

# AN ONLINE WRITING CENTRE FOR ENGINEERING STUDENTS

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## ABSTRACT

There are ongoing concerns about the discrepancy between graduate engineering students' communication skills and those identified as necessary by Government and professional bodies. Communication skills are critical for engineering graduates as surveys of actual work practices indicate that engineers spend 40-60% of their time communicating and an increasing amount of their time writing. However, many engineering students find written assessments challenging and although they may well understand that to advance in their profession requires excellent communication skills, both spoken and written, many remain unconvinced and believe that their skills in other areas such as IT or mathematics will be of greater importance upon graduation. This attitude is often indirectly supported within engineering curricula where teaching writing skills is still considered a low priority and presents faculty staff with a number of challenges such as the ability to articulate how they assess student writing, the capacity to address issues of plagiarism and the provision of timely, relevant and appropriate feedback on writing to bring about improvements. An additional challenge is the diversity of the engineering cohort with large numbers of students from non-English speaking backgrounds, both local and international and that commencing engineering students may have had limited practice in extended writing. A new online resource suitable for embedding writing skill development in the engineering curricula is described in this paper. It contains engineering based instructional materials, authentic writing examples, and eLearning feedback options. This online writing centre (*iWrite*), a collaboration between learning advisors and engineering faculty, can be mapped onto the CDIO Academy stages to develop writing skills across the undergraduate years.

## KEYWORDS

CDIO curriculum, engineering writing, communication skills, reports

## 1. INTRODUCTION

Developing engineering students' writing skills has been an ongoing concern for many decades. Since the early 1990s, a significant body of literature has appeared on how to motivate students to improve their writing and how to instruct them on the forms of documentation that employers expect engineering graduates to be able to produce. For example, the Journal of Engineering Education, the IEEE Journal of Professional Transactions and the English for Specific Purposes Journal together contain over 57,000 publications that discuss writing skill development in the engineering curriculum, explain the genres produced by engineers, and describe approaches to teaching these genres to engineering students [1]. However governments [2] and employers [3 - 4] still report that many engineering graduates' writing skills

are below requirements. Factors which can work against students' development of writing skills throughout the engineering degree program are complex, such as:

- Course assessment may not include authentic writing tasks.
- Writing skills in the engineering degree program may be developed ad-hoc and inconsistently.
- Generic writing courses are removed from the world of engineering and may not foster valuing or transfer of skills gained.
- Academic staff may not have the skills to teach writing skills, or to give feedback on student writing.
- Learning support staff may not understand the engineering discipline and its genres
- Many engineering students do not have English as their first language.
- Many students entering the engineering program have had little practice in extended writing.
- The current generation of students increasingly prefers to learn in a digital environment rather than the traditional classroom.

The CDIO curriculum provides an opportunity to embed writing skill development in the curriculum across all years and to ensure that written tasks are authentic to engineering practice. The authors believe that the CDIO approach will further encourage engineering students to value written documentation and will increase student motivation to develop their written communication skills throughout the engineering degree program.

USYD and UNSW Learning Centres have been collaborating with their respective Engineering Faculties for over 15 years on strategies and resources to improve the writing skills of their engineering students [5-7]. This has resulted in a strong knowledge base and experience of integrating genre-based instruction into engineering subjects. While success has been mixed due to the above compounding factors, there is encouraging evidence that discipline-specific genre instruction, integrated into a course can result in improved student writing skills [8-9]. Recently both institutions [10] have been collaborating on developing and implementing self-paced online interactive genre instruction in an online writing centre (*iWrite*) to further motivate the 'Google-eyed' Generation [11] of engineering students to improve their writing skills.

The online writing centre (*iWrite*) is an Office of Learning and Teaching (OLT) funded project to develop students' writing in a systematic and coordinated way across engineering disciplines in the undergraduate years. *iWrite* aims to make explicit to students their learning outcomes in writing through interactive resources targeting the writing products (the assessment tasks and genres) of the four undergraduate years in engineering. *iWrite* has been built and is currently undergoing implementation trials at the University of Sydney and the University of New South Wales before it will be made publically available from 2013.

The project is aligned with the CDIO Academy's goals [12], that is, to educate students with a deeper knowledge of technical fundamentals. Writing activities have shown to be some of the most useful in learning about complex topics [13], so our focus has been to promote writing as a form of learning. Writing also makes evident, and has the potential to change, students' conceptions about surface and deep learning [14].

Our aim herein is to describe how the components of the *iWrite* architecture can be integrated within a CDIO engineering curriculum to support the development of engineering students writing skills. Figure 1 shows how *iWrite* supports the genres that industry expects from our

graduates with (1) an activity management system [described in 15] and (2) online tutorials, including those genres relevant to the different CDIO system building stages.

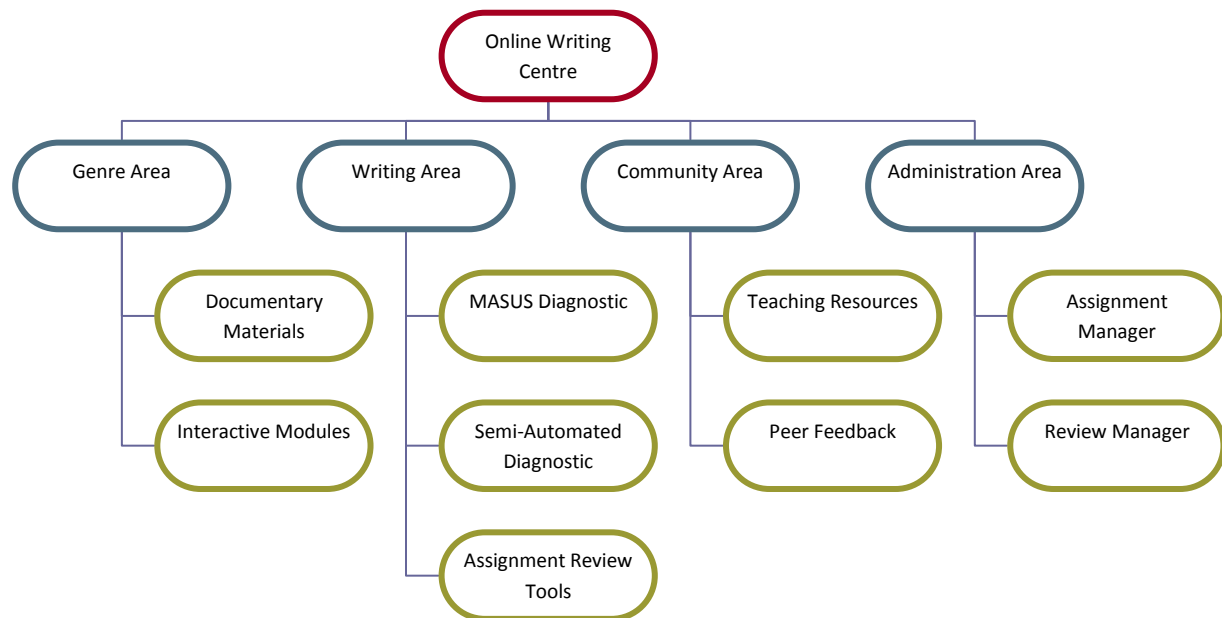


Figure 1: Information architecture diagram of *iWrite*.

## 2. *iWrite* OVERVIEW

*iWrite* introduces engineering students to a number of key documents/genres used in engineering practice; such as, proposals, lab books, lab reports, design reports, field trip reports, and research reports. *iWRITE* also provides information and exercises on clarity in expression, academic conventions, development of an argument, and use of visuals and provides a link to Sydney University Library's online research skills resources. Under a 'Start Here' link, the *iWrite* tutorials are presented in a linear sequence which is designed to reflect the documentation process before, during and at the end of a design/research project (Figure 2).

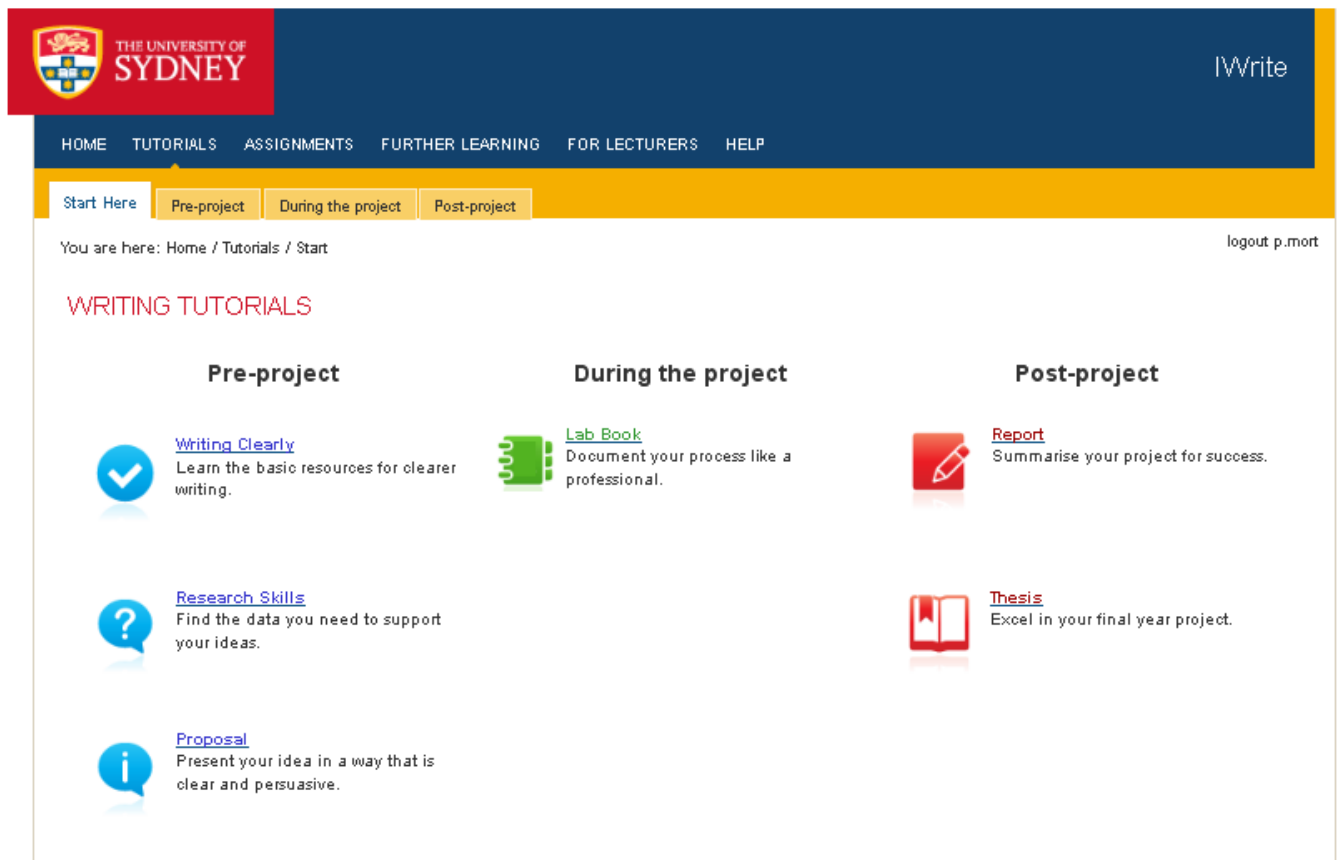


Figure 2. Screen shot of *iWrite* tutorials entry page.

### 3. INTEGRATING *iWrite* WITH THE CDIO CURRICULUM

The *iWrite* tutorials can be integrated into an engineering curriculum using the CDIO system building stages of **Conceive**, **Design**, **Implement** and **Operate**. This approach can help students to simultaneously develop their thinking, creative and communication skills in a relevant, contextualized and timely manner. A student can choose to work sequentially or iteratively through the tutorials.

The authors recommend that the tutorials be promoted to students at all stages of the design process and that emphasis on specific tutorials be based on both the learning objectives of the written task and the identified skill development needs of the students. Promoting the tutorials to engineering students can include the following activities:

- Review the tutorials and decide which genres and communication features are most relevant to your course assessment tasks and learning outcomes.
- Link to *iWrite* from course learning management systems, such as Blackboard or Moodle.

- In lectures, show/use sections from *iWrite* to communicate your expectations in written assignments.
- In assignment instructions, recommend which tutorials would be most relevant for students to explore.
- Provide hands-on time in a lecture or small class to explore the tutorials using computer labs or personal notebooks (students work in pairs or individually).
- Recommend relevant tutorials in your feedback to students (on submitted work and in class time).

Even though project work is usually team based, most professional reading and writing is a fairly solitary experience in which the writer works independently to structure key ideas and refine writing before offering it to the team for feedback. In this scenario, the *iWrite* tutorials can be considered as a personal reference tool which the writer can reference when preparing documentation of a project.

If a group project also requires multiple authors of a document, *iWrite* tutorials can be used as a reference guide in the planning and editing stages of collaborative writing. For example, when group members are reviewing each other's written contributions, they can refer to the *iWrite* tutorials to assist in editorial decision-making. If all team members are familiar with the *iWrite* tutorials, the authors believe peer feedback is more likely to be consistent and constructive, which should serve to enhance writer motivation and team cohesion. Peer feedback can be further facilitated by the *Activity Management* system in *iWrite* [described in 15].

Topic choice for instruction and the timing of that instruction are also important factors in student learning. While the CDIO stages are not meant to be prescriptive and are intended to allow flexibility in curriculum design, it can be useful to consider the timing of writing instruction in the context of the design process. For example, the *iWrite* tutorials can be mapped on to the four CDIO stages (Table 1) where tutorial selection depends on the learning activity and genre/documentation requirements at each stage. The black cells represent strong emphasis on topic/genre instruction; light grey cells represent optional topic/genre instruction; and the white cells represent no need for instruction as the topic/genre may not be relevant at that stage.

Table 1.

Suggested mapping of *iWrite* tutorials with CDIO building stages

	Conceive	Design	Implement	Operate
Writing Clearly				
Proposal				
Lab Book				
Design Report				
Field Trip Report				
Lab Report				
Report Criteria				
Thesis				

#### 4. CONCEIVE

The **Conceive** stage involves “defining customer needs; considering technology, enterprise strategy, and regulations; and developing conceptual, technical and business plans”[12].

At the **Conceive** stage, students are likely to be grappling with the design brief and, in particular, identifying constraints and challenges and creating a clear problem statement. Analysis of 83 first, third and fourth year engineering design proposals and final design reports was conducted at UNSW in 2011 to identify common strengths and weaknesses in students’ reports. These reports required students to document artifacts and conceptual design solutions. It was found that the majority of the reports failed to communicate a clear problem statement that acknowledged the constraints and inherent challenges arising from the design brief. To assist students in developing a clear problem statement, the *Design Report* tutorial includes instruction on the purpose, content and structure of problem statements, sample problem statements from student reports, and original marker’s comments. Students can then consolidate their knowledge by attempting short quizzes (match/identify problem statement features).

For final year students undertaking a research project, the literature survey task requires the student to provide a rationale for their research topic, develop a clear problem statement and identify potential methods of research. Anecdotal information from engineering staff at USYD and UNSW is that student’s literature reviews are not strong in showing critical analysis of the literature or in summarizing the gaps and opportunities for future research. To assist students in preparing a literature review, the *Research Skills* tutorial links to interactive instructional resources from USYD Library. To assist students in writing the literature review, the *Thesis* tutorial contains instruction on: the purpose and characteristics of a literature review, organizing the literature review, analyzing the literature, and key writing features of the literature review.

Throughout the tutorial, quizzes which incorporate sample extracts from students’ literature reviews are included to consolidate learning of concepts and techniques relevant to writing a good literature review.

The third example of *iWrite* being applied to the **Conceive** stage of the CDIO approach is the *E-Business Proposal* tutorial. The proposal is an important genre to master as it is used to gain support for ideas and assists in project planning, costing, and risk assessment. Students' proposals that were analyzed at USYD and UNSW have been identified as weak in developing a strong case/argument, conducting a risk analysis, and costing the proposed design solution. The *E-Business Proposal* tutorial provides instruction and examples on the organization of a proposal. Emphasis on key concepts and important features of a proposal is achieved by including quizzes and real student writing (Figure 3).

You are here: Home / Tutorials / Proposal (Pre-project) logout p.mort

**E-BUSINESS PROPOSAL THE SECTIONS OF A PROPOSAL**

- ▶ Module objectives
- ▶ Overall structure of a Proposal
- ▶ The Sections of a Proposal
  - ▶ Title
  - ▶ Introduction
  - ▶ Background
    - ▶ **Exercise**
    - ▶ Risks and Opportunities
    - ▶ Total cost of ownership
    - ▶ Concluding remarks
    - ▶ References
  - ▶ Writer's roles
    - ▶ Structuring your argument
    - ▶ Using evidence
    - ▶ Evaluating evidence
  - ▶ Academic writing:

**Background: exercise**

Evaluate the following two background sections by comparing their analysis and structure. Click on the box which corresponds to your answer. When you have finished, click SUBMIT to check your answers.

Text A	Text B	Checklist for evaluation
<p><b>Trading Websites</b></p> <p>Currently there are no online trading websites to facilitate cheap swaps of video games and we hope to be the first market in Australia.</p> <p>Our supply chain will primarily come from the users of Swapprr, as they provide their own games for the operation of our website. Swapprr is a facilitator or trading agent between the sellers of games and purchasers.</p> <p>The gaming market is a growing market in Australia. Research prepared by Bond University shows that 55% of gamers indicated that they will be playing video games as much as they are currently or more so in 10 years time. Further statistics include the 65% of gamers that play at least once a week.</p> <p>The target audience consists of males over the</p>	<p><b>Project Market</b></p> <p>There is a market of skilled workers in IT related education who are looking to supplement their income with part-time work. This market of students is one of the targets of Project Market; a 2005 ABS study (1301.0) cites 64.4 thousand higher education students in the field of information technology<sup>1</sup> and another study in 2000 revealed that the majority (57.8%) of students combine study and work<sup>2</sup> - this adds up to a significant number of students looking for or in work in information technology fields, who can be targeted as potential users of this website. Small projects on the Project Market would be suitable as starting points for careers in IT and design fields.</p> <p>Project Market will not only target part-time workers: we expect established freelance IT and</p>	<ol style="list-style-type: none"> <li>1. The background has a clear analytical structure. <input type="checkbox"/> Text A <input type="checkbox"/> Text B</li> <li>2. The background is sequenced logically. <input type="checkbox"/> Text A <input type="checkbox"/> Text B</li> <li>3. The text is about the right length for this section. <input type="checkbox"/> Text A <input type="checkbox"/> Text B</li> <li>4. Major competitors are discussed. <input type="checkbox"/> Text A <input type="checkbox"/> Text B</li> <li>5. There is evidence for</li> </ol>

Figure 3. Screen shot of an exercise from the e-business proposal tutorial.

The three sample tutorial components briefly described above show that *iWrite* can be a useful resource at the **Conceive** stage of engineering design to foster students thinking skills and communication skills development.

## 5. DESIGN

The **Design** stage focuses on creating “the plans, drawings and algorithms that describe what product, process, or system that will be implemented” [12].

Graphical elements are an important component of technical writing and team communication during the **Design** phase. Within the *iWrite* tutorials, there are many opportunities for students to learn about the types of visual communication used in technical writing as well as the conventions for presenting and integrating visual elements in technical reports. Tutorials containing components that focus on graphical communication include *Lab Book* [examples], *Field Trip Report* [examples and exercises], and *Design Report* [examples].

## 6. IMPLEMENT

The **Implement** stage “refers to the transformation of the design into a product, including hardware manufacturing, software coding, testing and validation” [12]. *iWrite* provides both tutorial and administrative support in this stage and moves students from the *Pre-project* phase of their writing to the *During the project* phase.

At this stage, students are actively engaged in carrying out their project through, for example, experimental laboratory work or software testing and development. The tutorials support them in documenting this process primarily through the *Lab Book* part of the site. This tutorial includes an introductory module on the reasons for keeping a lab book and guidelines on how to create an electronic lab book within the activity management system. Additional modules provide specific guidelines and examples for documenting laboratory work to be undertaken in a particular unit of study. Keeping an electronic lab book means that students can add entries at any time, encouraging a more reflective thinking process. In addition, tutorials in the *Post-project* phase support students in the process of transforming their design into a product. The *Design Report* tutorial guides students in reporting the testing and validation stages of product development. Problems experienced in writing these stages include providing too much detail of relatively minor trial-and-error actions the design team experienced rather than evaluating whether the error needs reporting at all and is of relevance to the final solution. Another tutorial which supports students at this stage is the *Report Criteria* module which exemplifies for students what is expected in the most challenging part of a laboratory report, the interpretation of their results.

During the Implement stage, the *iWrite* activity management system and tutorials can also support collaborative writing and peer-learning. For example, lecturers can require students to give peer feedback during the drafting of assignments, as well as on the development of code or designs etc. If peers are required to give feedback to each other on their draft writing submitted through *iWrite*, they can easily be paired using the activity management system. Lecturers can then recommend students to use the tutorials to guide them in giving written feedback to their peer and this feedback can then be assessed by the lecturer. In this way, students can see that this activity is valued and there is alignment between assessment and the interpersonal learning skills in the CDIO syllabus.



## 7. OPERATE

The **Operate** stage “uses the delivered, implemented product, process, or system to satisfy the intended value, including maintaining, evolving, recycling and retiring the product [12].

The final reporting of projects and experimental work in written form is well-supported in the *iWrite* tutorial site where a number of genres are exemplified, forming a rich resource for both students and lecturers. All of the examples are taken from authentic writing tasks set in a discipline context and are examples of student writing, not expert models. Guidelines and comments on the examples are provided by discipline staff as well as academic learning skills advisors. These modules are available for student self-access as well as for lecturers to use in tutorial sessions.

Of particular importance in this stage is the ability to draw a project to a close through effective recommendations and concluding sections of reports and theses. Students have difficulty in identifying and using their key findings to support their recommendations and/or conclusions so that these sections are weak and unconvincing. Both *Report* and *Thesis* tutorials aim to address this issue. First, by providing a typical structure for these sections and focusing on the stages in the development of the argument or the reasoning behind the conclusions or recommendations and secondly, by highlighting language features, such as the language of evaluation.

The importance of documentation in the Operate stage and in fact in all of the CDIO stages was emphasized by Robin King at a recent symposium: ‘The task is not finished until it’s been documented’ [16]. This is supported by Engineers Australia in their ‘Stage 1 Competency Standard for Professional Engineer – 2011’ which requires that a professional engineer,

... prepares high quality engineering documents such as progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations which are pertinent to the engineering discipline [17].

## 8. OTHER FEATURES OF THE ONLINE WRITING CENTRE

Within the *Writing* area of *iWrite*, a semi-automatic diagnostic writing task is under development. This task can be embedded within engineering curricula, ideally in the first weeks of a foundation first year unit of study. The task involves relevant readings and an assignment question about these to be answered under timed conditions online. Students then receive feedback on their writing in 4 areas: use of evidence from the readings, the overall structure of their answer, paragraph cohesion and academic style, and grammar [18]. Using this to get feedback on the student cohort, lecturers can then develop curricula to address writing needs, which could include tutorial activities from *iWrite* such as the *Writing Clearly* module. Currently this kind of diagnostic writing activity is undertaken by first year students in an offline environment in Engineering Faculties at the Universities of Sydney and New South Wales and assessment is carried out by a team of markers. The aim of the software is to develop a way of automatically identifying students most at risk in terms of their writing skills as well as students with well-developed writing skills. In this way the human marking load can be reduced.

## 9. CONCLUSION

To meet the stage 1 competency expectations of Engineers Australia, written communication skills are best developed by embedding writing instruction in the engineering curricula.

This paper has described the match between an online writing resource (*iWrite*), specifically designed to develop engineering students writing skills, and the CDIO Academy stages. Key features of *iWrite* include: descriptions of key engineering genres, real student writing with target features highlighted, and exercises to consolidate learning. Student engagement with *iWrite* is dependent on course lecturers' timing in promoting, demonstrating and referring students throughout the design/research project assignment. Furthermore, if students are encouraged to value the importance of written communication skills and are provided advice and constructive feedback, they will be motivated to improve their written communication skills.

## 10. REFERENCES

- [1] Google Scholar, Search Results for 'engineering, wrting, genre', Retrieved 18 April 2012 from: <http://scholar.google.com.au>
- [2] Commonwealth of Australia, Graduate Employability Skills: Prepared for the Business, Industry and Higher Education Collaboration Council, 2007, Precision Consultancy, Canberra.
- [3] Accreditation Board for Engineering and Technology, Engineering Change: A Study of the Impact of EC2000, 2008, Baltimore, ABET.
- [4] Engineers Australia, Program Accreditation, 2008, Retrieved March 16 2010 from [http://www.engineersaustralia.org.au/about-us/program-accreditation/program-accreditation\\_home.cfm](http://www.engineersaustralia.org.au/about-us/program-accreditation/program-accreditation_home.cfm)
- [5] Mort, P., "In My Own Words? Report Writing in First Year Electrical Engineering", in L. Emerson (Ed.), Tertiary Writing Network Proceedings, 2000, Hamilton, New Zealand.
- [6] Drury, H. "Teaching academic writing on-screen: A search for best practice", in L. Ravelli and R. Ellis (Eds) Analysing Academic Writing, 2004, Continuum, London.
- [7] Reidsema, C. and Mort, P., "Assessing reflective writing: Analysis of reflective writing in an engineering design course", Journal of Academic Language & Learning: Special Issue: Refereed proceedings of the 9th Biennial Conference for ALL, 2009, Vol. 3, pp. A117-A129. Available from: <http://journal.aall.org.au/index.php/jall/issue/view/7>
- [8] Skinner, I. and Mort, P., "Embedding academic literacy support within the electrical engineering curriculum: A case study", IEEE Transactions on Education, 2009, Vol. 52, pp 547 – 554.
- [9] Drury, H., Airey, D., and O'Carroll, P., "Improving report writing for undergraduate students in engineering through an online learning environment: the case of second year civil engineering", in Proceedings of the 21st Annual Australasian Association for Engineering Education (AaeE) Conference, Past, Present, Future the 'Keys' to Engineering Education Research and Practice, 2010, December, Sydney , Australia.
- [10] Drury, H. and Jones J., "Transforming the teaching of report writing in science and engineering through an integrated online learning environment, WRiSE (Write reports in Science and Engineering) ", *Proceedings of the 8th International CDIO Conference, Queensland University of Technology, Brisbane, July 1 - 4, 2012*

in Proceedings of the 27th Annual Conference of the Australasian Society for Computers in Tertiary Education (ASCILITE), Curriculum, technology and transformation for an unknown future. 2010 December, Sydney, Australia.

[11] Duffy, P., "Engaging the YouTube Google-Eyed generation: Strategies for using Web 2.0 in teaching and learning", The Electronic Journal of e-Learning, 2008, Vol. 6, pp 119 – 130.

[12] Crawley E. F., Malmqvist J., Östlund S., and Brodeur D. R., Rethinking engineering education: The CDIO approach, 2007, Vol. 133, Springer Verlag, New York.

[13] Emig J., "Writing as a mode of learning", College Composition and Communication, 1977, Vol 28, pp122-128.

[14] Hounsell, D., "Contrasting conceptions of essay-writing", The Experience of Learning, 1997, pp.106–125, Edinburgh, Scotland: Scottish Academic Press.

[15] Calvo, R. A., O'Rourke, S. T., Jones, J., Yacef, K., & Reimann, P., "Collaborative writing support tools on the Cloud", IEEE Transactions on Learning Technologies, Vol. 4, 2011, pp 88-97.

[16] King R., "The task is not finished until it's been documented", Presentation at the symposium on Developing students' academic and workplace writing skills in the engineering curriculum, 2011, November 4, University of Sydney, Australia.

[17] Engineers Australia, Stage 1 Competency Standard for Professional Engineer, 2012, Available from: <http://www.engineersaustralia.org.au/about-us/program-accreditation>

[18] Bonanno, H. & Jones, J., Measuring the Academic Skills of University Students The MASUS Procedure, 2007, Learning Centre, University of Sydney, Australia.

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**Pam Mort** has worked at the University of New South Wales for 14 years as a Learning Advisor. Her work has focused on writing in engineering and science disciplines. During this time she has collaborated with lecturers to develop writing and study guides for undergraduate engineering students. She also regularly team lectures and runs school specific workshops on writing reports and thesis writing to undergraduate and post graduate students in schools within the faculties of engineering and science. In 2002 she received an Innovative Teaching and Educational Technology ITET Fellowship from the Pro Vice Chancellor of Quality and Education to develop an interactive on-line resource on writing case study reports for risk management students. In 2007 she was a member of the ALTC funded cross institutional project team which developed an online report writing learning environment (WRiSE). She was recipient of a Carrick citation in 2007 for 'Outstanding contribution to developing student academic literacy in the Faculty of Engineering UNSW: A partnership approach between Faculty and The Learning Centre'.

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