# Integrating 'role play' in assessment to strengthen professional conduct and accountability of students: A pilot study

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## Structured Abstract

### BACKGROUND
In a process engineering setting, graduates are frequently allocated reviews of existing operations or required to scope new production processes by their supervisors with a view to improving or expanding on operations and overall productivity. These tasks may be carried out in teams and in consultation with the process engineer's immediate line manager or a more experienced engineer, such as the Production or Maintenance Manager; ultimately reporting to senior management, which is frequently a non-engineer. Although professional skills development is part of engineering curricula, 'professional conduct' and 'accountability' required for dealing with peers and superiors in industry is not very well addressed at university. Consequently, upon graduation, many students are, in terms of knowledge and experience in this area, underprepared to work effectively in industry settings.

### PURPOSE
The purpose of this study was to develop and implement a role-play scenario within a core 2nd year process engineering unit, so that students could gain knowledge, skills and experience in different aspects (and nuances) of professional conduct and accountability.

### DESIGN/METHOD
In the role-play scenario, students worked in 'engineering production teams' to design a process for an iconic Queensland fruitcake and to present their solution and recommendations (culminating in a poster presentation) to an assessment panel consisting of staff, role-playing as, 'production and plant managers'. Students were assessed on several areas, including professionalism using a criteria referenced assessment guide by a 3-member cross-disciplinary staff panel consisting of a Business Faculty lecturer, an engineer from industry and the lecturer of the Process Engineering unit. Professional conduct and accountability was gauged through direct questioning by the panel. Feedback was also sought from students on various aspects through a survey questionnaire after the role play activity at the end of semester.

### RESULTS
Overall, the role play was very well performed with students achieving an average score of 79.3/100 (distinction grade). Professional conduct as assessed by panel was on average better than scores given for professional accountability (4.0 compared with 3.6 out of 5). Feedback from students indicated that the learning activities had contributed to their overall understanding of the content and the role of process engineers. Industry involvement was rated very highly as contributing to their learning at 4.8 (on Likert scale from 1 – 5) and the poster presentation was rated at 3.6.

### CONCLUSIONS
This pilot study was successful in implementing a new assessment task for modelling professional conduct and accountability within a 2nd year core unit. This task incorporated a role-play activity and there was evidence to suggest that this and associated learning tasks were successful in broadening students' understanding and skills in this area required for engineering practice. Following feedback given by students and staff, improvements will be made to the nature of the problem, how it is defined, its assessment, and the approach taken in the role-play scenario when the unit is offered in 2014.

### KEYWORDS
Professionalism, Professional skills, Role-play, Team-work, Process design

# Introduction

Role-play as part of the undergraduate student experience is accepted as an effective pedagogy. Role playing is widely reported in undergraduate training for other professions, particularly customer based industries, such as nursing (Warland, Smith, and Smith, 2012), pharmacy (Rao, 2011), business (Kettula and Berghäll, 2013) and school teaching (Oogarah-Pratap, 2006). It is widely used to teach ethics to engineering students (Didier, 2000; Brummel, Gunsalus, Anderson, and Loui, 2010).

Cooley, Klinkhachorn, McConnell, and Middleton, (1991) reported difficulties in role-playing with Electrical Engineering students; most students were unable to perform their assigned role in a professional manner as they found the content uninspiring and viewed the activity as unrelated to engineering. However, Cooley et al. (1991) devised a role play scenario whereby the students were presented with a scenario where they had to weigh the financial benefits of a project against the risks (i.e. ethics based scenario) and provide a written recommendation in an assignment. At a following lecture the class was set up as a courtroom and asked to defend their recommendation as it had ultimately resulted in a (pretend) death. This role play strategy was successful as they were (i) challenged directly in front of others and (ii) compelled to accept responsibility for their statements (Cooley et al., 1991). These two elements were included in this study as a way to engage and motivate students to develop professional conduct and accountability in their undertakings during the course.

Engineers require skills in collaboration and communication with their peers and their managers. Process Engineering graduates working in industry are frequently allocated well-defined reviews of operations by their engineering supervisors with a view to improving operations and productivity. These tasks may be completed in teams and in consultation with their immediate line manager or a more experienced Process Engineer, such as the Production or Maintenance Manager; ultimately reporting their findings to senior managers, who may not be engineers. However, when they graduate, many students are underprepared in terms of the level of professionalism and accountability expected in an industry setting. They may also lack the experience of interacting with professionals from outside the engineering discipline.

This paper describes an approach taken in a pilot study to embed a role-play scenario with a cross-disciplinary focus into the curriculum of a core 2$^{nd}$ year process engineering unit, so that students could gain knowledge and experience of professional conduct and accountability (or professionalism) in practice. Professional accountability and professional conduct are two of the elements (3.1 and 3.5) in Engineers Australia Stage 1 Competency Standards. Learning outcomes for this unit included demonstrating effective communication skills and demonstrating an understanding of risk in operations management. The content of the unit was highly amenable to role play and the pedagogy allowed both learning outcomes to be demonstrated simultaneously. Additionally, the pilot project was an attempt to include an industry experience (albeit mock) and a cross disciplinary element into assessment early in the degree, which may be built on in subsequent years, if needed. The expectation was that this would provide students with a strong awareness of professionalism through assessment that mimicked industry practice. As this was a pilot study and part of ongoing unit development, a control group or prior testing of students was not included in the investigation. It was hoped that this approach would build on students' existing skills and result in better student outcomes compared to previous years.

## The Process Engineering unit

Queensland University of Technology (QUT) is currently developing a Process Engineering course and offered several new units to its first cohort of 2$^{nd}$ year Process Engineering students in 2013. The students had completed a generic first year of engineering program in 2012. This paper relates to a new assessment in the unit, ENB260 "Operations Management

and Process Economics". The unit was delivered over 13 weeks, through weekly 2 hour lectures and 1 hour tutorials. 3 tutorial sessions were dedicated to covering technical content required for the assessment piece. There were 23 students enrolled in the unit in 2013. The unit was intended to provide students with an introduction to operations management concepts, financial analysis and cost estimation, as well as develop communication skills and marketing awareness. The breakdown of assessment components for the unit was as follows: final poster presentation including the role-play activity was worth 20%; end of semester exam 50% and in-class exercises 30%.

# The assessment task and role-play activity

The assessment task given to students was to develop a product design for a new line of an iconic fruitcake and then to present their solution to three factory managers of a well-known Queensland bakery, using an electronic poster as support material. The students worked in assigned groups of 4 role-playing as junior engineers. At the end of the semester, the students presented their solution and recommendations (as a poster presentation) to the rest of the class and a 3-member cross-disciplinary assessment panel. Each group of students was required to communicate the product design, financial and operations management considerations, and risks associated with their proposed solution. The students were made aware that during the panel presentation they had to accept responsibility for their actions and decisions in order to increase their knowledge/expertise in professional conduct & accountability.

The panel consisted of the Factory Manager (role-played by a Business Faculty lecturer), the Production Manager (role-played by the unit coordinator and unit lecturer), and the Maintenance Manager (role-played by an experienced engineering manager). Engaging a Business Faculty lecturer and an engineering manager from industry for the panel facilitated a more realistic and cross-disciplinary approach for the assessment of the role-play activity. These two panel members did not have a role in the delivery of the unit. Their primary role was to assess student conduct and accountability during the final presentations.

Engaging students in cross-disciplinary and relevant current industry discussions was based on the notion that group work is an integral part of university assessments and that it enables students to cross boundaries between theory, practice and between disciplines (Fortuin & Bush, 2010). Furthermore, the authentic, real-world nature of the assessment item was expected to encourage students to invest more in the learning process. This would also make the learning outcomes more readily applicable and meaningful to students (Whitlock & Nanavati, 2013).

The assessment task was constructed as one that closely resembled a 'real world' engineering scenario where only general guidelines were provided, and therefore the students were expected to interact with the "Production Manager" (or unit co-ordinator/lecturer in role-play) for more information and clarification. This aligned well with QUT's strategic positioning as 'a university for the real world'. It was thought that this task would also (i) engage the students in learning the unit content (ii) underline the importance of professionalism and (iii) provide an experience that they would not otherwise have until they entered the workforce. This assessment task required demonstrated understanding of content delivered in lectures throughout the unit. The 2 students enrolled in the unit formed into 6 groups (5 groups of 4 and 1 group of 3). The following elements were required in the final role-play and poster presentation:

- Each member had to speak for a minimum of 3 minutes
- A summary of three production methods, highlighting key differences in ingredients and method used.
- A critical discussion of product design against company objectives for each recipe.
- 10 year Discounted Cash Flow Analysis.

- An assessment of the risk/threats to the product design, operations management issues and economics.
- A Gantt chart for the chosen production method.
- A visually attractive electronic poster.
- Verbal communication skills demonstrated by voice projection, composure, fluency, confidence and eye contact.
- Professionalism and other skills demonstrated by responses to specific questions posed by panel during and following each presentation.

Fruitcake was chosen as the product of choice as the making of it or its production process is simple and intuitive. The intent was to demonstrate the technical concepts taught in the unit without requiring excessive learning of the process itself; the students were in the first half of their 4 year course and still developing their early technical knowledge.

# Assessment of task

The task was marked using a criterion referenced assessment (CRA) sheet supplied to students via QUT's "Blackboard" on-line environment. The assessment was marked according to the group's overall performance with an individual component. The breakdown of marks allocated out of 40 was as follows:

- Technical content: 20 marks (group mark focusing on specified requirements for the Gantt chart, critical analysis and product design).
- Poster: 5 marks (group mark on quality and accuracy of information presented).
- Personal presentation/professional conduct: 5 marks (individual mark on level of professionalism shown during presentations, including composure, fluency, confidence, etc.).
- Professional accountability: 5 marks (individual mark on quality, accuracy, evidence and understanding shown in the responses to questions from panel with each student having to respond to at least one question)
- Additional formative task: 5 marks (individual mark on submission of a recipe (week 3) for the purpose of having several unique recipes for each group to consider.

Each of the above items were assessed using the standard QUT grading system 1 - 7 (with 4 being a pass) and converted to a mark according to the total allocation (e.g. a grade of 6 for presentation/conduct on the QUT system is equivalent to 4.3 out of 5 marks). The individual marks were moderated on a scale from -5 to +5 marks on the basis of their contribution to the group work.

The managers were encouraged to be realistic in their role play by asking direct questions and expecting the same degree of professionalism that would be required in industry. The students were asked directly who performed which activity (e.g. Gantt chart, the product design, writing the poster) in front of their peers. The questions posed by the panel during the final presentation required students to defend their positions in line with recommendations of Cooley et al. (1991) to make the students publically defend their position as well as accept responsibility for their statements and assertions. Responses given by students to typical questions asked by the panel are described in the Results and Discussion section.

# Feedback from students

Feedback from the students was sought by way of a paper survey containing 11 statements following the presentations. Students provided a level of agreement on a 5 point Likert scale

from “1” Strongly Disagree” to 5 “Strongly Agree”. The questions posed and average score obtained were as follows:

1. I understood the purpose of this unit: 4.6
2. This unit helped me understand what it means to be a Process Engineer: 4.3
3. I found the content easy to understand: 4.3
4. I understood what was expected of me: 4.0
5. The workload was not excessively demanding: 4.3
6. The lectures added to my understanding of the content: 4.3
7. In class exercises were beneficial to my learning of the content: 4.2
8. The poster presentation were effective and provided a useful learning opportunity: 3.6
9. Industry people were effective and provided a useful learning opportunity: 4.8
10. Overall, the unit was effectively delivered: 4.3

The first three questions related to the broader unit. Question 4 was posed to understand whether there were issues with the unit as a whole and/or with the role-play assessment. Question 5 was posed to determine whether the workload associated with role-play was higher than what was expected by the unit coordinator. Questions 6-8 were posed to gauge how effective the role-play presentation (question 8) fared against lectures (question 6) and in-class exercises (question 7). However the wording of question 8 and other questions will be further refined prior to next year.

# Results and discussion

Professional conduct was assessed during presentations based on the quality responses by students to questions posed by the panel. The average score given for this category was 4.0 out of 5. It was thought by the panel that the role-play exercise had made students more attuned to the requirements of professional conduct, and that they had prepared accordingly to make presentations of high quality. However, the CRA will be revised and elaborated in future to show the distinctions between the different assessment categories.

Responses to the panel’s questions were generally well presented but sometimes only after questioning by the panel. Furthermore, the questions were frequently not answered in their entirety by the first speaker. The average grade for professional accountability based on responses to questions from panel was 3.6 out of 5, which was lower than for presentation and conduct. This may be because students were unfamiliar with having to defend their work orally and be accountable in this manner for the work produced and/or the requirements on this were unclear.

Students were frank and honest when asked to identify their contribution to the group work although some students were confronted by the directness of the panel’s questions and comments. The directness and types of questions that were asked by the panel were considered as typical for industry.

The overall performance on this role-play activity as assessed by panel was above what was expected with an average student score of 31.7/40 (distinction grade). Individual student scores ranged from 25.3 to 38.5.

The inclusion of a Business Faculty lecturer enhanced the dynamics of the panel adding a different dimension to the Q&A sections during the presentations. As the ‘Factory Manager’ in role-play, the staff member was the most frank and direct of the panel members and asked questions typical for that role, such as;

- *“How is this product iconic?”* Responses included relating particular fruit ingredients, such as banana or pineapple, as being iconic to Queensland. One group designed a

gluten-free recipe which they regarded as iconic in the sense that it was novel and a point of market differentiation.

- *Who are your main competitors in the market and what are their products?"* Respondents regularly ignored their competitor's market positioning strategies. They often compared their iconic and high-quality product with bottom of the range generic products from supermarket chains.
- "*What supporting evidence is there that your preferred recipe is going to find a niche market or match the demands of a significant portion of potential customers in order to justify the proposed production numbers?"* Some groups had conducted some simple analysis, although most groups had not.
- *"What is your competitive advantage? For example, will you compete on price or on quality?"* Most groups suggested that they will compete on both i.e., use premium ingredients for the production of their product but at the same time pursue a price leadership strategy in the market by generously undercutting their competitor's prices. Some students suggested replacing certain ingredients with compatible low cost ingredients.

The Operations Manager (an experienced Process Engineer who had worked as a Factory Manager in industry) also asked direct questions which were not always handled well. Their skills at answering questions when they did not know the answer were not of an acceptable standard. This will be a focus of development in class activities during 2014. Typical questions posed were as follows:

- "How might production change if...?"
- "What would happen if there were a shortage in supply of a particular ingredient?"
- "What was the internal rate of return?" (The financial analyses were generally done correctly in accordance with the presented guidelines.)

Following the assessment, the students and panel members de-briefed about the assessment to discuss how graduate engineers and engineering managers relate in the 'real world' environment. Mostly, the students described the learning opportunity as a very positive experience. There were numerous comments about the cross disciplinary aspect of the assessment (i.e. having a Business Faculty lecturer involved) adding to the realism of the situation. However, the challenging nature of the assessment item was pointed out by some of the students in regard to the role play scenario as well as the type of questions asked by the panel member. Following the debriefing, prizes were awarded for the best group presentation, specifically a $50 iTunes voucher was given to each group member. The best group presented an argument for a gluten-free production method with iconic Queensland fruit and also provided evidence of being able to capture a growing market segment. This presentation was considered well-above average at the 2nd year undergraduate level. The runner-up group presented the panel with a well-constructed handout in the form of a booklet, which detailed their proposal, which was more than the requirements specified in the CRA.

# Conclusions and Recommendations

A role-play scenario has been developed and implemented within a core 2$^{nd}$ year process engineering unit with the aim of modelling professional conduct and accountability to students. The role-play involved students working in 'engineering production teams' on the development of a new bakery product. The students were required to present their findings and recommendations, including the process design to a cross-disciplinary assessment panel. The panel consisted of industry personnel and academic staff role-playing as, 'production and plant managers'.

Professional conduct and accountability was assessed during presentations based on the evidence of work presented by students and the quality of their responses to questions from panel. These two aspects were assessed separately and it was found that students displayed marginally higher skills in professional conduct than accountability, with an average grade of 4.0 compared to 3.6 out of 5. However, both scores were considered as an indication of students achieving a more than satisfactory level of skills in these areas.

Overall, the feedback from students indicated that they found this task and associated learning activities to be useful and rewarding experiences. The approach used by Cooley et al. (1991) namely, being directly challenged and required to defend positions was found to be engaging and motivating. However, there was dissatisfaction with certain elements of the task, as students found the assessment description too 'vague' and the choice of the bakery product (fruitcake) uninspiring. The vague nature of the description was intentional to reflect what students might encounter in practice. Nonetheless, several improvements will be made to the description of the task, the design of the assessment CRA, choice of product and specific questions asked by panel members during final presentations. Furthermore, this exercise will be repeated in 2014 with more scaffolding throughout semester to support students through the role play and other learning activities.

Feedback on the cross-disciplinary aspects and involvement of industry personnel was very positive, with students giving high scores in their responses, particularly to the latter question (4.8 on Likert). These aspects will be expanded and built on in 2014 as described below. Overall, the role-play exercise and learning activities were successful in providing students with a novel experience by modelling practises and standards expected in industry.

The specific recommendations are as follows:

1) Include a series of formative and peer assessments in the unit to strengthen the feedback and assessment processes. This will be in the form of 1:1 meetings with unit coordinator and group/video presentations to peers, prior to the final assessment by panel.

2) Run workshops on professional communications, standards and expectations throughout semester to scaffold and progressively develop these skills in students.

3) Review the CRA to further clarify requirements under key criteria, to consider professional conduct, accountability as separate items and increase the weightings for these criteria

4) Review and extend the feedback questionnaire to seek more specific information on the role-play and impact on learning from students.

5) Include amendments and guidelines to the role-play task description to guide students more effectively through their activities and learning process. A PowerPoint presentation will be specified rather than a Poster for final presentations to panel.

6) Replace the bakery product (fruitcake) with something more relevant and/or engaging with a simple production process, the focus will continue to be on acquiring/demonstrating technical and management concepts, as well as professional conduct and accountability.

7) Expand and explore the cross-disciplinary nature of the exercise to further improve learning outcomes with student groups made up of both engineering and business students, working towards a common CRA.

# 2014 iteration

At the time of submission of this manuscript, the 2014 iteration is well underway which considerably expands the scope of role-play.

*The assessment task*

The end product was replaced with rum, as rum making is more typical of the industry with a well-known production process. It is also topical for Brisbane, as QUT is based in a state with

an iconic Australian rum producer (Bundaberg Rum). A detailed assessment guide provided a much more strongly defined scenario for the role play task. A brief description of it is as follows: “a struggling rum manufacturer has been taken over by a German parent company and the company has to choose between three scenarios, (i) lay off staff which affect factory operations; (ii) use lower quality cheaper feedstocks which will affect product quality; or (iii) change to a new product. Engineering and Business students work for a consulting firm which has been approached by the rum company which is seeking assistance. In conjunction with their Business Development Management group members, they have to provide a holistic critical analysis of the engineering and business aspects of the scenarios”.

*Student teams*

Process Engineering students were placed into teams of 4-5 with students studying Business Development Management (a Business Faculty unit) to add to the cross-disciplinary component. A single assessment sheet will apply regardless of whether students are enrolled in Process Engineering or Business Development Management.

*How it will be assessed*

There will be a gradual build up to the final role-play exercise and panel assessment at the end of semester, with weekly communications workshops and progressive and formative assessment tasks. For example there will be a team meeting with the Production Manager (5%), a video presentation to the class to obtain peer feedback (35% - graded by both the Business and Engineering unit coordinators) prior to the final assessment panel meeting (reduced to 10% of final mark and without a poster). The final assessment meeting will be a closed session consisting only of the student team and 3-member staff panel. A single group mark will be applied with a peer review dispute resolution process in place.

## References


Brummel, B. J., Gunsalus, C. K., Anderson, K. L., & Loui, M. C. (2010). Development of Role-Play Scenarios for Teaching Responsible Conduct of Research. *Science and Engineering Ethics*, 16(3), 573-589.

Cooley, W. L., Klinkhachorn, P., McConnell, R. L., & Middleton, N. T. (1991). Developing professionalism in the electrical engineering classroom. *IEEE Transactions on Education,* 34(2), 149-154.

Didier, C. (2000). Engineering ethics at the Catholic University of Lille (France): Research and teaching in a European context. *European Journal of Engineering Education,* 25(4), 325-335.

Fortuin, I.K.P.J., & Bush, S.R. (2010). Educating students to cross boundaries between disciplines and cultures and between theory and practice. *International Journal of Sustainability in Higher Education*, 11(1), 19-35.

Kettula, K., & Berghäll, S. (2013). Drama-based role-play: a tool to supplement work-based learning in higher education. *Journal of Workplace Learning,* 25(8), 556-575.

Oogarah-Pratap, B. (2006). The use of role-play as an assessment strategy in health education for trainee primary school teachers - a case study/Uso del juego ocupacional como una estrategia de evaluación en la educación en salud para la preparación de profesores de escuela primaria - un estudio de caso. *Journal of Science Education,* 7(1), 36-39.

Rao, D. (2011). Skills Development Using Role-Play in a First-Year Pharmacy Practice Course. *American Journal of Pharmaceutical Education*, 75(5), 1-84.

Warland, J., Smith, C., & Smith, M. (2012). Much ado about the flu: Design and implementation of an e-role play for a large class of undergraduate students. *Nurse Education in Practice,* 12(2), 65-71.

Whitlock, B., & Nanavati, J. (2013). A systematic approach to performative and authentic assessment, *Reference Services Review,* 41(1), 32-48.