



## Linking Teaching with Research in the Disciplines

### Case studies for Courses and Course teams

***Bringing home the swampiness of life: the use of peer-assessed problem-based case studies within food science and technology by the integration of industry sponsored technology transfer projects into student learning.***

**Authors:** Charles Brennan, Elizabeth Folland, Rick Preston and Nicola Blatchford, The School of Biological Sciences at Seale Hayne (Food Technology), Seale-Hayne Campus, University of Plymouth, Newton Abbot, Devon.

**Contact details:**

Charle Brennan  
Institute of Food, Nutrition and Human Health,  
Private Bag 11222, Palmerston North, New Zealand

c.s.brennan@massey.ac.nz

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**Classification Category:**

- Developing student appreciation of research in the discipline.
- Using teaching and learning processes which simulate research processes
- Using assignments which involve elements of research
- Giving students first hand experience of commercial consultancy
- Bringing data/findings from research/consultancy into the curriculum

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**Context:**

“First teach them the relevant basic science, then teach them the relevant applied science, then give them a practicum in which to practice applying that science to the problems of everyday life”

Donald Schon 1987

Life after university has often been likened to a swamp. University life often leaves us unprepared to manage the complexities of dealing with work related problems. These problems are often solvable not by one particular solution, but a combination of integrated packages which, as a whole, facilitate the overall solution. University life often compartmentalises learning experiences and skill developments, and may restrict the students (and academics) ability to connect different modules and learning outcomes in a wider multidiscipline knowledge.

Problem based learning offers students a great opportunity to apply their practical and theoretical knowledge gained through either individual modules or through combination of modules, to solve industry specific problems. The use of this style of learning has clear advantages in developing student ability to function well in a team environment and to pool and apply their previous knowledge into real-life situations. It is this ability of a student, to be able to integrate theoretical and practical elements of their curriculum, which facilitates their progression to the work-place environment, and makes students suited to careers in industry.

Over a number of years the University has been successful in obtaining a range of Teaching Company Scheme awards (now renamed as Knowledge Transfer Partnership awards). These projects are normally two-three year in length and involve a recent graduate being placed in a company to problem solve processing or quality issues as well as implementing technology transfer between the University and the company that they are placed in. Funding for these projects is jointly supplied by the DTI / DEFRA and the individual food company.

Examples of such schemes have been highly useful in illustrating to final year students the potential application of their knowledge, and serving to illustrate the possible activities they will be undertaking during their employment. In order to make the linkages even clearer, we have used the basis of a particular teaching company scheme to develop a specific case study each year. Each case study focuses on a small problem within the larger 2-3 year TCS project. As such, this project tends to be a blend of practical use of food technology pilot plant equipment, and also background theoretical research. Students are allowed to organise their work pattern in order to meet the objectives of the particular project.

The opening sessions of these case studies are lead by the graduate working in the company (or a company representative) to outline the area to be researched. The final assessment of the case study is as a group conference –style oral presentation, using PowerPoint presentation techniques. These presentations are exclusively peer-assessed. Indeed time is taken within the module to discuss and devise appropriate marking strategies and descriptors. Thus the students take ownership not only over their working time but also in the style of assessment strategy, giving them greater understanding of learning patterns.

The overall aims of these case-studies are to:

- develop industry specific understanding of problem solving techniques
- illustrate the linkages between theoretical and practical knowledge
- facilitate a stronger link between research and teaching within the institute
- promote functional team-working
- enhance students use of IT in assessment presentations
- encourage student reflection on learning outcomes

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### **What does the teacher do?**

An example of the most recent use of such techniques is given below, however it should be noted that any research project has the potential to be used for such an assessment.

1. A current Teaching Company scheme with Pullins Bakery Ltd was used as a potential source of case-study material. This particular TCS was focussed on the optimisation of bread and vegetable materials to enhance the shelflife and the sensory characteristics of a sandwich. Initial discussions with the company lead to the selection of a range of sandwiches which could be used in the investigation, and a working brief was determined. A third year module was used as a vehicle for this case-study. The case study followed on from a series of theoretical sessions with the students on factors affecting bread quality, and the role of instrumental analysis in determining crop product quality and shelf-life.
2. The graduate working in the company Miss Emma Wells, presented to the students the basic principles behind sandwich making, and the market analysis of sandwich production in the UK. At the same time the graduate explained to the final year students the background of the problem to be researched; discussed potential raw materials needed for production, and shared industry knowledge on consumer preference for sandwich quality.
3. Within the same tutorial, the students were encouraged to reflect on their previous analytical knowledge of both food composition and chemical / instrumental analysis of food materials. The lecturer, and technical team involved in the module, discussed with the students potential qualitative and quantitative measurements of food quality, and how applicable these procedures would be to solve the case study. Such procedures include basic chemical composition of food components (protein, carbohydrate, fat contents), shelf-life determination, available moisture content, textural and sensory characteristics of individual food components and the sandwich as a whole, and rheological properties of foods.

4. The students were divided into groups of 4 to conduct the 4 week long practical and reporting element of this case-study, and encouraged to continue these discussions in their groups. To facilitate these individual group discussions the tutorial was reconvened in the student cafeteria (to aid informal peer-discussion on the topic). Whilst the students were in their group discussions, the lecturer and support staff circulated around the groups in order to share experiences and knowledge between student and facilitators. At the end of this session each student group had prepared a one page project plan, together with a list of raw materials and analytical equipment they required for further analysis.
5. Throughout the following three weeks the individual groups were allowed to organise both their practical research pattern (within a timetabled slot of laboratory activity), and their information retrieval techniques. The students were encouraged to have e-mail contact with the graduate at Pullins Bakery Ltd (to discuss industry-specific areas of the research) as well as having contact with the academic staff supporting the practical.
6. During the final week of research activity, students were reminded about the mini-conference presentations which were required as their assessment of the case-study. Guidance was given on presentation techniques and the use of graphics and IT in presenting information using Microsoft PowerPoint software. Examples of previous conference presentations by the academic were provided as a benchmark. At the same time, the actual marking strategy of such presentations were discussed and the elements of presentation to be assessed, together with the balance of marks associated with each element, were agreed within the group. This process was mediated by the academic; however the students lead the discussion and formulated the marking criteria.
7. On the day of the student presentations, students were allowed access to the computer running the software in order to practice the presentation. Evaluation sheets were distributed amongst the group and the process of peer-reviewing was reinforced. The presentation evaluation sheets were graded on a scale 1-9 using the criteria already agreed on. A total of 10 criteria were used, such as timekeeping, readability of slides, amount of information supplied, relevance of information supplied, evidence of sound laboratory practice and evidence of teamwork, amongst others.
8. Students were then expected to evaluate each groups performance (according to the criteria already laid down), and any additional information about a groups performance was noted on the evaluation form. At the end of the series of presentations, all evaluation sheets were collected in by the academic.
9. Evaluation sheets obtained in this exercise were then scrutinised by the academic and the marks allocated to each group (for every element of the assessment) was fed into a database software package. The final mark for each specific element of the exercise was given as the mean awarded to the group by their peers, and the overall mark was derived according to the marking criteria as agreed by the students.
10. Follow up workshops were used to disseminate good practice to students and to evaluate student perception of such processes.

#### **Further developments:**

Further developments have included the use of virtual posters for first and second year assessment processes. These have been designed to embed IT and communication skills into modules. Other developments may be to devise workshops specifically aimed at introducing the principles and aims of peer-assessment. This would have the advantage of reducing student reluctance to participate in such exercises, and also help with their understanding of assessment marking strategies. A result of such could be their ability to better manage their own assessment achievements in modules.

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#### **Hot tips and things to look out for::**

The use of problem-based learning in a case-study environment does create difficulties. However, the autonomy given to the students through the discussion and development of marking criteria allows for greater student ownership of their learning process. Possible areas of difficulties arise from the following:-

- The link between industry and the academic needs to be close and there needs to be a willingness on behalf of the industry to support the students and the academics during such activities.

- Choice of the case-study is important. The academic needs to be aware of the basic knowledge-base of the students and also the potential areas where knowledge or skill gaps exist. It is important to pitch the investigation at the appropriate intellectual level, and ensure that the students have sufficient time to explore all the necessary avenues in their research plan.
- Staff need to be willing to explain (openly) how and why student assessment criteria are set. This facilitates the students understanding of developing their own marking criteria and leads into the idea of peer assessment. Sometimes the actual idea of peer assessment is so strange to the students that additional time need to be spent in reassuring students of the fairness of such schemes, and the importance of treating the process professionally.

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## 7. Does it work?

### Impact on students:

Students have a very positive attitude to the activity and find that the dialogue with industry is an excellent way to develop analytical thinking and problem-solving skills. The idea of an industrial-based problem-solving learning activity is at first daunting to the students, as they are generally not accustomed in integrating a variety of learning experiences together during their studies. However the final year students appreciate the relevancy of such experimental work and enjoy researching on a project which utilises their full understanding of the food chain.

The use of peer assessment in this case-study also benefits the students. Although there is may be a slight reluctance to use peer-assessment for the assignment initially (sometimes students expressing a wish that the assignment is evaluated by academics, following usual guidelines), the students do accept their roles in the assessment procedure and act responsibly. Through completing the assessment they do learn how to reflect on the work of their peers, how to assess and evaluate work separate from personal friendships, and how to accept positive criticisms regarding the quality of their own work. Indeed, it is interesting that the process also allows the students to reflect on their own learning styles and choices of appropriate communication tools.

As such the case-study is extremely useful in developing critical evaluation of their own compositions, and a greater autonomy over their working practices. This development of self-evaluation, and self-worth, is noteworthy when you also take into account the students greater awareness of the use of their skills and knowledge acquired so far, in problem-solving real-life situations.

### Impact on staff:

Staff have benefited from this practice by being able to bring live research projects into their teaching portfolio. This facilitates the link between research and teaching and ensures that the relevancy of theoretical and practical based teaching is promoted. The help of industrial partners also brings a great benefit to staff, not only in terms of the staff developing a deeper understanding of industry specific problems, but by also allowing staff to apply their theoretical knowledge and experiences laterally to an industrial situation.

The graduate working within the company, and representatives from the company itself, also benefit from the exercise. Student presentations can be delivered or forwarded to the company in order to include the company in the learning loop of the exercise. Formal, or informal, discussions between students, academics and industry can take place to further develop key ideas and advance the appreciation of the complexity of the problem from all sides. Thus these case-studies offer a true development of partnership between academics, students and industry. Often, the case studies are useful in highlighting potential areas of further research and development, and greater collaborations between the University and the industry. This may be again in the form of additional case studies or honours students / MSC students research projects as part of their final year assessment.

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### Relevant references

Schön, D.( 1987) Educating the Reflective Practitioner. San Francisco: Jossey Bass