A TEMPLATE FOR THE INTEGRATION OF TEACHING AND LEARNING OF COMMUNICATION SKILLS IN THE ENGINEERING COURSE

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ABSTRACT

Published studies in the open literature and experience of new engineering graduates have shown that employees who are able to clearly communicate their thoughts and ideas to their employers through written reports and oral presentations advance more quickly in the organisation compared to those who lack these skills even if they do not possess superior technical knowledge. Also, surveys of engineering employers have shown that while the technical knowledge of engineering graduates is considered to be adequate, the perception is that they lack the personal communication skills required of them in the work place. The traditional method of teaching communication skills to engineering students is through especially designed units which are taught by specialists in the field of communication. Engineering students generally consider these units to be of little importance because (1) the teaching material is often not related to engineering as the lecturers are not necessarily engineers, (2) these units are in addition to the engineering units which students have to complete, and (3) they have the label of being a "service" unit. In order to overcome these shortcomings, teaching and learning of communication skills was integrated with the teaching of technical contents to final year students in a two-semester long Final Year Project (FYP) core unit in the undergraduate engineering degree during 2003 to 2008. The assessments tasks for the FYP unit included submission of a Project Proposal, a Progress Report, a Research Paper and a Final Report, plus an Oral Presentation. Students were given instruction on how to prepare for these activities at appropriate times during the semester. This paper describes the details of the approach used, the results obtained and the comments received from students who have completed these units.

Keywords: Teaching and learning, communication skills, engineering education.

INTRODUCTION

The need for the development of written and oral communication skills of undergraduate Engineering students has been widely recognised in the work place. Surveys of engineering employers have shown that while they have confidence in the technical capabilities of graduates, they have expressed a desire for engineering graduates with good communication skills [eg, Hessami and Eley, 1992]. Although it may seem difficult to add more content in the already congested curriculum of undergraduate courses to teach such skills, several authors have experimented with different ways of integrating the teaching of these skills into the engineering curriculum [e.g., Moodie et al, 2007; Borthwick, 1994; Marsh and Tomlinson, 1993; Clinch and Goulter, 1992, Hessami and Sillitoe, 1997; Silyn-Roberts, 1993]. Embracing the "integration" philosophy of such studies, a method of integrating the teaching and practising of communication skills with the teaching of technical contents in a final year unit/subject is described in this paper. For this purpose, after introducing the program, the FYP selection process and teaching methodology are explained and a description of each assessment task is provided. Finally, students performance data for 2003-2008 are outlined and discussed in relation to their performance in other final year units. It is shown that students have performed very well in this final year unit compared to all other units taken by them at that level.

The unit which was used for this purpose is called the Final Year Project (FYP) which spans over two semesters in an eight semester long engineering degree course. The work for the FYP is worth 12 credit points, normally 6 in the first semester and 6 in the second semester of enrolment. As a rule of thumb, students are expected to spend 12 hours per week on a 6-credit point unit/subject. The FYP load of 12 credit points is half of the normal load of 24 credit points per semester for a full time student. Therefore, the total number of credit points required

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for course completion is 8 times 24 or 192.

The assessment of the FYP unit was based on 5 tasks: Project Proposal, Progress Report, Oral Presentation, Research Paper and Final Report. Students received instruction and guidance on all aspects related to these assessment tasks so that they could maximise their mark for each task.
The FYP is an essential part of the syllabus of the Mechanical Engineering degree, and all students must complete this requirement. The objective of the project is to ensure that students have adequately demonstrated their preparedness to perform their duties as qualified professional engineers after graduation. It is the culmination of the Engineering Degree Course. Prospective employers may want to see the FYP publications in a job interview. Therefore, they should be concisely and clearly written to impress possible future employers.

The FYP work can involve a review of the literature, laboratory experimentation, analytical work, numerical simulations, and/or industrial involvement. Although most projects have a research orientation and would be university-based, students are encouraged to participate in industry-based projects as well.

All projects require the direct involvement of an Academic Supervisor from the Department. In consultation with the prospective Academic Supervisor (and the Industrial Supervisor where applicable), students are required to select a topic and register it by completing and submitting the FYP Registration From to the Final Year Project Coordinator before the end of week two of the first semester of enrolment. The deadline for changing the FYP topic and/or supervisor is Week 5 when the Project Proposal and Risk Assessment Reports are due as explained later in this paper.

For the purpose of FYP, students select a project from a list which contains all the projects offered by the academics in the Department. Students carry out their project work under the guidance of the Academic Supervisor who had proposed the project. The FYP Co-ordinator organises seminars which are designed to help students with the generic aspects of engineering research as well as communications skills. Seminars related to engineering content cover topics of literature review, research methodology and data analysis. Seminars on communication skills cover topics on how to write a Project Proposal, a Progress Report, a Research Paper and a Final Report; there is also one seminar on how to prepare and deliver an effective Oral Presentation. Also, included in these seminars is a guest lecture by a practicing engineer from the industry to expose students to real world engineering problems and challenges.

Therefore, the technical content of the project is learned by students while completing their projects under the direction of an Academic Supervisor who is an expert in the field. The communication skills are learned by attending various seminars, and by writing reports and a research paper, and by making an oral presentation to communicate the results of their investigation. Finally, knowledge of professional practice is gained by listening to practicing engineers. Consequently, students simultaneously learn the technical content related to their project as well as the generic communication skills required of them in the workplace. Engineering graduates with such knowledge and skills can be expected to be more successful in their chosen profession when they enter the work force.

FYP SELECTION

Final year projects are generally nominated by academics in the Department and may include industrial projects. For these projects, students would consult with the nominating academics in order to obtain their agreement before committing to the project. However, this is not the only mechanism to set-up a project that might interest students. For example, if students are thinking about an engineering topic which they wish to study in detail, and they are passionate about it, they could discuss it with suitable academics in the Department who may have relevant expertise in that area, and who may be interested in supervising that topic. Similarly, students may consult with engineers in industry to find a project of interest to them, and to an academic in the Department who may wish to act as the project's Academic Supervisor. In all these situations, the Academic Supervisor plays a central role not only in supervising the work and providing technical advice but also in communicating students' performance results to the Department.

For university-based projects (FYP-UB), students obtain the agreement of the prospective Academic Supervisor before registering their project. However, for industrial projects (FYP-IB) undertaken in Australia, the agreement of the industry supervisor is also required. If students intend to complete their FYP overseas, their first step would be to find a suitable project which could be industry or university based. With the project title, and the names of the Industrial and/or Academic Supervisor(s) students should then get the agreement of a Departmental Academic Supervisor who would be interested in supervising that topic. Students would then be able to request Department's permission to work on such a project.

For overseas FYPs which are university based, the host university's regulations will apply. If no such guidelines are available, the Department's guidelines will be followed. These guidelines will also cover overseas industrial projects. As the duration of overseas projects may be different from those at Monash University, the submission deadlines will be determined by the Overseas Project Supervisors and communicated to the student(s) and the Monash Academic Supervisor at the commencement of the project.

TEACHING METHODOLOGY

No formal lectures on the technical aspects of the various projects are given to students. However, students are required to meet with their Academic and Industrial Supervisors (formally or informally) on regular basis in order to discuss such technical matters and the progress of the project. In order to help students with their involvement in FYP's, several seminars on the topics listed below are scheduled and students are encouraged to participate in these seminars.

S1: General Overview: Organisation and Requirements
- S1a: Introduction to the Library Facilities
- S1b: Writing the Project Proposal and Risk Assessment Reports
- S1c: Writing the Progress Report

S2: Research Methodology and Data Analysis
- S2a: Preparing for the Oral Presentation
- S2b: Writing the Research Paper
- S2c: Writing the Final Report

Although the seminars on the technical matters related to the FYP research (S1 and S2) are given by engineering academics in the Department, seminars on the communication skills (S1a to S1c and S2a to S2c) are presented by educational experts from the University's Learning Skills Unit. While attendance in all seminars was compulsory, during 2008 the communication seminars were made optional as some students felt sufficiently confident about their skills, and asked for and received exemption from attending these seminars.

WRITTEN AND ORAL COMMUNICATION SKILLS

All students who enrol in the FYP units, participate in a number of assessable activities not only to satisfy the technical requirements of the FYP units but also to learn about communication skills. As mentioned before, students are required to submit four written reports for assessment, and make one oral presentation which waas also assessed. Although a seminar on each of these topics (which were listed above) provides students with general guidelines, the following written information is also provided to them. This two-prong approach is used so that students get the maximum benefit from their involvement in the FYP units.

Risk Assessment Report (Due Week 5, 1st Semester of Enrolment)

All FYP students are required to prepare a Risk Assessment Report in accordance with the instructions provided to them by the OHS (Occupational, Health and Safety) Consultant of Monash's Faculty of Engineering. The instruction for preparing this report is delivered to students during a two-hour seminar in Week 2 of the semester. The purpose of this training course is (a) to teach students the principles of hazard identification, risk assessment,

and management, and (b) to practise the application of these principles in a simplified risk management methodology. The initial focus of the seminar is on the techniques and principles of risk management, involving the use of case studies relevant to the style of FYPs undertaken by students. Students then learn how to initiate systematic risk assessment of hazards within their project. In general, the risk assessment process involves **hazard identification**, **risk assessment** and **risk control** for all major hazard groups that may arise during any FYP work. These hazards may include (a) manual handling, (b) process and equipment, and (c) chemical, biological and/or radiation exposure. After attending the OHS seminar, students should be able to (a) review their work area and activities against each of the major hazard groups and (b) identify and assess hazards in their work place, rank them in terms of priority, and provide guidance for the development of appropriate control measures. This information can then be incorporated into a standard Risk Assessment Report which students would write and submit for assessment.

Project Proposal (Due Week 5, 1st Semester of Enrolment)

The **length** of the Project Proposal should not exceed 5 A4 pages (12 pt font with 20 mm margin on all sides) or about 2000 words plus appendices if necessary. The **purpose** of the proposal is to (a) explain the need for the research, and (b) plan the project. This approach can often helps students to identify any potential problems they may have in carrying out the research work, and assist them in developing contingency plans.

Students should carefully consider their particular project in order to decide for themself what is the best way to organise the information into logical sections and then to devise appropriate headings for these sections in the proposal. Typical sections in a proposal and their contents are briefly outlined below:

Title: It provides a concise, accurate and informative representation of the material included in the report, and it immediately orientates the reader to the focus of the research project.

Background (or Introduction): It explains why the project is undertaken. It provides an overview of the background to the project and establishes a particular area, or problem, that needs to be investigated further. To establish the need for the research, this section may include a concise preliminary review of the previous studies on this topic that students read during the first few weeks of the project. This section provides a clear statement of the topic of the proposed research.

Aims (or Objectives): This section clearly describes the aims of the study (to measure, to devise, to design, to establish, to identify, etc). If there is a general aim, a number of specific aims should also be established. Aims can also be incorporated in the **Introduction**.

Methodology: It outlines **how** the study will be undertaken (by conducting a series of experiments; by developing a model; by conducting a survey of engineering practice; by reading and critically reviewing a number of research papers; by doing fieldwork; etc).

Project Plan: This section describes **what** students will do to achieve the aims of the project. It is a plan of the tasks that will enable them to achieve the stated aims/objectives of the project. To prepare a Project Plan, students need to break the project down into a series of steps or stages, and then outline the tasks within each stage (for example, in stage 1, I will devise a survey which…..; carry out the preliminary experiments; design the …….. In stage 2, I will interview three engineers; carry out further experiments; build the ….). If possible, students could also identify concrete outcomes for each stage of the project (eg, outcomes of stage 1 are a series of graphs showing ……The outcome of stage 2 is a brief review of the research papers on ...…. . Outcomes of stage 3 are the collection and analysis of data on the effect of …...). Students should try to provide as much detail as possible in the Project Plan as it will help them to carry out the project work more effectively and efficiently. The Project Plan should also include a **timetable** in which students plan the timing for the main tasks; this information can be presented in a Gantt chart. This timetable can help to keep students on track throughout the project. The Project Plan may also include a **list of the resources** required to do the project.

Potential contributions of the proposed research: Under this heading, students can summarises, perhaps in point form, the main areas where the project will make a contribution. Examples of potential contributions are:
The study will provide an estimation of ……; recommendations for …..; an understanding of ….; an improved design for…; further knowledge of …...

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References: Students should list only those sources which they have **consulted** and **referred** to in the text of the report. The suggested format is (author, date, page numbers if appropriate) which is placed in the text after the cited information. All the references with relevant details should be listed alphabetically by author's surname at the end of the report.

Appendices: At the end of the report, under appropriately labelled headings, students can provide more detailed information than required in the body of the Project Proposal such as details of equipment specifications, pilot study data or research design or analytical models to be used.

Progress Report (Due Week 13, 1st Semester of Enrolment)

The **length** of the Progress Report should not exceed 10 A4 pages (12 pt font with 20 mm margin on all sides) or about 4000 words excluding title page, table of contents and appendices if applicable. The material in the report should be presented in a technical report format. The **purpose** of a progress report is (a) to summarise the work that has been already completed in the first semester, and (b) to outline in detail the work which will be carried out during the second semester in order to realise the objectives of the project.

Typical sections in a Progress Report and their contents are outlined below:

Summary: It provides a brief overview of the report, summarising the topic of the project, the work already completed and the work planned for Semester 2.

Table of Contents: It lists the contents of the report with clearly set out, numbered sections and subsections with their corresponding page numbers as explained further in Section 4.7 where Final Report is discussed.

Background (or Introduction): It is similar to the Introduction of the Project Proposal. It provides the background to the investigation, defines the topic or the research problem, and clearly states the aims of the research.

Project Work completed in 1st semester: It presents students' progress to date. Students need to describe the work that they have done (for example, the first stages of a design; a preliminary literature review; some experimental work). They then need to discuss the outcomes of their investigation so far. This section may include headings such as literature review, preliminary experimental work, design calculations, data analysis, case studies, findings to date, etc.

Project Plan for the second semester: This is similar to the Project Plan that student submit as a part of their Project Proposal. However, based on the work completed in Semester 1, they can provide a more detailed and more focussed plan of the work which needs to be done in order to achieve the aims of the project. Possible subheadings in this section are:

- Aims (or Objectives)
- Project Plan
- Timetable
- Resources

Conclusions: It briefly summarises the main information in the report. **References:** It should be listed as outlined under Project Proposal. **Appendices:** It can be used to provide additional information to the reader about the details of, for example, the calculation procedures, the design features of a particular piece of equipment, the raw data collected in the laboratory or in the field, etc. Students should remember that if they do not refer to the appendices in the text of the report they should not be included.

Oral Presentation (Due Week 10, 2nd Semester of Enrolment)

The **length** of the presentation should be 12-15 minutes with an additional 5-8 minutes for questions. The primary **purpose** of the Oral Presentation is to receive appropriate feedback from the project supervisor(s) and the audience on the details of the FYP work which students have planned to be undertaken; a secondary objective of this exercise is to provide students with an opportunity to learn about public speaking in a friendly and congenial environment. The presentation should therefore include an overview of the FYP, a brief review of

the relevant literature, a description of the methodology that will be used in the research, a summary of expected results of the investigations, the expected accuracy of the results and a general discussion of the implications of the expected findings. If the research has not yet reached its conclusion, students need to outline the work which will be completed by the end of the project. Also, it is important to clearly state the contribution that the research will make to the field of study. Since the time of the presentation is limited to 15 minutes, the presentation needs to be concise and precise.

The key features of a good presentation are:
- a clear logical **structure**
- effective **visual aids**, and
- **good delivery** techniques.

Structure: Formal talks are highly and explicitly structured. The language clearly marks each section in the presentation in order to help the listener keep track of where they are and in order to help them remember important information. Predictably, presentations have an **introduction**, a **body** and a **conclusion**. The introduction makes important statements about the topic and the structure of the talk. It also clearly establishes the purpose of the presentation (for example: to present the three major findings of the investigation; to outline the background to the investigation and then to focus on the key features of the design.). The body presents and develops the topic. The conclusion provides a clear and memorable ending to the presentation.

Visual aids: Visual aids are a vital part of an effective presentation. They provide important visual information to support and enhance the verbal communication and make it much easier for the audience to remember the main points of the presentation. While visual aids significantly improve the communication of the ideas, producing them forces the speaker to condense the content of the presentation to the key ideas. Therefore, they provide the speaker and the audience with a clear and logical structure during the actual talk. Remember to (a) make your visual aids simple; present only one key point per slide; (b) make text and numbers clearly legible (at least 18 points); and (c) avoid large slabs of written text; use a maximum of six lines and no more than six words per line.

Delivery techniques: It is important to remember that during a presentation the speaker is making face-to-face personal communication. A successful presentation is more than just words and slides. It involves the whole person, and therefore a relaxed posture, good eye contact, natural hand and body gestures and a pleasant strong voice can help the speaker to communicate his/her ideas. The speaker should aim for an interactive, animated presentation style similar to a natural conversational style. The speaker should make the presentation interesting and engaging, and should share his enthusiasm for the project with the audience.

Question time: Students will be given a 5-minute question time at the end of the presentation. It is a good idea to anticipate the questions that the audience might ask. The speaker should go through each section of the presentation carefully, and work out questions that could be asked about the work presented in it. If necessary, the speaker should change the information in the section so that the most important questions are clearly answered as part of the presentation. Otherwise, the speaker should have a good answer ready for those questions. For further information on giving effective presentations, speakers can consult [Mablekos, 1991 and Mandel, 1994] listed at the end of the paper.

Poster Presentation (Optional)

Poster Presentation was offered as an additional assessment task some times, and it was used instead of Oral Presentation on some other occasions. However, in this paper, only Oral Presentation is considered for assessment purposes but the description of Poster Presentation is included for reference. The primary purpose of the Poster Presentation is to give students the opportunity to announce to the audience especially the project supervisors and assessors how far students have gone with the research which they had proposed. The secondary aim of this presentation is to receive appropriate feedback from their supervisors to help them achieve their proposed objectives in the remaining three weeks of the semester. A third goal is for students to learn how to present their research findings through a poster.

The poster should be prepared in a manner that can be easily understood. Ideally, the content of the poster

should be clearly divided into sections, including abstract, introduction, problem definition (or aims of the work), results and conclusions. In short, the poster should contain all the essential information which students must include in their Research Paper, but should not be cluttered with unnecessary details. Figures, charts, photographs, etc. should be similar to those in the Research Paper for easy recognition by the audience. Each figure and table should have a brief title and/or caption. Overall, the poster should provide an easily remembered "take home message".

The lettering and diagrams should be large enough to be read from a minimum of 1 meter away from the poster. Students should consider using colours, symbols and other schemes to improve clarity and presentation of the content of the poster. Suggested lettering size is 28 pt bold Arial for the poster title and 16 pt bold Arial for names and addresses of authors and section headings, such as Abstract, Introduction, Methodology, Results, Discussion and Summary; the text of the Poster can be in 14 pt Arial. Remember to properly space the material on the poster for better reading and comprehension.

As much care should be exercised on the preparation of the Poster as for the preparation of the original figures in the Research Paper, and for the preparation of slides for the Oral Presentation. Many of the rules for the preparation of good slides apply to the preparation of good posters:

- Keep them simple and avoid overcrowding.
- Make sure letters are legible and large enough for distant reading.
- Posters similar to slides should display sufficient contrast between lines, lettering and background.

Do not try to provide too much information on one sheet. An overloaded poster rarely attracts attention. It is strongly suggested to display only short sentences or a list of sentences (or phrases) under each heading preceded by bullets or numbers to describe the work. Students should remember that they will be in attendance to provide further information to the audience if/when required.

Research Paper (Due Week 13, 2nd Semester of Enrolment)

The **length** of the Research Paper should not exceed 6 A4 pages inclusive of appendices (if applicable). The format requirements of the Research Paper are described in the Appendix. The main **purpose** of the **Research Paper** is to help students learn how to write a scientific and technical paper in their area of research, and to learn how to write concisely but with precision and accuracy. The Research Paper should contain the important technical details provided in the Final Report. For reasons of consistency, students are required to adhere to the instructions provided in the Appendix.

It is very important to prepare the Research Paper with utmost care because it may be the only document that the 2nd marker will see in order to assess student's performance in the FYP.

For archival purposes, all **Research Papers** if prepared according to the instructions of the Appendix will be bound as a book entitled **Profiles and Projects: Graduate Yearbook**, and made available to students at cost price; previous copies of this publication are available in the reference section of Monash's Hargrave-Matheson Library. If students wish their paper to be included in this book, they are required to submit to the FYP Co-ordinator (a) a good quality hardcopy and an electronic version of the Research Paper in MS Word on a floppy disc or CD, and (b) a properly completed and signed **Copyright Transfer Agreement**.

Final Report (Due Week 13, 2nd Semester of Enrolment)

The length of the Final Report should not exceed ~50 A4 pages (12 pt font for the body text and 14 pt font for the headings) or about 20,000 words excluding the title page, table of contents and appendices. The purpose of the Final Report is (a) to present a clear and logical report of the completed research, and (b) to announce the significant outcomes of the project.

The format of the Final Report is similar to that of the earlier reports with the conventional sections (such as Summary, Introduction, Body, Conclusions, References and Appendices). The body of the report is then divided into sections with appropriate headings devised according to the work undertaken in the project. For example, for a research project in which the investigation has been an experimental study of a particular problem, then

appropriate section headings in the Body may be: Literature Review, Experimental Investigation, Error Analysis, and Results and Discussion. However, for a design project, the section headings may perhaps follow the steps in the design process.

The information which is typically included in various sections of a major project report is outlined below.

Summary: It provides a concise overview of the substance of the report to give the reader a clear understanding of the investigation. It states the topic of the investigation and outlines its main stages, and it states the most important findings and outcomes of each stage. It also highlights the major conclusions of the investigation. As some readers read the Summary of the report only, it should be self-contained; it should not refer to figures or references.

Table of Contents: It lists the contents of the report with clearly set out, numbered sections and subsections with their corresponding page numbers.
Students should number the various sections by the decimal point numbering system as follows:

1.0 Title of first main section
  1.1 First subheading
  1.2 Second subheading

2.0 Title of second main section
  2.1 First subheading
    2.1.1 First division in the first subheading

The above listing usually does not go beyond a three-number or two decimal point (eg, 2.1.1) sub-subheading as it gets too complicated. If is found that the text needs more subdivision than this, bold side-headings can be used but these headings should not be included on the Contents page.

All the preliminary pages, ie, those preceding the Introduction (eg, Title page, Summary, Acknowledgements, Contents page, List of illustrations, etc.) should be numbered in lower-case Roman numerals (i, ii, iii, iv, v, etc.). The first page that is counted is the Title page, but do not label it as such at the bottom of the page; leave it blank. Number all the remaining pages of the report with Arabic numerals, making page 1 the first page containing the Introduction.

Appendices (note the use of the word: it is one Appendix, two or more Appendices) should have a title describing the contents of the appendix (for example, Appendix 1: Sample Calculations) and should be listed accordingly in the Table of Contents. They should not be just called Appendix 1, Appendix 2, etc.

Introduction: It provides the reader with the necessary background information to understand the rest of the report. It usually includes:

- the background of the topic of the report or the problem which has been investigated.
- a convincing explanation about why this topic/problem needs to be investigated.
- a clear statement of the aims of the investigation.
- a brief outline of the structure of the report.

Middle sections: These sections present the details of the project. Depending on the type of investigation that has been conducted, the work can be divided up into various sections with appropriate headings and sub-headings.

Conclusions: This section provides a clear summary of the major findings of the investigation. A possible way of presenting the conclusions is to list them as bulleted or numbered points, where the most important or strongest conclusions are stated first and the least important and more tenuous conclusions are stated last. As this section summarises information included in the report, no new material should appear in it.

References: The sources used in the study should be listed as explained under Project Proposal.

Appendices: These sections can be used to provide additional information, as outlined in the Progress Report. It should be remembered that **each appendix must have been referred to in the text of the report**.

Figures: Each figure in the report must have a caption underneath the figure and must be referred to in the text of the report. The source must be cited if the information in the figure does not come from the investigation completed by the author of the report. For example:

Figure 3: Atmospheric CO2 concentration for 800-2000 AD (Clodic, 1997).

ASSESSMENT METHOD

For projects involving only one student, student's performance is assessed on four written submissions (namely, Project Proposal and Risk Assessment Report, Progress Report, Research Paper, and Final Report) and one Oral Presentation. If two or more students are involved in a single project, it is their responsibility to divide the work in consultation with their Academic Supervisor into identifiable parts so that each student's individual contribution can be assessed adequately. The Project Proposal and the Progress Report should clearly specify the particular aspects of the project work that will be completed by each member of the team. Similarly, the Final Report should clearly identify individual student's contribution by linking the different chapters (or sections) in the report to individual student's names. While these students can submit a common or group Project Proposal and Risk Assessment Report, Progress Report, and Final Report, they are required to make individual Oral Presentation and submit individual Research Papers on the work that each student has completed.

The marks allocated to each assessment task are specified in the following table. Generally speaking, 75% of the mark is given by the Academic Supervisor and the remaining 25% is assessed by a second marker who can be another academic and/or the industrial supervisor of the project.

Table 1: Breakdown of assessment marks

Assessments Tasks	Mark (%)
Project Proposal and Risk Assessment Report	5
Written Progress Report	15
Oral Presentation	15
Research Report	15
Final Report	50

The Assessment Criteria used for the written reports are listed in the following table:

Table 2: General marking template

Mark (%)	Comments
90 – 100	With appropriate editorial adjustments you would submit this report to a refereed journal.
80 – 89	With appropriate editorial adjustments you would submit this report as a paper for a conference.
70 – 79	You'd be pleased to brag about this report over the bar at a conference.
60 – 69	Just a project
50 – 59	Adequate

Strict deadlines apply on the submission of each of the above Assessment Tasks. If students are anticipating a difficulty with the specified submission deadlines, they must make a detailed application to their Academic Supervisor asking for an extension. Provided the request is supported by the Academic Supervisor in writing, and it is received by the FYP Coordinator at least 2 weeks before the specified deadline, an extension may be granted by the FYP Coordinator. The penalty for late submission of written work or for failure to make the Oral Presentation as scheduled without prior approval from FYP Coordinator will be at the rate of 5% per week or a portion thereof. The penalty will be applied by the FYP Coordinator on the mark(s) submitted by the supervisor(s) or second marker, and the percentage is that of the **full mark allocated to the particular Assessment Task** under consideration. For example, a student has submitted his/her Final Report worth a maximum of 50 marks 12 days after the deadline. The supervisor has given him/her 41/50. The penalty which

will be applied by the FYP Coordinator would be 2*5%*50=5.0 marks, and the student would receive 36.0 marks out of 50.

STUDENTS' WORKLOAD, PERCEPTION AND ASSESSMENT RESULTS

The FYP workload on students varies significantly depending on the nature of the project, the level of support (in terms of resources and supervision) available to them, the expectation of the supervisors, and students' ability to manage their time and work load. Some students fit into the role very easily and take the open-ended challenge of FYP happily and seriously, and mange the project superbly with or without a lot of supervision. On the other hand, students who have become accustomed to the routine of lecture-based classes and who have followed the detailed instructions for each task they have performed during their eduction would struggle. However, at the project selection stage, students have the opportunity to choose the project that suits their learning and study style properly. Consequently, majority of students find a suitable FYP and perform very well as explained further later. Very few students who run into problems are those who have not invested much time in the selection of their project.

Comments received from students in formal and informal evaluations have generally been positive. However, students have complained about the rigid structure of FYPs, the deadlines which students have to meet, the presentation formats students have to follow, etc. without realising that these are common requirements in the work place as well; most practising engineers follow such requirements on regular basis. Therefore, most complaints by students are not necessarily due to inappropriateness of the requirements but rather the inconvenient nature of them especially when students are under pressure from other studies that they are involved with.

A review of the enrolment in the FYP units in the Department indicated that in 2003 nearly 70 students started their project in semester one (March) and completed their work by the end of semester two (November). This number gradually increased to nearly 200 students in 2008 as shown in the data provided in Table 3 below. Since students can also start their FYP mid-year, the number of students enrolled in FYP in July 2003 was only a handful (about 10) but there were nearly 60 students enrolled in FYP units in July 2008; these students (ie, the mid-year intake) are not included in the data provided in Table 3.

The average mark for FYP units has consistently been around 80% indicating that students perform very well in the FYP units. Although the data show a failure rate of nil, occasionally a student does not finish his/her FYP for various reasons; these students have not been included in the data of Table 3. The very good results of FYP units can be attributed to (1) students self-select their project and therefore they are interested in the subject matter, (2) success or failure of the project would reflect positively or negatively on one student only and therefore there is a higher degree of feeling of responsibility, (3) the open-ended nature of these projects allow students the latitude to explore ideas which appeal to them and which cannot be covered in the syllabus of other units/subjects. For reasons of comparison, the average mark in other final year units in the Department is somewhere in the 55% to 75% range. The failure rate also varies between nil to as high as 25%. The higher failure rate is generally for the more analytical engineering science units.

Table 3: Assessment Results for FYP Students During 2003-2008

	2003	2004	2005	2006	2007	2008
P (50 – 59%)	5	3	0	6	1	6
C (60 – 69%)	3	10	6	7	23	21
D (70 – 79%)	20	28	40	36	47	82
HD (>79%)	40	37	42	41	73	90
Total number of students	68	78	88	90	144	199
Average	80	79	79	76	79	78
St Deviation	9.9	8.4	6.2	8.5	10.7	8.1

The administration of the FYP units is labour intensive and requires a great deal of attention and devotion. However, the benefits to students are immense and some students do appreciate what they learn in this unit and what they are able to achieve. Those students who may chose to continue their studies towards a MEngSc or PhD often work in an area related to the topic of their FYP. Therefore, the FYP research is not only useful to

those who go to the industry and work as a practising engineer but also to those who choose research as their future career.

CONCLUSIONS

Students who completed their FYP requirements under this scheme benefited enormously from the instruction they received for various activities during the semester, and this was reflected by their performance. As mentioned in this paper, the average mark of 76-80% during 2003-2008 for the FYP unit was consistently higher than the average mark for other final year units in the department. Similarly, the quality of work completed by students was considered superior not only in terms of marks they received but also the informal comments provided by students and staff. It will be a worthwhile exercise to contact students who have gone through this program in the future to assess their progress in the work place compared to students who did not receive such teaching and instruction during their undergraduate study program.

The template which was used to improve the communication skills of engineering graduates as described in this paper involved the teaching and learning of good writing and speaking skills appropriate to the engineering profession. For this purpose as a part of a final year unit/subject students were given appropriate instructions at various stages of their studies in order to write a Project Proposal, a Progress Report, a Research Paper and a Final Report; such instruction was also provided for preparing an Oral Presentation. This teaching was embedded in the assessment of the technical content of the project which students were involved. Results showed that students performed better in this unit compared to other final year units in the department.

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Appendix

Profiles and Projects: Graduate Yearbook 2008 Department of Mechanical and Aerospace Engineering Monash University

TITLE (14 pt Arial bold CAPITALS)

Author (12 pt Arial)

Supervised by (enter supervisor's name) (12 pt Arial)

ABSTRACT (80 mm below top edge)

Put abstract here.

NOMENCLATURE

Put nomenclature here.

INTRODUCTION

Put introduction here.

BODY

Put body of the paper here.

INSTRUCTIONS TO AUTHORS

Banner: The banner shown above should be included in the top right hand corner of first page in **10 pt Arial bold**, right justified.

Title: The title should be centred in **14 pt Arial bold CAPITALS.**

Author: The author's full name (in the order of first name, middle name, last name) should be centred in 12 pt Arial**.**

Supervisor's name: The supervisor's title and full name (in the order of first name, middle name, last name) should be centred in 12 pt Arial**.**

Abstract: Start 80 mm below the top edge of the paper in double columns.

Paragraphs: Indent the first line of all paragraphs (not headings) by 7 mm, and leave one blank line between paragraphs. Also, leave a blank line before and after a heading but not subheadings which the text should follow.

Font: All the text in the paper should be typed in Times New Roman except for the Banner, Title, Author and Supervisor details which should be in Arial. For headings use **12 pt Bold CAPITALS**. For subheadings use **10 pt Bold Title Case**. For captions

Margins: 25 mm on the left, 20 mm elsewhere.

Figures and Tables: Imbed such illustrations in the body of the paper nearest to where first mentioned. Fit illustrations in one column where possible. Use different lines and symbols instead of colours to identify graphs in the legend so that black and white photocopies are as effective as the originals using different colours. Insert table captions on the top and figure captions on the bottom of the illustration.

References: List alphabetically by author's surname. Cite references by (author, year) in the paper.

Page Limit: Paper's length should not exceed 6 A4 pages inclusive of Appendices. Do not number the pages.

CONCLUSIONS

Put conclusions here.

ACKNOWLEDGEMENTS

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