



POSTER PRESENTATIONS IMPROVE ENGINEERING STUDENTS' COMMUNICATION SKILLS

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ABSTRACT

This research reports the procedures the writers have employed in teaching several academic and workplace communication skills through engineering multidisciplinary projects (EMDPs). In these projects students are divided into teams, with each team comprising a minimum of three and a maximum of four students from different engineering majors. The students choose and appoint a team leader, choose a research topic/problem in the surrounding environment that requires input from all team members and collaboration from all students, each in his/her respective discipline, in finding a solution to the situation/problem. Team members choose the topics, obtain approval of the topics from cooperating engineering faculty and the course instructor, and then prepare detailed research proposals. They receive specialist feedback on their proposals, and based on how detailed their proposals are, are given the go ahead to proceed with their research. The execution of the research project requires the use of several technical communication skills such as, internet searches; sending email messages; writing formal letters; meeting with officials, engineering academics and experts, as well as giving powerpoint supported oral presentations, EMDP poster presentations and submitting end of research written reports.

Keywords: Poster presentations, Teamwork, Communication skills, Project defense

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1. INTRODUCTION

There has always been dissatisfaction with engineering students' communication skills in academic (see (Brandt, 2009) for an interesting survey of opinions) and the workplace (Ashman *et al.*, 2008; Nair *et al.*, 2009; EL- Sakran and Awad, 2012). Hence, the past twenty five years have witnessed a strong move within educational institutions from a lecture-based instruction paradigm towards an active learning paradigm where learning responsibility is handed over to learners and the instructor acts as a guide and a facilitator. This shift in focus on developing excellence in communication skills, both oral and written, has brought in several changes in English for Specific Purposes (ESP) and technical communication syllabus and course design.

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Some of these changes are “well developed professional communication skills, collaborative work practices, effective self-management and a clear understanding of social responsibility (EL-Sakran *et al.*, 2012; 2013).

This paper outlines evidence from a number of studies concerning the importance of professional communication for engineering students. The paper then reports the procedures employed to contextualize these skills through poster presentations of engineering multidisciplinary projects. It also presents the procedures used to examine evidence of transfer of communication skills in students’ defense of these products.

2. CONTEXT OF STUDY

Higher education institutions, specifically, colleges of engineering have become increasingly aware of the need to provide more than the traditional technical discipline-based education for their students. A sound knowledge of engineering theory and practice alone is no longer sufficient to meet the demands of the market place. Students graduating from engineering programs are expected to possess an effective range of oral and written communication skills and to have developed collaborative work practices (El-Sakran *et al.*, 2011; 2012; 2013).

The teaching and learning of highly required workplace technical communication skills (i.e. writing reports; calling for meetings, preparing meeting agendas and taking, writing and editing minutes; writing and sending formal email messages and letters; giving formal presentations; etc.) out of their relevant contextual settings does not guarantee full student involvement in the learning process and may be futile (Mercer, 2006; Yu, 2008; Chun, 2010). Contextualizing the teaching of these skills opens students’ eyes to their proper and appropriate uses in authentic communication situations (Amare and Brammer, 2005; Predmore, 2005).

It is the purpose of this research to report on the procedures the writers have employed in teaching several academic and workplace communication skills through engineering multidisciplinary projects (EMDPs). In these projects students are divided into teams, with each team comprising a minimum of three and a maximum of four students from different engineering majors. The students choose and appoint a team leader, choose a research topic/problem in the surrounding environment that requires input from all team members and collaboration from all students, each in his/her respective discipline, in finding a solution to the situation/problem. Team members choose the topics, obtain approval of the topics from cooperating engineering faculty and the course instructor, and then prepare detailed research proposals. They receive specialist feedback on their proposals, and based on how detailed their proposals are, are given the go ahead to proceed with their research. The execution of the research project requires the use of several technical communication skills such as, internet searches; sending email messages; writing formal letters; meeting with officials, engineering academics and experts, as well as giving powerpoint supported oral presentations, EMDP poster presentations and submitting end of research written reports.

3. PREVIOUS STUDIES ON ENGINEERS' COMMUNICATION SKILLS

Bodmer *et al.* (2002), in a European and US survey of 1372 engineers, identified leadership, social skills and communication to be lacking in graduates; an international survey (WCEC, 2004) of 1091 chemical engineers during their first five years of employment found deficits in management, effective communication and leadership. The study conducted by Martin *et al.* (2005) involved chemical engineering graduates in South Africa. This investigation showed that the foundations of success for the respondents, technical knowledge and technical skills, were not sufficient for success in the profession. Other attributes (interpersonal skills, communication, teamwork and management) were needed to build on this foundation for success in education and in industry. In particular, this study emphasized that communication is dependent on interpersonal skills, and teamwork and management are dependent on communication. Other research (EL-Sakran and Awad, 2012) emphasizes the need for engineers to be able to integrate technical expertise with behavioral and societal issues, to work on solving complex problems in teams composed of professionals from many disciplines and exhibit high level communication skills. Copious other studies have indicated deficiencies in engineering graduates' communication skills required for success in the workplace (Bodmer *et al.*, 2002; Martin *et al.*, 2005; Ashman *et al.*, 2008; Nair *et al.*, 2009; Male *et al.*, 2010). Another study (Kassim and Ali, 2010) calls for more focus on oral communication skills for engineers.

Now and in the very near future engineering students have to communicate with professors, defend senior design projects and talk to prospective customers. Such different interactive roles necessitate that they develop and entertain flexible oral academic and persuasion skills that are context-sensitive, become audience sensitive and respond accordingly. Lack of such skills is also reported in academia. Brandt (2009), in an interesting and revealing study titled 'PowerPoint or Posters for EAP Students' Presentation Skills Development?', points out that major/disciplines' instructors need their students to exhibit good academic speaking skills. She adds that university instructors value students' ability to discuss and persuade rather than present only. This finding is also reiterated in several others studies Kehe and Kehe (1996); (Ferris and Tagg, 1996b) and (Ferris and Tagg, 1996a) Winsor *et al.* (1997)). These studies have in common a focus on competencies that are deemed essential but often deficient in engineering workplace situations, either by engineers identifying their self-perceived shortcomings or by more experienced engineers observing the limitations of junior colleagues.

4. THE PRESENT STUDY

The activities described in this paper are carried out in an English for Engineering Course taught to the College of Engineering students at the American University of Sharjah in the United Arab Emirates. In this course, engineering students are supposed to study and learn several technical communication skills required for their academic study and the workplace. Like any other language course, students are taught how to write and produce several technical written communication genres addressed to assumed and imagined readers, which makes the course lack authenticity and deprive the students from the real pleasures of writing to a real

audience. The English Department at the American University of Sharjah in the United Arab Emirates, acting upon a recommendation made by the Accreditation Board for Engineering and Technology (ABET), designated the English for Engineering a prerequisite study for engineering students to be undertaken before going for internship and before studying the Senior Design Project in their final year. This has been so in response to employers' and students' complaints that engineering trainees desperately lack the basic skills needed for communication with co-workers, supervisors and employers. In consequence, a recommendation has been made that engineering students will typically study this course during their third academic year before embarking on their senior design projects and internship. ABET has also made a general and broad recommendation that all engineering students from different majors should get involved in multidisciplinary engineering projects that would require individual inputs from all the students in the team. Since this has proved difficult to implement in specialized engineering courses, where students from different majors study separately from others, the most suitable context for this has been the English for engineering class which comprises students from all engineering disciplines and from different cultural and ethnic backgrounds.

In response, an engineering multidisciplinary projects component has been incorporated into the course in order to provide engineering undergraduates training in a range of collaborative, typical of workplace communication and academic skills. Since the course contents cover in addition to research skills other vital communication skills, the researchers have incorporated in the body of the engineering multidisciplinary projects most of the communication skills listed in the course learning objectives as detailed below (for more details on course contents, see Appendix A). Engineering Multidisciplinary Projects-based teaching and learning can provide the appropriate context for introducing, developing and implementing not only research skills, but also the technical communication skills stated in the course learning objectives.

As noted by Parvis (2001), to speak effectively in front of a group is "...a skill that has to be taught to students and needs to be honed throughout college life and into the job market". Based on the evidence provided in this study, students should have the opportunity and instruction that will enable them to attain these skills and capabilities. Herrington and Oliver (2000) identified nine critical characteristics of activity based learning. These are:

1. Provide authentic contexts that reflect the way the knowledge will be used in real life;
2. Provide authentic activities;
3. Provide access to expert performances and the modelling of processes;
4. Provide multiple roles and perspectives;
5. Support collaborative construction of knowledge;
6. Promote reflection to enable abstractions to be formed;
7. Promote articulation to enable tacit knowledge to be made explicit;
8. Provide coaching and scaffolding by the teacher at critical times; and
9. Provide for authentic assessment of learning within the tasks.

Along the same lines, Merrill (2002) suggests that learning is most effective when:

1. Learners are engaged in solving real-world problems;

2. Existing knowledge is activated as a foundation for new knowledge;
3. New knowledge is demonstrated to the learner;
4. New knowledge is applied by the learner; and
5. New knowledge is integrated into the learner's world.

This paper examines the effect of activity-based learning on the students' learning experiences and learning outcomes. Therefore, poster presentations have been made an essential component of the English for engineering course. The revised course syllabus requires students to make a succinct collaborative oral presentation using powerpoint slides, to give a poster presentation and to produce a written report on their engineering multidisciplinary projects. Students design informational posters, focusing on a current research project. Previous studies of poster presentations (Cianflone, 2011) have discussed professional and formal poster presentations delivered in conferences. This study reports on the use of poster presentations by engineering students in an English for communication course where the focus is on written and oral communication skills.

In an attempt to help students develop competent communication presentation skills, the authors adopted the following procedures.

5. PROCEDURES

1. Teams of a minimum of three engineering students and a maximum of four (see Appendix B) from different engineering disciplines choose a research topic and prepare a proposal on it.
2. The proposals are submitted to the English language instructor and an engineering faculty for comments and feedback.
3. Teams work on the research and give an oral progress report half way through the semester and are given feedback from colleagues and the course instructor.
4. Teams are given a one-hour training session/lecture by a specialist faculty detailing the design, size, color and contents of poster.
5. Teams prepare and design posters using free online poster design sites provided to them by the course instructors.
6. The student teams are presented with the grading rubric given to the assessors (see Appendix C).
7. Teams are told that their poster presentation and defense should be comprehensive and should not exceed a maximum of 10 minutes.
8. Teams are presented with dates for presenting and defending posters.
9. The presenting teams are given email address of the assessing team chair and are asked to contact him/her to negotiate with the team of assessors their availability for the poster assessment. Students provide the chair with their common time slots and the team chair confirms the time slot that best suits the assessors.

10. As the main objective of the poster presentation is to test team members' interactive communication skills, their ability and competence to explain technical engineering information to non-technical audience and transfer of learning, two faculty from colleges other than engineering and one senior high achieving student (based on the AGPA; 3.5 and above out of 4, and the recommendation of a professor who knows him/her) are selected to assess team members on the poster layout, use of visuals, contents (i.e., results, discussion, methodology used, analysis, conclusion, etc.). Those faculty and students are supplied with a list of criteria for assessing the posters and the presenters (see appendix D for a detailed description) in terms of format, language, content and overall impression. The assessment also covered time management, question referral, ability to simplify technical information for a non-technical audience, coordination between presenters, transition from one presenter to another, use of interactive expressions and language referring to visual elements, justifications for topic choice, persuasion, accepting and acknowledging research limitations, project practicality and marketability, etc. All together, there were four teams of assessors comprising 8 faculty and four senior students (total of 12 assessors).
11. The referees/judges, to minimize and erode individualistic and idiosyncratic ratings and to ensure reliability of scores, were briefed on the evaluation procedures in a training session where they were shown how to use the rating scale and how to assign scores. Such a practice would ensure intra and inter-rater reliability.
12. Referees asked different questions and each referee made an individual assessment based on the criteria given.
13. All referees' assessments are tallied to measure inter-rater reliability and then marks are added up and divided by three to assign presenters a mark out of 12.
14. All together, there were 17 presenting teams totaling 54 students in one semester.
15. At the end, all assessors were asked to nominate a poster as the winning poster from all posters.

6. REFLECTIONS AND FEEDBACK FROM THE INSTRUCTORS AND THE STUDENTS

EMDPs have proven to be an effectively rich and successful vehicle for developing several technical communication skills that engineering students need to master to be successful communicators in academia and the workplace. Instructors' and students' deliberations on the course and the way it is conducted indicate that EMDPs have helped achieve the following:

- Shift focus from teacher-centered practices to students' collaborative learning-centered environments, thus achieving more student autonomy, confidence and responsibility.
- Realize Swales (1990) & concept of "community membership" through exposing students to and giving them access to academia and workplace needed communication skills.

- Provide learners with real opportunities to create their own texts, engage in real communication tasks with real audiences, and reflect on the outcome of their communication process.
- Students are not told or asked to pretend, imagine, or assume a role or an audience; by contrast they are engaged in real and authentic communication tasks using several communication skills and genres, and negotiating and producing specified preset goals.
- Students use language for real purposes, involving discussions, negotiations, and decision making. [Rilling and Dantas-Whitney \(2009\)](#) rightly argue that “The goal of using and creating language for real-world purposes within language instruction is to bring authenticity to the learning experience, not to the texts themselves”.
- Students study items of the course contents and then use the information they have gained in real life-task-based activities.
- Develop in students “transferrable skills and knowledge” ([Chun, 2010](#)) that they can use during their study, internship and after graduation.
- Teaching, learning, and assessment all take place as the students perform the task.
- Provide an “interdisciplinary, student-centered approach to teaching focused around student-generated projects ([Stipe and Yasen, 2009](#)).
- Students function in both initiating and responding roles and thus perform a wide range of language functions (e.g. asking and giving information, agreeing and disagreeing).
- Provide opportunities to negotiate meaning when communication problems arise.
- Student presenters liked the experience and requested its continued use with future cohorts. Poster presentations cater for different learning styles and allow for personality preferences, students’ creativity in poster design and show each team member’s contribution to the research projects. Posters give a full picture of the research, and; therefore, the audience could ask questions on any issue without having to follow any specific order as it is the case with PowerPoint presentations ([Brandt, 2009](#)). In other words, the order of questions is decided by the audience.
- Poster presentations prepare students for relevant community membership by getting them engaged in interactive tasks that they may do in the future when they participate in conferences. Another advantage is the fact that students may be subjected to criticism through the assessors’ expression of opposing opinions to those adopted by the poster presenters; a key issue in academia.

If some of the best rated poster presentations are videotaped and shown to subsequent classes as models, students could be required to critique them using the grading rubric given to them. Such students’ critiques could foster a good discussion and open students’ eyes to issues that their posters should contain.

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7. APPENDIX A

The structure, the components and the steps of the engineering project in the old & new syllabi and the modifications introduced.

1. Old Syllabus

1.1. Individual Technical Presentations

- Proposal

- Progress report
- Technical presentation

2. New Syllabus

2.1. Engineering Multi-Disciplinary Presentations (EMDPs)

- Topic Choice and Approval
- Proposal Submission
- Oral Progress report
- Submission of written progress report
- Poster Presentations
- Submission of Final Written Report

2.2. Meeting, Planning and Documentation

- Minutes of official team meetings
- Documentation of informal team meetings
- Documentation of key decision-making
- Documentation of team meetings/team representative(s) with officials, academicians and experts and task assignment
- Documentation of planning
- Timeline for EMDPs execution and submission

8. APPENDIX B

8.1. Team Formation & Organization

Initial Group Formation

1. You should have 4/5 members and at least three members should be from different engineering disciplines.
2. You need to select a leader/contact person who will be the primary link between the course instructor and the group.
3. The leader will also be responsible for ensuring that the group achieves its targets on time and completes tasks assigned.
4. It is possible to rotate group leadership so that each member has an opportunity to experience the challenge of leadership and has the chance to develop the appropriate skills that the role demands.
5. Communication will be the key to good team work (an important attribute for multi-disciplinary groups) so make sure you establish an efficient communication system immediately (You may create a group email for this purpose).

9. APPENDIX C

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EMDP Poster Presentation, Spring, 2012

Poster Presentation Assessment: 12% Presentation # _____

4 = fluent, logically structured delivery with clear use of markers to highlight important information, appropriate language use, few if any errors, clearly engages questions

Comments:

Assessor:

10. APPENDIX D

10.1. Poster Assessment criteria cover:

1. Poster format (layout, contents, font size, use of visuals, use of captions to refer to visuals, color, background, use of sections headings and sub-headings, etc.).
2. Use of linking adverbials (i.e., therefore, as a result, consequently, etc.).
3. Coherence and cohesion
4. Involving audience in discussion (i.e., as you see, if you look here, as you can see from Table x, according to this figure, etc.).
5. Maintaining enough and adequate eye contact with audience.
6. Fluency; defined here as continuous and uninterrupted delivery.
7. Accuracy of language used.
8. Time taken to respond to questions.
9. Academic integrity (i.e., citing sources for quotes and visuals).
10. Innovative solutions to real life problems.
11. Intrusive background color
12. No clear labels [Figures or Tables]
13. No in-text-reference to visuals
14. Sources not clearly identified (picture of stumping treatment)
15. 1/1.414 ratio not consistent
16. Small print on figures hard to read
17. Separating border unnecessary
18. Bullet points not needed
19. Size and color of font not consistent
20. Use of initials without citing the full words (IBA, NAA)
21. Too many colors
22. No section headings
23. Logical sequence not obvious
24. Banner across top of poster distracting
25. Poster is unbalanced (heavy panels at the top)
26. Poor quality of visual (pixilation very coarse)

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