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A learning collaboration between Engineering and Journalism undergraduate students prompts interdisciplinary behavior

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ABSTRACT

Final-year university engineering and journalism undergraduate students collaborate in a multimedia design and communication project to test the hypothesis that design and communication emphasis by engineering students can be enhanced by interdisciplinary collaboration with media-equipped journalism students. Research was conducted by environmental manipulation, observation, administration of a survey, and qualitative and quantitative analysis of media products. Participants reported increased media communication skills, an awareness of the necessity of communicating with other disciplines, and some change in their intended strategies for future projects. Evaluative instruments recorded a high level of student satisfaction with the collaboration. Evidence was obtained of a close relationship between engineering education and journalism education, leading to a level of interdisciplinarity among student participants.

Keywords: Design, communications, multimedia

INTRODUCTION

Communication is a fundamental skill of the engineer. This is recognized by academia and industry alike with communication skills development now firmly embedded in most undergraduate engineering curricula. However, there are occasions when specialist communicators are required and engineers must learn to how to acquire, adapt to, and manage this resource. Indeed industry requires engineers to be able to 'operate across boundaries, be they technical or organizational, in a complex business environment' (Spinks et al. 2006).

In the late 20th and early 21st centuries, social expectations have emerged as the single most-important driver or inhibitor in many projects. The methodology 'Enquiry by Design' (Sarkissian et al. 1997, The Prince's Foundation 2000) is used with increasing frequency to ensure that the needs of existing and future communities are met and that infrastructure is designed and operated to support these needs. The process entails consultation with communities, regulatory authorities, and local councils at the beginning of the conceptual phase of design and it is important that communication between parties is open and understood by all. Engineering corporations are more frequently engaging communications consultants to make sure that they have understood the social expectations associated with the project and also that their intentions are understood by the community.

However, 'the way an individual understands and appreciates the nature of knowledge affects the way [they collaborate] with colleagues in different academic disciplines' (Borrego and Newswander, 2008) therefore engineers who understand others' perspectives will be better at integrating these into projects and, as a result, will produce work which meets social expectations.

The necessary cross-disciplinary and communication skills of engineering undergraduates can be developed through collaboration with journalism students as representatives of specialist communicators. The choice of journalism is further supported by Bond (1990) who notes that communications consultants, with a degree in journalism or English, working with scientists, engineers, and technicians are necessary to explain science and engineering to the lay public. This position is supported by Schudson (1989:167) who notes that:

> *One field of culture poses problems of special interest in this respect: science rejects vividness, drama, and splash as legitimate features of discourse. Science cuts against aesthetic conventions. In science, the duller, the better. Boringness is a kind of virtue in science; deadpan is the appropriate rhetorical style; poker face is the appropriate pose. It may be that in a very well-organized cultural community, as science or certain subfields of science can be, local conventions may overpower more general cultural conventions. At the same time, scientific rhetoric is not immune to seeking after 'interesting-ness', it is just that 'interesting' may be defined in a slightly different way.*

Another reason for pushing an undergraduate collaboration between engineering and journalism students is that of sustainability. Sustainability, which arguably forms the largest challenge to the engineering profession, requires both engineering and social science perspectives for it to be achieved. It is recognized that sustainable development can only succeed where there is a clear understanding of, and allowance for, the social-environmental interface (Lehtonen 2004) and educational researchers (Felder et al. 2000) have emphasized this.

There is sound pedagogy behind interdisciplinary courses, with advocates finding that such courses capture students' intellectual interest (Lattuca et al. 2004), prepare students for work by developing higher-order cognitive skills (Newell 1990), and increase students' tolerance for ambiguity, sensitivity to ethical issues, and creativity (Newell 1994). Interdisciplinary collaborations involving engineering students have been successfully undertaken before (McNair et al 2008, Richter and Paretti 2009, and Wojahn et al. 2004) to 'explicitly [teach] mindsets open to soft skills' (Wojahn et al. 2004), to enhance design thinking, and allow students to gain experience of cross-disciplinary collaborations.

This paper reports on the design, implementation, and outcomes of a collaborative exercise between engineering and journalism students. The exercise was developed to overcome the lack of opportunity for engineering students to communicate outside their discipline and the journalism students' reluctance to engage with a previously unknown audience group. It aimed to enrich the cohort experience, introduce the students to the possibility that there are other ways of thinking about a problem, begin their journey into interdisciplinarity, and prepare them for industry. We evaluate the level to which the innovation enriched the cohort experience, introduced the students to the possibility that there are other ways of thinking about a problem, began their journey into interdisciplinarity, and prepared them for industry.

BACKGROUND

Definitions

Cross-discipline collaborations have been described as multidisciplinary, interdisciplinary and transdisciplinary. This paper adopts the following definitions as per Marques (2008):

- multidisciplinary describes a collaboration in which there has been no alteration of each discipline's approach;
- interdisciplinary describes a collaboration in which there has been transfer of concepts and approaches in order to arrive at a common conceptual framework;
- transdisciplinary describes a collaboration which goes beyond interdisciplinarity and provides a framework that transcends the disciplines and creates a new field where all are equal.

Borrego and Swanston (2008) round out this definition with the observation that multidisciplinary teams 'split apart unchanged when work is finished' whereas members of an interdisciplinary team are 'changed by the experience'. In the context of the engineering undergraduate, the innovation described in this paper seeks to take both the engineering and journalism students beyond the multidisciplinary and into the interdisciplinary in order that the experience have a positive effect on their future work. Indeed, the innovation was designed to allow the students to gain interdisciplinary learning and thereby understand and integrate new values and approaches to their design process (Richter and Paretti 2009).

Overview of pedagogy

Integrating journalism and communication skills with engineering design and development ensures that authentic communication occurs across disciplines and that social expectations are understood and met. This collaboration builds on evidence (Parker et al. 2003) that formal collaboration between students in different cohorts should be encouraged at an early stage in order to have an effect on their future practices.

The broad learning objective of the innovation (interdisciplinary communication and collaboration) can be broken down into a number of more explicit learning objectives by paraphrasing Richter and Paretti (2009). Students should be able to:

- identify the contributions of other disciplines;
- value these contributions;
- identify the information needs of the other disciplines;
- integrate the inputs from the other disciplines;
- learn from and use the methods of the other disciplines.

The process described and analyzed in this paper has two areas of innovation. The first lies in bringing together a multidisciplinary team to allow both cohorts of students to examine the problem from a new perspective. The second innovation is that the researchers deliberately replaced themselves with their students for selected learning activities so that instead of the collaboration appearing to be two sets of learners each with a teacher, it more closely resembled a face-to-face dialogue between two sets of learners each prepared to teach the other something new. Thus, in *praxis* terms, the engineers and the journalists each acquired a 'critical awareness of the situation of the (other) by becoming interdependent with the (other)' (c.f. Freire 1972) and therefore each entered 'into a co-learning relationship guided by action and reflection' (Huesca 2003:212).

The Engineering course

ENGG4101 (*Systems Engineering and Design Management*) is a semester-long elective that is open to 4th year chemical and mechanical engineering undergraduates at the University of Queensland (UQ) in Australia. The course objective is the conceptual design of a cutting-edge, commercially viable engineering product or system. Learning outcomes were that students will demonstrate the ability to: clarify customer requirements through market analysis, undertake product benchmarking, complete trade studies, estimate costs, assess risks, and disseminate the concept for 'executive' approval. ENGG4101 is followed by ENGG4102 (*Advanced Product Design*), in which the course objective was for students to take the concept designs through to embodiment. Learning outcomes are that the students will demonstrate the ability to produce a website and a business plan for their project. ENGG4101 has been constructed to effect a classroom environment that promotes

self-directed learning, active and problem-based learning, and development of teamwork, communication, and presentation skills: This 'active, collaborative, project-based learning is superior for developing the characteristics valued by [engineering graduate] employers' (Ochs et al. 2001).

Assessment is based on students' ability to demonstrate professional, technical, and analytical skills. Each student is required to develop and maintain a design portfolio which includes notes from team meetings, concept developments, design sketches, experimental results, workshop outcomes, and reflections. This is the only individual assessment; all other assessment is team-based including: a scoping report, a concept development workshop, a technical report and oral presentations. Up until 2008, these presentations had been 'in-house', that is they had been tailored for, and were delivered to, engineers. No attempt had been made to help the students learn how to communicate design concepts back to the market that they originally connected with, although students did engage in initial consultations in order to formulate customer needs and a market analysis.

The Journalism and Communication course

JOUR3111 (*Convergent Journalism*) is a semester-long compulsory course for final year (3rd year) journalism students at UQ. The course objective is that students would be able to tell structured stories to specific audiences through a framework of audience relevancy using previously acquired skills (in Years 1 and 2) of reporting, journalistic investigation and editing within forms of online multimedia, including text, audio and video. As well as enhancing awareness of the specifics of online multimedia production theoretically, the course aims to develop the students' capacity to produce appropriate forms of journalism which reflect the specifics in the media context. Until 2008, JOUR3111 students had been required to first identify then work with a discrete audience group of their choice, compose and publish digital multimedia news reports designed to address the news needs of that audience, and then compose and present a reflective video diary detailing the results of the experience. However resistance—and thus less than optimal constructive alignment (Biggs, 1999) had been observed among students regarding the task of identifying, describing and dealing with a previously unknown audience group. So in 2008, it was decided to offer a 'pre-packaged' audience, thus removing the main obstacle of uncertainly of assignment selection.

METHODS

The innovation

Through prior discussion, we determined that allowing our separate courses to meet was likely to address at least one of the gaps identified in each course. In the case of the engineering course, we

decided to "help students learn how to communicate design concepts back to the market that they originally connected with" and in the case of the journalism course, we decided to offer journalism students the members of the engineering class as the "pre-packaged audience". Arrival at this decision allowed the innovation to emerge and be enunciated: the journalism students would role-play as the market group to whom the engineers had to communicate their design concepts, and the engineering students would role-play as the audience to whom the journalists would address their media processes and products. This would be achieved by physically bringing the classes together on a single day in Week 7 of the 13-week semester. Our professional experience suggested that the environment for this would best be described as a media conference: a morning set aside in one of the university's largest lecture rooms where teams of the engineers would present their design projects to teams of the journalists, while the rest of each class acted as the audience.

This teaching innovation is recognised as "environmental manipulation" (Matthews, Farrell & Blackmore 1996: 440), an established methodology in health sciences which is also applicable here. As those authors note, environmental manipulation is 'based on the theory that the environment affects the individual and the individual affects the environment'.

In the present study, the manipulation amounted to conducting the media conference as a conjoined cohort, and then applying some fine tuning (Table 1) to place students in unfamiliar but safe situations with students from the 'other' discipline which, it was proposed, would prompt changes in their behavior.

Once the foundational decision of "environmental manipulation" was taken, fine tuning was applied in four steps. Firstly we swapped classes in the 4th week of semester so that the journalism academic could explain to the engineers how to prepare for and approach a media conference ("what journalists want from presenters"), and the engineering academic could explain to the journalists "how engineers think" and provide a taste of what motivates engineering students. This is underpinned by the recognition that giving the students the 'meta-knowledge and skills for facilitating relational space' (McNair et al., 2004: 397) better prepares them for the collaboration. Then in Week 6, before the media conference, each team of engineers prepared a written media release for their respective journalist team, describing the design project and including contact details. This mimics the professional practice in which an engineering company, consortium or alliance releases details of projects to the media so that journalists can research and prepare their reports before coming to interview representatives of the engineering company. It established the communicative environment necessary for both engineering and journalism students to approach the media conference with some confidence. Finally, in Weeks 8 and 9, the engineers and journalists met again for informal workshop sessions designed to allow the engineers to acquire some of the journalists' new-found insights into media production and apply these to their own

end-of-semester projects. Some of these projects were published on the Internet, as this example shows: http://www.youtube.com/watch?v=uTTUzFOJ6uo and http://www.youtube.com/watch?v=LlGGIoDf8rM.

The steps in the teaching innovations are summarized in Table 1. Further information, examples and observations on each of the steps are detailed in the notes to Table 1.

	Engineering students			Journalism Students		
Step	**Action**	**Assessment**	**Timing**	**Action**	**Assessment**	**Timing**
1. Introductory lecture	Lecture from Journalism academic	Nil	Early in semester	Lecture from Engineering academic	5%	Early in semester
2. Pre-release media package	Prepare 1-page plain English product overview with definitions	Nil	3 days before media conference	Read pre-release and prepare for media conference	5%	Synchronous with engineers' delivery of package
3. Media conference	Oral and some media presentation of product	10% Peer assessed	Middle of semester (20 min/team)	Attend, record, photograph, film etc	5%	Synchronous with engineers
4. Focus group workshop	Run focus group workshop	10% Peer assessed	After Step 3 (20 min/team)	Participate	Nil	Synchronous with engineers
5. Multimedia report (Draft)	Nil	Nil	Nil	Prepare draft multimedia report	20% instructor assessed	Due 1 week after media conference
6. Multimedia report feedback	Review draft multi media report	Nil	2 days after release	Feedback from engineering students and journalism academic	Nil	During week after conference
7. Multimedia report (Final)	Nil	Nil	Nil	Finalise report	20% instructor assessed	2 days after engineer response
8. Video presentation workshop	Workshop with journalism students	Nil	4 weeks before submission due	Aid engineering students in use of multimedia design tools	5%	Synchronous with engineers
9. Final video conference (engineers)	Video presentation and question session	20% Peer assessed	Last week of semester	Attend, feedback to engineers	Nil	Synchronous with engineers
10. Final video reflective diary (journalists)	Nil	Nil	Nil	Present video diaries	40%	Last 2 weeks of semester

Table 1: Operationalizing the teaching innovation.

NOTES (Numbers refer to the Step numbers in Table 1.)

1. The introductory lecture from each convener was designed to introduce each cohort to the other discipline and the possible benefits of working together. Both authors noted that their opposite cohort were apprehensive about the collaboration.
2. The pre-release was designed to allow the journalism students to be able to prepare better for the media release and to give the engineering students a 'heads up' on the language they needed to employ during the media conference. For example, one of the engineering teams was producing a software package that predicted polymer flow from a die. This team produced a 1-page document that outlined what a polymer was, where polymers were used in the world, and real-world applications of extrusion technology.
3. The media conference and ensuing 'focus group' workshop session (the environmental manipulation segments) were run over a continuous period of 3 hours with each engineering team being given 20 minutes for the initial media conference including questions, and 20 minutes for the workshop. Each journalist student (n=93) selected one of the seven engineering teams to report on and brought audio-visual equipment with which to record the session. All students listened to all presentations.
4. Due to time constraints, the 'focus-group' workshops were run in parallel with the students splitting into three cohorts. This allowed the students to have longer workshops but the audience and therefore 'potential customer input' was smaller.
5. Many of the multi-media reports were published on the Google-owned *YouTube* video-sharing network or other social networking sites such as *MySpace* and viewed online by the engineering students.
6. There was a very short time for the engineering students to give feedback on the reports but no complaints were received about this aspect of the collaboration, perhaps because it fitted the engineers' standard model of operation (discussed later). Each engineering team had 3 or 4 members so each student reviewed approximately 3 reports.
7. Each journalism student received formative feedback from the engineering students on the multimedia article and was able to re-shape his or her story where necessary, based on that feedback before submitting a final version.
8. Time and technical facilities were made available for groups of engineering students to meet their relative journalism student groups and learn how to make a short multimedia presentation (Step 9). This workshop was not rigorously organized by the authors: students were told the time and place and left to their own devices. This was in keeping with the second area of innovation whereby the researchers deliberately replaced themselves with their students. It is noted that the students were only partially able to coordinate this peer-to-peer training

as getting students together proved problematic without lecturers compelling them, or even guiding them.

9. Each engineering team ran their video report of their concept design and its proposed development and then answered questions from both cohorts and the authors. The engineering students had been told to prepare the video as if for the directors of their company from whom they needed approval to further develop the concept to production stage.

INNOVATION EVALUATION

The assessment and validation of the extent of interdisciplinarity within the innovation was challenging. We encountered the 'lack of conceptual clarity about the nature of interdisciplinary work and its assessment' noted by Mansilla and Gardner (2008, p. 2) and also differences between the disciplines about assessment standards and measures, which had earlier prompted discussion between us and our colleagues. Mansilla and Gardner (2008) propose three categories for assessment: the process of moving towards interdisciplinarity; the 'leverage' created by interdisciplinary work; and the comparison between interdisciplinary and multi-disciplinary outcomes. The second and third categories appear to be encompassed by Smelser (2003) when he notes the 'character of knowledge produced' in the context of comparative analysis of interdisciplinarity.

With this in mind, we decided to measure the effect of the teaching innovation in two ways: through a paper survey that was administered to both cohorts at the final video conference at the end of semester (addressing the 'process' and the 'leverage') and through a systematic communications audit and analysis of the engineering students' end-of-year presentations for the follow-on subject ENGG4102 and then comparison with the presentations (output) of the previous engineering cohort (addressing the 'outcomes'). The 'character of the knowledge' is measured somewhat by both the survey and the analysis. In addition, how the learning was accomplished has been evaluated through assessment of the social interactions among students (Wojahn et al. 2004) by survey and observation.

The survey aimed to discover to what extent the collaboration had changed the way the students said they worked and thought, to ascertain whether the innovation had caused interdisciplinary collaboration. We also used the opportunity to obtain feedback from the students about the innovation: what worked, what didn't work, and what could be improved. The survey took an average of 10 minutes for each student to complete. The survey data were kept separate from, and had no impact on, course grading assessment. No ethical implications or concerns were identified by, or have emerged since from, either the academics or the students involved.

Thematic analysis was used to evaluate the open-ended survey questions. This was a simple procedure whereby each student's answer was in turn analysed for new or recurring themes. These themes were developed as the answers were analysed and were not set or influenced by the researchers.

A template developed at the Poynter Institute for Media Studies, Florida (Quinn et al, 2007), used for online designers and evaluators to assess and optimise information recall and communication, was used to audit and compare the ENGG4102 outputs from 2007 and 2008. It relies on strategies which emphasise the graphic and visual and de-emphasise the strictly (word-driven) 'textual'. These strategies include the ability to tell a story using Question and Answer techniques, timelines, lists, and fact boxes, the use of images, the use of audio, the use of video, and evidence of interactivity. Each of the presentations was scored against the Poynter strategies using a modified Likert scale where 1 indicates no evidence of use, 3 indicates some evidence of the technique, and 5 indicates explicit and dominant use. The values 2 and 4 were used to improve the degree of granularity in the assessment. These scores were then averaged to arrive at a single number which could then be compared across the two cohorts.

RESULTS

Observations

We witnessed an apprehensive and anxious approach to the media conference by the students; this was the first time the cohorts had met face to face and it obviously was an unknown experience for the students. The journalism students, most of them females aged about 20, feared that the technical content of the presentations would be overwhelming and 'over their heads', although it was noted that the preparation and dissemination of the 'pre-release media package' and an introductory lecture by Kavanagh had eased their fears somewhat. The engineering students, mostly males aged about 21, vacillated between *arrogance*—they said the journalism students would not have the intellectual capacity to grasp their concept designs—and *fear* of having to speak to a large and unknown audience. They said their initial reaction to the array of audiovisual equipment that the journalism students brought to the conference was one of 'flight'. This cohort wariness has been observed by Wojahn et al. (2004) who see the issue as being 'critical to an interdisciplinary mindset' (p 162) in terms of flexibility in handling differences.

However, despite these initial negative reactions, the media conference was observed to be extremely successful: students operated on a high level of energy and reports from the students of both cohorts were that they thoroughly enjoyed themselves. That students entered into a co-learning environment was demonstrated by an unscheduled continuation of the session outside the lecture room in the Great Court of UQ where more interviews were conducted. The engineering students got

over their initial shyness of being recorded and needed very little encouragement to pose for photos and, in the case of the polymer team, explored the meaning of polymerisation through interpretive dance! The class discussion at the next session of ENGG4101 was focussed by the students on how many times their team had appeared on *YouTube* and the buzz that this had created for them. Additional positive reinforcement was provided by the publication of articles about the exercise on the university news website and in the monthly magazine *Engineers Australia*.

The video presentation workshops (Step 8, Table 1) were not so successful. As previously stated, the times and studio availability were the only aspects organised by the course conveners. The students were expected to liaise directly with each other to ensure that the necessary skills and knowledge were delivered to the engineering students. Both cohorts felt that the sessions were poorly organised and that they would be of more benefit if a tighter structure for the workshops existed. The fact that 48% of the journalism students indicated that they had not used video recording equipment before commencing JOUR3111, and the high expectations of the engineering students in this regard, no doubt contributed to the general dissatisfaction associated with these workshops. From the course convenors' point of view, this lack of organisation on the part of both student cohorts reinforced existing perceptions that undergraduate students generally need well-defined structures in which to operate. The observation might be made, from a professional standpoint, that clearer motivation, more self-directed learning and more independent action might be desirable in final-year students about to enter the workforce, but the reality in 2008 was otherwise.

The final video presentation by the engineering students was well attended by the journalism students although attendance was not compulsory for them. Their feedback to the engineering students was detailed and constructive ("music underneath the voice-over at the beginning would've been effective to capture audience attention and continuing through to maintain audience and add more 'depth' to video") and the engineering students said they made an effort to read the feedback. In the authors' opinion, this shows commitment from both disciplines both to the other cohort and to the collaboration.

A thematic analysis of the journalism student feedback showed that one-third of the students felt able to comment on the engineering aspects of the presentations by making suggestions of a technical nature, and by indicating that they understood the perspective of the engineering students.

The survey

Table 2 summarizes the student responses to a question on the survey, designed to indicate where improvements could be made, when the authors asked them to rate the steps (see Table 1) in the collaboration for their helpfulness in achieving course objectives. The question was scored on a Likert scale (1 Not at all, 2 A little, 3 Average, 4 Better than average, 5 Very much). As not all students answered all questions, the number of responses (*n*) for each question varies.

	Journalism (n=45)					Engineering (n=27)				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Introductory lecture from other discipline (Step 1)										
Number	2	3	16	13	10	1	4	7	6	2
Average	3.6					3.2				
Preparation for media conference (Step 2)										
Number	0	7	14	18	5	0	4	11	9	1
Average	3.5					3.3				
Media conference (Step 3)										
Number	0	1	6	17	18	0	1	5	11	8
Average	4.2					4.0				
Focus group workshop (Step 4)										
Number	5	14	12	11	2	0	5	8	7	5
Average	2.9					3.5				
Multimedia report (Step 5)										
Number	0	2	11	18	10	1	2	7	9	5
Average	3.9					3.6				
Feedback from multimedia report (Step 6)										
Number	5	5	8	19	4	2	3	10	5	4
Average	3.3					3.3				
YouTube collaboration (Step 9)										
Number	4	3	10	20	3	0	3	14	4	3
Average	3.4					3.3				

Table 2: Students' satisfaction with respect to helpfulness of the collaboration.

The differences in the average scores between the cohorts are not statistically significant with the exception of the workshop (Step 4) which the engineering cohort found to be more helpful. This was expected, as the workshops were designed by the engineering teams to extract 'focus group' information to help with their product design whereas the workshops had no bearing on the journalism students' work or assessment. The highest ranked item by both cohorts was the media conference; this is attributed to the observed enjoyment of the experience by both cohorts.

The survey also asked a number of questions designed to investigate the level of interdisciplinarity achieved by the collaboration. Table 3 shows whether the students believed the teaching innovation had made a difference to the way they worked, their understanding of the other cohort and their own discipline, and how they would approach work/design tasks in future. The last question is more orientated to determining the level of the collaboration achieved but the preceding questions were

As a result of collaborating with students from another school, has there been a change in the way:	Journalism (n=45)		Engineering (n=27)	
	Yes	No	Yes	No
You've done your work?	30 (67%)	15	17 (63%)	10
You think about other disciplines?	35 (87%)	6	19 (70%)	8
You think about your own discipline?	33 (72%)	11	18 (67%)	9
You will do your work in future?	31 (72%)	12	16 (59%)	11

Note: Not all journalism students answered all questions and hence in some cases $n \neq 45$.

Table 3: Differences resulting from the collaboration.

included to find what might underpin such a change, if any. Note that 'think' was not defined in the survey but a subsequent question enquiring about knowledge (Table 4) was used to elaborate further on this perception of change in thinking.

In each case more than 50% of students indicated that the collaboration had made a difference to how they would work and think professionally. The largest change for both cohorts was the way students thought about the other discipline. Interestingly, the changes reported by the journalism students were higher than those among the engineering students in every category.

The prescriptive questions in Table 3 were followed by an open-ended question which asked 'What are the changes (if any)?'. Three themes, indicating that the collaboration did achieve a level of interdisciplinarity for a proportion of both cohorts, appeared in the answers:

1. appreciation of the other discipline ($N_{journalism}$ =13, $N_{engineering}$ = 5);
2. change to their practices ($N_{journalism}$ =19, $N_{engineering}$ = 8); and
3. inclusion of the other cohorts' practice in their practices ($N_{engineering}$ = 6).

Table 4 shows the results of questions focussed on respondents' knowledge of the other discipline as a result of the collaboration. The question was scored on a Likert scale (1 Not at all, 2 A little, 3 Average, 4 Better than average, 5 Very much).

Again it can be seen that journalism students were more affected by the teaching innovation, reporting higher scores in both their perception of understanding of the other discipline and in the value of the collaboration. However, the most significant result here is that both cohorts felt equally strongly that the collaboration helped their professional development.

The students were asked 'How did you deal with the opportunity of relating to a discipline that you don't usually relate to?' Table 5 shows the results of a thematic analysis of the responses to this question.

Overall the students reported having enjoyed the interaction with the other cohort but that more journalism students found the interaction to be challenging. This should not be interpreted as a lack

	Journalism (n=45)					Engineering (n=27)				
	1	2	3	4	5	1	2	3	4	5
How well do you understand the other discipline now?										
Score	0	4	20	20	1	0	4	11	11	1
Average	3.5					3.3				
Did collaboration help you do well?										
Score	0	6	13	19	7	0	7	10	7	3
Average	3.6					3.2				
Did collaboration help your professional development?										
Score	0	7	8	19	11	1	2	6	10	8
Average	3.8					3.8				

Table 4: Knowledge of other cohort as a result of collaboration.

	Journalism (n=48)	Engineering (n=27)
Positive (interesting/ enjoyed)	20 (42%)	10 (37%)
No problem	3 (6%)	1 (4%)
Negative ('the innovation was not warranted')	1 (2%)	2 (7%)
Challenging	11 (23%)	5 (19%)
No answer	13 (27%)	9 (33%)

Table 5: Thematic analysis of 'dealing with the opportunity'.

of enjoyment as it seemed evident to the authors that both cohorts approached the other with a level of anxiety although this quickly dispersed in the energy of their first communications.

The students were asked what they thought the highlights and lowlights of the collaboration were: this was an open-ended question. Table 6 shows the results of a thematic analysis of the students' answers.

The results show journalism students were impressed by the media conference experience—a 'real world' experience for all concerned—but were not impressed by the final engineering video presentation, unlike engineering students for whom this was a new experience.

The major negatives identified by the journalism students, such as lack of equipment access and logistics, might have stemmed from the students being unused to the high-pressure environment to which engineering students were subjected. Engineering students at UQ are purposefully exposed to short timelines for deliverables, changing requirements to develop their adaptability,

and working with ambiguity and uncertainty. While pressure, short production turnarounds and tight deadlines are also a feature of the journalism profession and its university formation, journalistic work routines and mechanisms tend to foster a search for objectivity, certainty and simplicity.

The fact that journalism students appeared to be less able to 'work outside the box' was also supported by the answers to a question asking what students would change about the collaboration and what they would leave the same (Table 7).

Eighteen journalism students, the largest number of students, suggested increased preparation and organisation of the collaboration. This challenges our innovation of purposefully leaving the collaboration 'under-scripted' so that the students could communicate without the interference of

Theme	Journalism (n=48)	Engineering (n=27)
Highlights		
Media conference	20	11
Interaction with the other discipline	15	6
You-tube/ video presentation	–	5
Practical experience	8	–
Lowlights		
No lowlight	2	2
Lack of equipment access	10	5
Logistics/ timetabling/ organisation	11	1
Exercise had low value	7	1
Technical issues	8	1

Table 6: Collaboration highlights and lowlights—a thematic analysis.

	Change		Don't Change	
Theme	Journalism	Engineering	Journalism	Engineering
Workshop	3	3	–	3
Improve collaboration	4	4	7	–
Increase preparation/ organisation	18	2	–	–
Media conference/ You Tube	–	–	8	3
Change: everything	–	1		
Don't change: anything			5	3

Table 7: Student's change proposals—a thematic analysis.

the course convenors and thus enter a co-learning relationship. It is therefore necessary to explore what could be done to increase the journalism students' self-direction. Interestingly, McNair et al. (2008) identify this need for 'instructional scaffolding' as something that inhibits students from moving outside their discipline and from being able to see the interdisciplinary collaboration as a productive experience.

The communications audit and analysis of ongoing engineering outputs

There were 16 students from the ENGG4101 cohort who took ENGG4102. The logistics of team-based project work meant that 4 of the original products from ENGG4101 were taken forward by teams comprising 4 original students and 1 new student each. Thus each team was seeded equally with students who had participated in the teaching innovation. Ongoing interdisciplinary behavior was noted in the submissions required for the course. Firstly, for the first time since the course's inception in 2003, there were videos employed at the trade expo by two of the four teams. Secondly, prior to the innovation, ENGG4102 teams presented their product websites offline on CD but, having received specific information in digital media delivery in collaboration with the journalism students, all teams presented their websites online. And finally, a heightened awareness of the need to communicate outside engineering was noted in the reflections of some of the student's individual portfolios.

A detailed evaluation of the websites using the Poynter Institute for media studies template (Quinn et al 2007) is shown in Table 8. The websites presented by the 4 teams exposed to the innovation are T1 to T4 and those of the previous year are P1 to P4. A modified Likert scale has been used (1 = no evidence of use, 3 = some evidence of the technique, 5 = explicit and dominant use). The table shows strong evidence of interdisciplinary behavior and weak evidence for some transdisciplinary behavior.

The results strongly suggest that the interaction of journalism and media students with the engineering students produced measurable elevation in the engineers' willingness (and perhaps capacity) to use the important devices which the authority (Poynter) regards as essential for information recall while navigating news media websites. Overall scores increased significantly after the experience of collaboration with journalism students in the previous semester, with all four teams scoring higher than those from the previous year. Specific increases were seen with respect to the use of Q&A and time lines for all teams, while the use of audio and video increased in two of the four teams. The students' use of images, lists, and fact boxes was similar for the periods under review, suggesting that these may be artifacts of engineering education not influenced by students' use of other means of communication.

	Poynter Template Strategy (2007)								
Team	Use of Q&A	Use of time-lines	Use of lists	Use of fact boxes	Use of images	Use of audio	Use of video	Use of inter-activity	Total score
Students without collaboration with journalism students									
P1	1	1	5	5	4	1	1	3	21
P2	1	1	5	5	3	1	1	2	19
P3	4	1	4	3	3	1	1	2	19
P4	1	4	3	4	4	1	1	3	21
Students with collaboration with journalism students									
T1	3	5	5	5	5	5	5	4	37
T2	4	4	5	4	4	1	1	4	27
T3	4	5	5	5	5	3	5	2	34
T4	5	3	5	5	5	1	1	2	27

Table 8: ENGG4102 websites evaluation.

DISCUSSION

Was interdisciplinarity achieved?

Measures employed in this study made it difficult to conclude with significance that interdisciplinarity was achieved and that the effects were lasting but the data tend to tell that story. Student perceptions recorded at the time of the innovation indicated that more than 50% of the students felt that they had achieved a new understanding of a different discipline but there was no significant data about whether this was a true perception likely to lead to action, or whether there would be any lasting effects from the experience.

Assessment of the submissions of the ENGG4102 cohort certainly do lend themselves to an interpretation towards interdisciplinarity but this may be due to factors other than the teaching innovation such as the heightened awareness of media possessed by Gen Y, or the availability of free websites. The teaching innovation certainly highlighted the need for multi-disciplinary communication to both cohorts and provided an opportunity for the students to interact with a completely different discipline. This interaction on the whole was well received and illuminating for both cohorts.

Examination of the innovation in terms of Richter and Paretti's learning objectives (2009) proposed earlier in the paper is more positive. The open-ended questions in the survey showed that students did identify and value the contributions of the other students which cover the first two learning objectives. The next learning objectives were explicitly covered by the innovation which

required the engineering students to identify the information needs of the journalism students, and the journalism students to integrate the inputs from the engineers. The final learning objective, that the students learn and use methods used by the other discipline, may have been achieved but as indicated above, is not confirmable due to confounding factors.

Was a co-learning relationship achieved?

There was evidence in the feedback from the journalism students from the press conference that the engineers had managed to connect with them:

> 'Really grasped the concept of communicating to a "Journalist audience"'

> 'I think the next generation of engineers will have the people skills to avoid the issues of prior generations.'

There was also evidence of the opposite:

> 'Most groups didn't state their aim of their project clearly and simply!'

> '... some of the presentations were really hard to understand, they needed to be explained for ordinary students who don't have an engineering background.'

Discussions with the ENGG4101 cohort showed also that although there was a better understanding of the JOUR3111 cohort, there were no lasting ties between the cohorts. Originally we had envisioned that some ongoing professional partnerships may occur but this did not eventuate and the cohorts retained their separate identities.

As with most teaching innovations, there are many unforseen events that occur during the first trial and these are often easily rectified the second time the innovation is run. The act of explicitly communicating these hurdles and challenges, based on the previous cohort's experience, to the new cohort, is often sufficient to significantly increase student satisfaction and learning.

What will we do differently?

We were committed to running the teaching innovation again (and did so in Semesters 1, 2009 and 2010) and to trying to embed such interdisciplinary opportunities in other courses and with other disciplines. With respect to the ENGG4101-JOUR3111 collaboration described in this paper, the 2009 cohort was made explicitly aware of the successes and failures of the initial trial in an

attempt to give them a meta-level viewpoint and engage them further in the aims of achieving both interdisciplinarity and a co-learning relationship.

Further guidance was given in support of the video workshop (Step 8, Table 1) especially with respect to the journalism students. In addition the workshop session of the media conference was tailored such that it was of greater relevance to the journalism students. Some internal evaluation was conducted for university purposes, with very positive results, but not the full range of instruments described in this paper.

CONCLUSIONS AND RECOMMENDATIONS

The collaboration between two groups of university undergraduate students from superficially unrelated disciplines produced a net positive learning effect greater than the known effects of taking their individual discipline-specific courses without collaboration. There is evidence to suggest that the engineering cohort came out of the collaboration with greater skills in communication than when they entered, that they emerged more aware of the need to communicate with disciplines other than their own, and with the determination to change their behaviours to accommodate this newfound need. This second finding is supported by the findings of McNair et al (2004) who also found that their engineering students gained a 'growing awareness that social skills are a genuine part of the job an engineer faces when representing their technical work to colleagues across cultural and disciplinary boundaries' (p397) through interdisciplinary work.

This experiment of creating a combined learning experience for two groups of university undergraduate students from superficially unrelated disciplines has been evaluated in terms of the process undertaken, the leverage created by the combination, and the outcomes achieved compared with outcomes from previous 'separated' courses. An overall assessment of the level of behavior against the scale described earlier—multidisciplinary, interdisciplinary and transdisciplinary—is also noted.

The clearest aspect of the process noted in this study was the need to manage the social expectations of the participants before work began. The interface for the mostly female journalism students and the mostly male engineering students was at first an uncertain environment which could have generated poor outcomes. This uncertainty mimics the difficulties encountered, and the mitigating strategies undertaken, during 'Enquiry by Design' exercises referred to earlier. Difficulties included fear and initial unwillingness to engage; mitigating strategies included exchange of experts from each discipline and a deliberate adoption of two-way, open communication pathways. The suggestion that journalism and engineering can be related in the business environment (Bond 1990) is strongly supported.

Suggestions by Lattuca et al (2004) and Newell (1994) that this kind of collaboration would leverage each group to produce higher-order results than obtainable individually, and increase students' tolerance for ambiguity, were generally supported, with certain exceptions. Higher-order results were produced among the engineers, evidenced both by the paper survey of the cohort and the audit and analysis of their later presentations. The journalism students achieved better confidence levels and became able to ask technical questions of the engineers and understand the replies. The majority of each cohort (and more among the journalists) reported that the collaboration had made a positive difference to their professional development and how they would work and think professionally: specifically, appreciation of the other discipline; change to practices; and inclusion of the other cohort's practice in their own practices. Anecdotally the journalism students also produced higher-order product outcomes, indicating some leverage. However, there was only marginal evidence that this collaboration increased the engineers' tolerance for ambiguity, since that was already high in their cohort. And of all the evident outcomes from the journalism students, this issue was the only one to meet resistance: instead of achieving increased levels of tolerance for ambiguity, they exhibited some resistance to ambiguity (it was more 'challenging') and the self-directed learning required of them.

This was a surprising outcome and, along with a coincidental collaboration, suggests room for further research. The coincidence occurred when co-author Cokley attended the *Future of Journalism* conference[1] at Cardiff University, Wales, in September 2009, and the second World Journalism Education Congress at Rhodes University, South Africa in July 2010[2]. During conference discussions at each venue, journalism educators and researchers at several campuses in the United States, Sweden and the Netherlands mentioned that students struggled with innovation, ambiguity and change in the emerging multimedia cross-disciplinary environment. A potential multinational study is now being scoped and discussed.

Analysis of outcomes produced the strongest evidence of interdisciplinary behavior and some weak evidence for transdisciplinary behaviour among the engineering cohort. The communications audit and analysis conducted of the engineers' projects in 2007 and 2008 strongly suggested the emergence of interdisciplinary work, based on the presence of more interactivity, more multimedia productions, and improved Q&As and graphical timelines.

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