledge of the objectives of this course and this can be clearly seen from Figure (2). One of the reason for this high ratio is that most of the third year mechatronics engineering's students have already transferred from different universities and technical colleges in Turkey and this is their first year in our university. We believe that their attitude will be different by the end of this year.

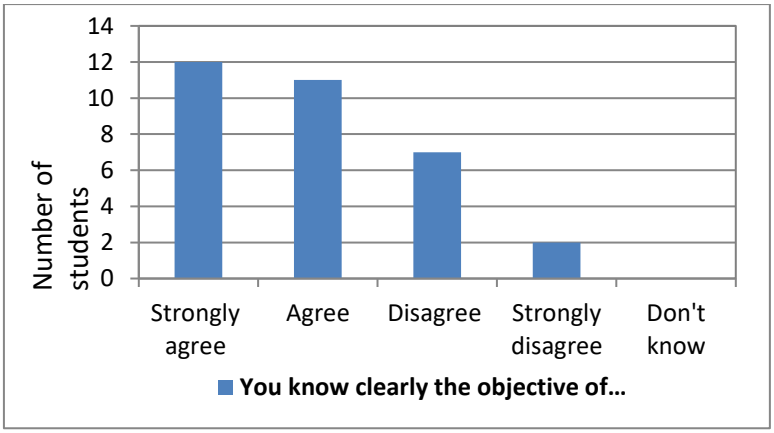

Figure (2) Analysis of the second question

Regarding the third question, high percentage (85%) of the student sample agree that their English level is enough to digest the course materials. May be as a private university most of the students studied their high school subjects in English medium of instruction so they have a good command of English since it is known to all the students that the medium of instruction in the faculty of engineering is English. This result allows the instructor to concentrate on the scientific issues without worrying about the level of English of the students.

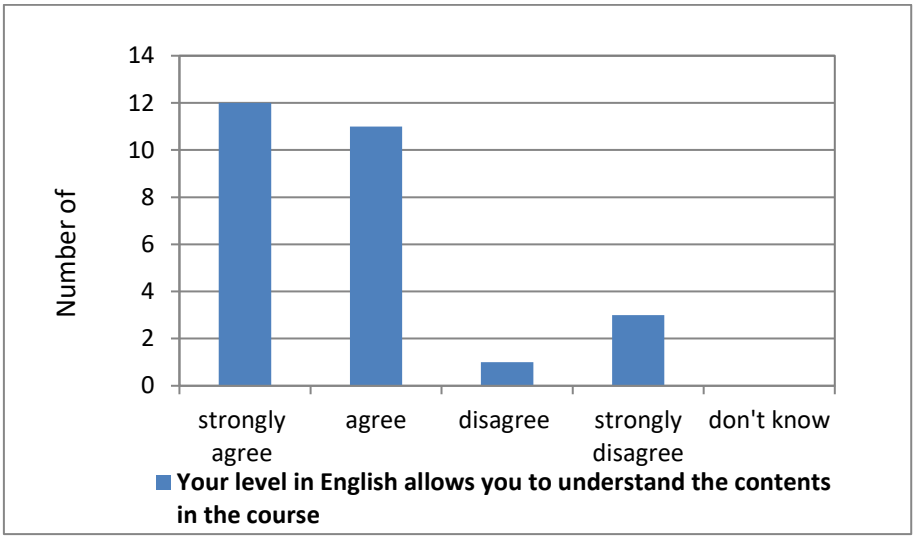

Figure (3) Analysis of the third question

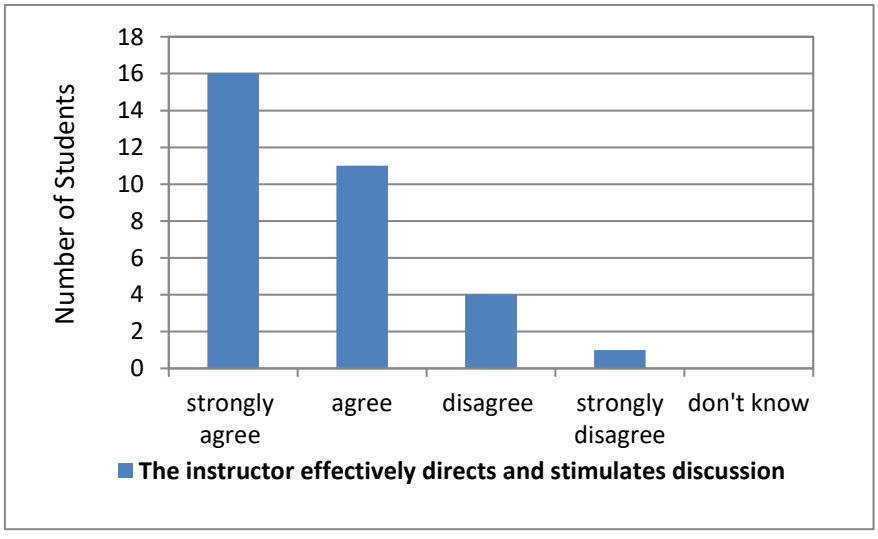

Figure (4) Analysis of the fourth question

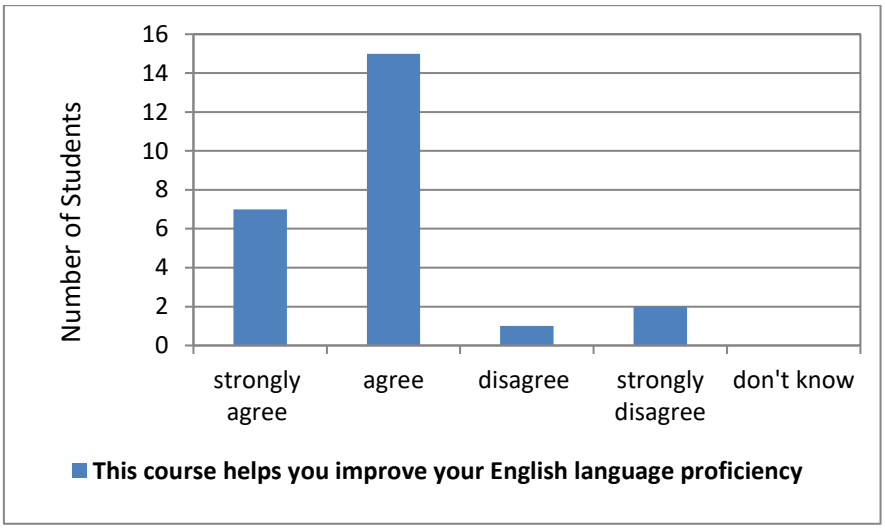

Figure (5) Analysis of the third question

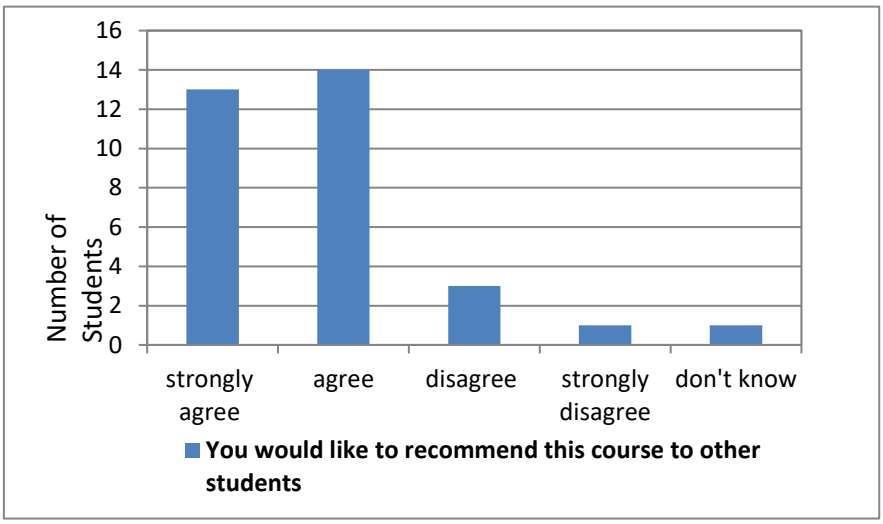

Figure (6) Analysis of the fourth question

Figures (4, 5 and 6) can be combined together to reflect the students' trust in the course materials in improving their level of English. Almost 84% in the three figures give positive response in answering the questions. The remaining 15.5% have negative response in almost all the figures and it looks like they have problem in English proficiency and we have to take care of this problem. Figure (6) shows that 84.5% of the students are going to recommend the course to their colleagues which reflects their satisfaction. Figure (4) also proves that the instructor has a positive effort in motivating the students to study and practice as we are applying interactive learning approach with continuous assessment during the whole semester. We have also project presentation at the end of the semester for all the courses we are teaching.

The same survey was also given to another batch of students on the fourth year mechatronics engineering taking the Applied Robotics course ME 421. For the senior students, this was the

third time they are taking courses with the author and they are on their final semester before graduation. The answer for the survey is given in Table (2).

Table (2) Results for the Applied Robotics ME 421 course questionnaire

statement	strongly agree	agree	disagree	strongly disagree	don't know	Votes
This course is important for your career	8	0	0	0	1	9
You know clearly the objective of this course	6	3	0	0	0	9
Your level in English allows you to understand the contents of the course	8	1	0	0	0	9
Do you have previous experience about the course material	3	6	0	0	0	9
The instructor effectively directs and stimulates discussion	8	1	0	0	0	9
This course helps you improve your English language proficiency	4	2	2	0	0	8
You would like to recommend this course to other students	7	0	2	0	0	9

It can be seen from the results in the second table that the students are familiar with the author's approach and they appreciate it. In comparison with the results shown in Table (1), the students agree in the five questions with percentage up to 100% except for the last two questions the percentage is between 75% and 78 %. The author taught many courses for this batch of students in the second, third and fourth years and they are familiar with his approach which explains the difference.

3. Discussion

It is clear that teaching in English can be helpful and beneficial for non-speaking English students for technical and humanity courses. The response for students for technical courses is much more positive than humanity because in technical courses what they need to know is scientific terms and they will be able to interact with the subject. For humanity courses, they may need to have good command of the English language to read, understand, present and answer questions.

Some of the students feel shy to ask because they feel they have not mastered the language and they are reluctant to ask in front of their colleagues. One of the solution to the problem is increasing the interaction in the class between the students and the instructor. This can be simply done by asking some questions and give bonus marks for the students answering the question. Another possible approach is to encourage the students to ask whenever they need any help or they do not understand any part of the topics.

Another practice which we can normally do for each subject is assigning 10% of the marks for project presentation. The 10% can be divided equally between the report as well as the presentation. At the beginning of this approach, some of the students are reluctant to participate but as they saw their colleagues doing this they start participating in the subsequent courses. Normally the project presentations are conducted at the last week of the course and all the students (even who did not submit a project) has to attend and participate in the discussion. It is discovered that this way is very effective in encouraging them to express themselves in presentation and gaining confidence.

4. Conclusions

It is found that course project's presentation is a very efficient practice in encouraging students to participate and gain self-confidence and communication skills. The author taught many courses to almost the same batch of students and some of them were initially very reluctant to present their projects. The project's marks were divided equally between report and presentation. In previous courses, some of the students prefer to submit only nice reports and they refused to present their work. They were happy to get half the project's marks without presentations. For later courses, they were very happy and confident to present their projects. From this experience, it is recommended to assign some marks for project presentations for each technical engineering course.

One of the effective approaches in encouraging the students to be active ın the class and not passive is the effective use of both the projector and the board during the lecture. Presenting nice illustrations and well organized steps in modelling and solution of the problems make students feel that they will be able to do the same without much effort. The best way is just to present the problem, discuss the requirements, and the instructor should solve by his hand on the board. In this case, the students can share the procedure with the instructor and they got the feeling that they can follow, practice and understand when they try by their own. Also it will be good practice for them to get rid of their shyness in asking questions and find solutions.

Another problem is the dependence of some lazy students on their active colleagues in getting high marks without performing their own job. It is common to see average Grade Point Average (GPA) students trying to work with high GPA students in assignments and in course projects as well. The positive side of this cooperation is to train students how to deal with team work to solve mutual problems. The negative part can be overcome by asking each group to show the contribution of each member in the project individually. As they will present their project in front of their colleagues, they will try to share knowledge and understand the project so they can answer the questions in front of the whole class.

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