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Engaging with Industry in the Classroom through the use of Online Technology

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Abstract[59]

A long established method of learning in Irish third level education has been the collaboration of colleges with Industry in the form of work placement. Workplaces provide a diversity of learning that is contextualised, socialised and not readily available in traditional learning contexts (Sheridan & Linehan, 2013). Because the workplace is the context of practice, learning in the workplace is considered a form of authentic learning informed by real contexts, activities, and best practice (Franz, 2008). The placement of students is often a difficult process and not always practical with large class sizes. Therefore, it is necessary to reimagine how we engage with industry and foster relationships within the context of an online environment. We describe (1) a workshop designed to provide an authentic learning experience for large undergraduate classes, and (2) evaluation of students learning in relation to Level 8 standards (QQI, 2014): Knowledge, Know How and Competence. The workshop is delivered using a blend of online and traditional classroom environments. The appeal of the workshop is in fostering relationships with industrial partners. Students are, randomly assigned to groups and tasked with addressing a complex workplace case scenario. Scenarios are provided by the Health Products Regulatory Authority (HPRA) and represent real situations encountered in the regulation of medicines. In a limited timeframe, students must research the problem, identify a course of action and present findings to the HPRA via online technology. HPRA representatives give immediate feedback on each case. Learning is assessed in relation to Level 8 standards using a survey tool. Data indicates that participants develop insight into their own professional competencies in relation to teamwork & communication, specialised knowledge of the industry and problem solving skills. Key to the success of the workshop is framing the student presentations in a professional context.

Keywords: work placement, blended learning, case based studies, online technology, industrial engagement

Introduction

The global economic downturn has placed a new emphasis on employability and transferable skills. In a National Survey of Employers in Ireland (McGann & Anderson, 2012), many employers called for more work placement within undergraduate courses, enhanced cooperation and collaboration between enterprise and academia across a range of opportunities and incorporation of more 'real life' skills within higher education courses for graduates.

Authentic learning as a pedagogical approach "*typically focuses on real-world, complex problems and their solutions, using role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice"* (Lombardi, 2007). Work placement is widely used in curriculum design to meet the need for Authentic learning.

Work placements can provide diverse learning experiences for students to enable them to gain the transferable generic skills that employers seek (Sheridan & Linehan, 2011); learning is contextualised and socialised, and the forms of learning (for example, emotional intelligence and coping with the

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unexpected) are those that are not generally recognised in traditional, disciplinary learning contexts (Sheridan & Linehan, 2013). Because the workplace is the context of practice, learning in the workplace is considered a form of "Authentic" learning informed by real contexts, activities, and best practice (Franz, 2008).

The placement of students is however often a problematic process. There are difficulties sourcing placement opportunities for a growing number of students (Sheridan & Linehan, 2013), and students are often reluctant to take up placements due to the difficulties associated with accommodation, transport and lack of payment for the placement. Thus a major concern raised by higher education staff, in relation to the work placement, is the lack of alternatives to placements within programmes.

Educational technologies have been successfully used as tools to mediate authentic learning (Herrington, 2006; Amory, 2014). Increasingly, our learning environments involve technology to mediate student-teacher, student-student and student-expert communication, particularly in online programs and increasingly in blended programs (Oliver, 2008; Parisio, 2011). The use of technology in education has the potential to create a more relevant learning experience for students and teachers (Donnelly & O' Rourke, 2007). Online instruction has emerged as an alternative mode of teaching and learning and a substantial supplement to traditional teaching (Tallent-Runnels *et al*., 2006; Bozalek *et al*., 2013). While eLearning may bear the risk of eliminating some of the important supports offered by traditional processes (O' Neill *et al*., 2004), the benefits of utilising technology, particularly for developing online collaborative links and activities, cannot be ignored. Online instruction now provides opportunities for the development of customised learning settings that can scaffold and support student learning to enhance and transform the traditional learning experience (O' Neill *et al*., 2004; Donnelly & O' Rourke, 2007; Oliver, 2008). Appropriately designed technology facilitated learning settings can be used to address learner needs and requirements in higher education, in particular, those facing students in large undergraduate classes (Oliver, 2008). Online technology can effectively mediate collaborative construction of knowledge including collaboration with experts in the workplace (Amory 2014).

Engagement of Higher Education Institutes with Industry has been identified as a key element required to increase employment, productivity and social cohesion (European Commission, 2011), and restore Ireland's competitiveness (IBEC, 2010). Therefore, it is necessary to address the disjuncture between curriculum design and what is required of working professionals, so that our students graduate prepared to confront the realities of the twenty-first century workplace (Franz, 2008; Bozalek *et al*., 2013); to reimagine how we engage with industry, foster relationships, and provide an authentic learning environment within the traditional classroom.

We conceived a case-based workshop to provide an authentic learning environment for large undergraduate classes and used Herrington's nine elements of an authentic learning environment (2010) as a conceptual basis for design: authentic context, authentic task, access to expert thinking and modelling of processes, provide multiple roles and perspectives, support

collaborative construction of knowledge, promote reflection to enable abstractions to be formed, promote articulation to enable tacit knowledge to be made explicit, provide coaching and scaffolding by the teacher at critical times; provide for authentic assessment of learning within the tasks. To facilitate an authentic learning context (biopharmaceutical industry) within the traditional classroom, we utilised online technology in the design. In this paper, we describe (1) a one day case-based workshop delivered using a blend of online and traditional classroom environments and (2) evaluation of student potential for development in relation to the following Level 8 standards (QQI, 2014): Knowledge (specialised knowledge related to the pharmaceutical sector), Know How (research skills and problem solving) and Competence (teamwork/roles, professional communication, learning to learn).

Methods

The research was carried out at the Institute of Technology, Sligo (IT, Sligo) by staff involved in teaching "Workpractice" modules to full time final year Bachelor of Science Level 8 (B.Sc L8) students on the Pharmaceutical Science and Medical Biotechnology programmes.

A case study approach was used and research was designed as follows: Six case scenarios, based on real workplace events were developed collaboratively by the authors at IT, Sligo and the Health Products Regulatory Agency (HPRA). All scenarios represent real situations encountered in the manufacture and regulation of health products that require action or recommendation by the HPRA. A one-day workshop was developed in which students addressed the assigned case scenarios in a group setting and presented their recommendations in an online consultation session to HPRA experts and to a live audience simultaneously. A survey was designed to elicit student perceptions of the learning environment, own learning and professional competencies.

Participants

Seventy two full time undergraduate students participated in the workshop. Of these, 21 students were taking a "Workpractice" module as part of the B.Sc L8 Pharmaceutical Science and 51 were taking a similar module as part of the B.Sc L8 in Medical Biotechnology. A majority of students had just completed summer work placements in Pharmaceutical or Medical Device industries.

Workshop learning environment

A blend of traditional classroom, library meeting rooms and online learning environments were used to engage students in an authentic [workplace] context (Herrington *et al* 2010) and to facilitate student's access to expert thinking. The workshop design incorporated on-line technology as a tool to mediate learning, *learning with* technology as distinct from learning from the technology, a position reinforced by Amory (2014).

In the days prior to the workshop, a background lecture on the structure, role and function of the HPRA was delivered separately to both groups in a classroom setting and students were reminded of some problem solving methodologies (e.g. brainstorming, Is/Is not, Root Cause Analysis, 5 Whys) that had been introduced in other modules. Lecture slides and links to some

key resources were made available online through Moodle® version 2.6; IT Sligo's virtual learning environment. Students were randomly assigned to 12 groups of six (each containing two Pharmaceutical & four Medical Biotechnology students).

On the morning of the workshop students reported to a classroom setting. Each group was presented with a regulatory case scenario to address and assigned a breakout location in the Yeats Library. In most cases breakout rooms contained whiteboards and all had full access to the internet and Yeats' library resources. Student groups were given two hours and 30 minutes to research their problem scenario, identify a solution or course of action, consult with a paired team and upload to Moodle® a single MS PowerPoint 2010® (Microsoft, Redmond, WA, USA) presentation (5 slides) outlining their recommendations.

The afternoon session was held in a large tiered lecture theatre and began with a brief introductory presentation by HPRA staff, facilitated by online web conferencing through Adobe Connect 9.0®(Adobe, San Jose, CA, USA). A moveable webcam was used to facilitate video feed from the lecture theatre. Representative spokespersons from each team presented their recommendations simultaneously to the theatre audience and to HPRA staff (via Adobe Connect®). HPRA experts then gave feedback to each team and answered questions from the audience. All team members were required to stand at the podium during each presentation.

Case scenarios

Regulatory case scenarios covered the following topic areas: 1) Quality Defects, 2) Pharmacovigilance, 3) Supply chain, 4) Bioprocessing, 5) Tablet manufacture, 6) Active Pharmaceutical Ingredients. Each consisted of a descriptive paragraph outlining a particular situation encountered by HPRA staff during the course of their work, followed by a series of questions on how the situation would best be investigated. Students were asked to play the role of the HPRA in addressing each scenario.

Evaluation: Survey

The study used a survey instrument to assess students' perceptions of their learning. This instrument served to reveal students opinions on their learning, force students to reflect on their own competencies and collect qualitative feedback on how the workshop could be improved. The survey was divided into 3 main categories: 1) Workshop facilitation and learning environment, 2) Work-practice learning outcomes: knowledge and understanding of the Pharmaceutical sector, skills in research, problem solving and communication, 3) Self-evaluation of professional competencies. The survey included 44 items that used a Likert scale to allow students to express their level of agreement with statements (1 – low level of agreement 5 high level of agreement) and six open ended questions on the same themes.

The study used both quantitative and qualitative techniques. Fifty seven completed surveys were returned (N=57). Quantitative data were captured into MS Excel® (Microsoft, Redmond, WA, USA) and item checks were performed to verify the scores. Student responses were coded quantitatively according to the Likert scale and descriptive statistics were applied.

Qualitative contextual data was collected from student responses to open questions in the questionnaire and tutor observations during the workshop The study adopted a constant comparison and triangulation method to analyse the data.

Results

Results are summarised below under categories related to our research questions 1) Learning environment, 2) Student self-assessment of Learning - Knowledge, Know How, Professional Competence, 3) Student confidence in own competencies. Quantitative data items were categorised. Mean responses to Likert scale rating (1-5) were calculated for all items to indicate students' strength of association with each statement. The standard deviation (SD) of responses for each item indicates the variability of response for each statement. Qualitative responses were coded to each category and relevant subcategories (knowledge, know-how, competence).

Learning environment

Students report a high level of satisfaction with the learning environment overall (Table 1). In particular, they report high levels of satisfaction with the level of meaningful feedback received (mean rating of 4.26 ± 0.10 with a low variation in response SD 0.77), the level of critical engagement (4.16 ± 0.10, SD 0.75), the level of participation encouraged (4.05± 0.13, SD 0.95) and the facilities provided (4.04± 0.09, SD 0.68). Results indicate that the environment was conducive to learning (4.12 ± 0.10, SD 0.78) and demanded that students behave as professionals (4.05± 0.100.13, SD 0.94). Students report lowest levels of satisfaction, with a higher variation in response, for the clarity of instructions given (3.84± 0.15, SD 1.12) and help in identifying the appropriate resources (3.82± 0.13, SD 0.98). Qualitative data indicates that the two major strengths of the learning environment were:

- Mixed team structure: "*Combining two different courses" and "working with unfamiliar people,* "*developed teamwork and communication skills." "Everyone could contribute to improve understanding"* and *"Share ideas."*
- Authentic industry context: The "*real-life case scenarios get people thinking and behaving like professionals*." The workshop "*forces you to think in more detail*" "*to solve problems." "Coming up with a valid reason for corrective action was enjoyable*." Time pressure "*encourages brevity and sharpness of thinking*." "*Feedback from HPRA experts*" enabled students to "*better understand how industry deals with issues."*

The most commonly expressed areas for improvement are a revised schedule incorporating more breaks and with "*more time for research, presentation preparation and practice*," and more opportunities "*to engage the whole team in presentations."* Some students expressed a need for *"Clearer instructions*" more background information and more consistency in facilities for teamwork.

Student Self-Assessment of Learning

Students perceived that participation in the workshop had developed learning outcomes related to their knowledge of the Pharmaceutical sector (Table 2), know-how in relation to research and problem solving skills (Table 3) and professional competencies in teamwork and communication (Table 4). When asked to record three main points of learning at the end of the workshop, 44% of students responses related to knowledge of the Pharmaceutical sector 30% related to professional competencies) and 26% related to know-how. The most cited specific points of learning were "*effective teamwork*," "*tools for problem solving,"* and "*the role and responsibilities of the HPRA."*

Knowledge of the Pharmaceutical Sector

Results of quantitative analysis (Table 2) suggest that the workshop has helped students to understand the role of the regulatory authorities more clearly (4.14± 0.11, SD 0.82). Students also reported a deeper insight into the responsibilities of pharmaceutical industry professionals, industry structures and practices and the links between Quality Management Systems and Regulatory affairs. Higher variation in response (SD) is evident for some items in the knowledge category particularly those that relate to connections to broader coursework. A similar pattern is observed in qualitative data.

Know How: Research skills and problem solving

Students perceived positive learning outcomes for all items related to research and problem solving with mean values ranging from 3.49 ± 0.12 to 3.84 ± 0.12 (Table 3). More students rate the development of critical thinking skills and problem solving skills positively while fewer students are positive about the development of their ability to source documentation.

In open ended questions, students cited "*tools for problem solving*" as one of their key learning outcomes, representing 13% of all coded responses for the workshop and the highest outcome in the know-how category. Planning and time management skills and the skills to organise and structure information for presentations were also cited in this category.

Competence: Teamwork/roles, professional communication, learning to learn

Effective teamwork is the major competency developed through participation in the workshop and the learning outcome most commonly cited by students across all categories (Table 4). "*How to form a team" "working with unfamiliar people" "the importance of team roles" "how to encourage participation by all" "communicating with team members" "compromise" and "leadership"* are all reported in this context. Communication skills are also cited frequently as a point of learning in open ended questions however, references to communication are ambiguous; there is some indication that communication skills in the context of teamwork are perceived positively while communication skills in the context of delivering presentations are not. Results related to learning to learn are also unclear based on quantitative data in this section and are perhaps more evident in the results that follow on students confidence in their own competencies.

In open questions related to setting targets for professional development students most frequently cited the improvement of presentation skills and public speaking as their main focus, followed by teamwork and communication, problem solving skills, understanding of industry QMS and critical thinking. Organisation and planning, research and information skills were also cited as a focus for professional development. Only one student identified familiarity with on-line technology as a target for professional development anticipating that it would be an important channel of communication in the workplace.

Table 1: Learning Environment	Mean (N=57)	SE	SD
The tutors/HPRA staff provided meaningful feedback on my work	4.26	0.10	0.77
The tutor was helpful when I had difficulties or questions	4.19	0.12	0.91
The workshop encouraged critical engagement with the material	4.16	0.10	0.75
How successful was the workshop in creating an environment that was conducive to learning?	4.12	0.10	0.78
The workshop demanded that I behave as a competent professional	4.05	0.13	0.94
The workshop encouraged student questions and participation	4.05	0.13	0.95
Facilities for the workshop were satisfactory	4.04	0.09	0.68
The workshop was appropriate for the stated level of the class	4.00	0.11	0.83
The workshop was organized in a way that helped me learn	3.91	0.11	0.82
Considering both the limitations and possibilities of the subject matter and the course, how would you rate the overall effectiveness of this workshop?	3.84	0.10	0.72
The workshop instructions were clear	3.84	0.15	1.12
The Tutor/HPRB representative helped me identify the resources I needed	3.82	0.13	0.98
I had clear expectations of the workshop at the outset.	3.65	0.11	0.86

Table 2: Knowledge of Pharmaceutical Sector	Mean (N=57)	SE	SD
The workshop helped me understand the role of the regulatory authorities more clearly	4.14	0.11	0.82
The workshop helped me to understand the ethical responsibility of pharmaceutical industry professionals to ensure quality, safety and efficacy of medicines	3.88	0.13	0.98
The workshop gave me deeper insight into the responsibilities of employees in the pharmaceutical industry.	3.82	0.13	0.95
The workshop gave me deeper insight into the structure of Quality Management Systems within the pharmaceutical industry	3.72	0.11	0.85
The workshop gave me a deeper insight into the how Pharmaceutical Regulation informs industry structures and practices	3.68	0.11	0.81
The workshop complemented my understanding of Pharmaceutical regulation from previous coursework.	3.68	0.14	1.07
The workshop helped me make progress in understanding the terminology used in pharmaceutical regulation.	3.58	0.14	1.07
The workshop helped me to conceptualize the role of quality assurance in pharmaceutical manufacturing.	3.56	0.14	1.02

Table 3: Know How: research and problem solving skills	Mean (N=57)	SE	SD
The workshop developed my ability to think critically about the subject	3.84	0.12	0.90
The workshop developed my ability to read and think critically	3.84	0.12	0.92
The workshop provided the opportunity to practice problem solving skills	3.81	0.10	0.76
The workshop provided the opportunity to practice research skills	3.81	0.13	0.97
The workshop improved my problem-solving skills	3.74	0.12	0.92
The workshop developed my ability to source guidance documents.	3.60	0.13	0.98
The workshop developed my ability to provide constructive critiques to others	3.49	0.12	0.89

Table 4: Teamwork, communication, learning to learn.	Mean (N=57)	SE	SD
The workshop developed my ability to interact with diverse groups of people	4.02	0.11	0.82
How satisfied were you with the standard of your team's presentation?	3.88	0.11	0.84
I am confident that I can address any gaps in my knowledge and skills highlighted during the workshop.	3.86	0.12	0.93
The workshop highlighted gaps in my knowledge.	3.77	0.11	0.83
In this workshop, I learned a great deal	3.60	0.11	0.86
The workshop developed my communication/presentation skills	3.46	0.13	0.95

Table 5: Self-evaluation of professional competencies.	Mean (N=57)	SE	SD
How satisfied were you with your effort in this workshop?	3.81	0.11	0.85
How competent did you feel in contributing in group discussion?	3.75	0.13	0.99
How competent did you feel in identifying appropriate resources to address your case scenario?	3.61	0.14	1.03
On the basis of the workshop I feel confident in my professional skills and knowledge base?	3.56	0.13	0.95
How competent did you feel in directing the groups' activities?	3.44	0.13	1.00
How confident did you feel to volunteer as a presenter?	2.65	0.16	1.19

Student confidence in own competencies

When asked to reflect on and rate their own efforts, competence and confidence in performing the assigned workshop task, students reported being satisfied with their own efforts (3.81±0.11) and competent in their ability to contribute in group discussion (Table 5). While students most commonly

report "sourcing information" as their main contribution to addressing the assigned case scenario, they report slightly lower levels of self-perceived competence in this skill (3.61±0.14) with a higher variation in response (SD1.03). Students self –perceived competence in directing group activities is lower than for other roles reported (3.44 ±0.13), however, 34% of students report various leadership roles as their main contribution (Fig 4). Students also reported contributing ideas/brainstorming (16%) and preparing slides for presentation (11%).

65% of students reported being least confident about their ability to present and were reluctant to volunteer for this role (2.65 ±0.16); quantitative ratings related to confidence to present, also elicited the highest variation in response (SD1.19). Their level of background knowledge and understanding of terminology was a concern for about 13% of students. 11% of students were not confident about "*being heard*" in group discussion. Smaller numbers (4%) of students reported leading people and sourcing authoritative information as the skill in which they were least confident.

When asked what advice they would give to future students undertaking the workshop task the most common responses related to the benefits of active participation: *"Give it your all; "be brave;""be confident in your abilities;" "don't be afraid to speak up and ask questions;" "share ideas;" "everyones ideas are valuable;" "listen and respect everyone's opinion."* We have coded all other student advice as follows: Actively manage schedule and resources: *"Be organised;""Don't muck about- manage time;" "Delegate roles as quickly as possible (to the most suitable people)" "Assign leader with final editorial privilege at outset (usually presenter;" "Put slides together earlier make time for presentation practice."* Take time to clearly define the problem at the outset: *"Take time to understand terminology/problem before rushing in;" "Brainstorm and plan at the beginning"* Prepare, anticipate knowledge and skills required: *"take time to understand work that HPRA do beforehand."" revise research skills;" "read up on tools to help form and organise teams."* Focus on key aspects and use appropriate tools: *"stay focussed on the problem- keep asking questions to find root cause;" "use appropriate tools;"" highlight key aspects - stick with these."* Practice presenting &volunteer: "*even if you are unsure*."

Discussion

Many employers are calling for more work placement opportunities within undergraduate courses and the incorporation of 'real life' skills in education (Sheridan & Linehan, 2011; McGann & Anderson, 2012). In our experience, placement of students is often a difficult process and not always practical with large class sizes. We decided, with this research to reimagine how we engage with industry and foster relationships. Using the principles of authentic learning outlined by Herrington *et al*., (2010) we designed a blended learning workshop combining online technology with the traditional classroom.

The workshop design deliberately incorporated online technology as a tool to mediate learning rather than learning from the technology. The technology employed during this workshop can be categorised as recommended by Amory (2014): as an information stream providing relevant resources; as an

enabler of communication and collaboration between academic staff and students in IT Sligo and HPRA experts in Dublin; and as an information transformation tool, where students gathered information from different sources and presented it back to the HPRA staff. While students were not specifically asked about the technology interface in survey questions, it is interesting to note that in all qualitative responses only one student made reference to the online learning technology; citing more familiarity with technology for online presentations" as a target for his professional development. This implies that the technology was perceived by students as a mediator of learning and not as an object of learning.

Results indicate that the workshop design was successful in creating an authentic learning environment in which students were engaged in learning. The principles of authentic learning outlined by Herrington *et al*., (2010) provide a useful structure for discussion:

- Authentic context: Regulatory case scenarios supplied to the students were 'real life' situations encountered by HPRA staff. Student survey data and qualitative responses support their perception of having to operate at a more professional level and the value they placed on "real-life" cases and placed value on the mixed team structure. They also recognised the reality of time pressure, unfamiliar contexts and the importance of effective communication skills.
- Authentic task: The tasks were complex, comprehensive and mirrored activities relevant to the kinds of problems to which knowledge is applied in the workplace. Students report on having to organise themselves to work as a team, manage time and resources available, identify and source relevant regulatory guidance documents, draw on their knowledge of the relevant subject matter developed through coursework and work-placement, and utilise both problem solving and professional communication skills. Student feedback suggests that the process of solving real problems is a key motivating factor for engagement.
- Access to expert thinking and modelling of processes: Students interacted with their peers who may be more knowledgeable (Vygotsky, 1978), lecturers and experts in the field. This sharing of knowledge can both be recognised as important facilitators of learning. The use of peer to peer learning is particularly evident in the results of problem solving skills: skilled students have evidently modelled the use of tools for problem solving for others; and in relation to the preparation of presentation materials and presenting where those that volunteered to present were perceived as leaders.
- Providing multiple roles and perspectives: Students were required take on the role of the HPRA expert in order to examine the case studies. They also developed insight into the industry roles and responsibilities of the Qualified Persons for quality assurance (QP) and for pharmacovigilance (QPPV).
- Supporting collaborative construction of knowledge: Student's advice to future students to "*give it your all and participate*" suggests that students recognised the value of collaborative learning through effective teamwork

and also through interaction with experts "*Ask HPRA questions if you have any."*

- Promoting reflection to enable abstractions to be formed: Reflection is seen in authentic learning as social and interdependent, working in collaborative groups, rather than individual process (Bozalek *et al*., 2013). Students were able to compare their ideas to more knowledgeable others, academic staff and HPRA experts, and thus associate and integrate new knowledge into their conceptual frameworks. The study used a survey instrument to assess students' perceptions of their learning, encourage students to reflect on their own competencies, to identify areas for development and on the basis of reflection, offer advice to future students.
- Promoting articulation to enable tacit knowledge to be made explicit: Tutors encouraged students to brainstorm and use whiteboards to discuss and map out their understanding of the case issues. Students were provided with the opportunity to present their growing understanding of the tasks to the HPRA representatives and ask questions. The variety of case scenarios allowed students to learn by listening to the interaction of others.
- Providing coaching and scaffolding by the teacher at critical times: The scaffolding of a background lecture prior to the workshop, clear instructions on the task at hand and schedule for the day, links to useful resources through Moodle® and a tool to encourage reflection at the end of the workshop are viewed as important in this respect; some students reported feeling not sufficiently prepared with background knowledge on the HPRA as a result of not attending the background lecture or taking time to read up beforehand. During the workshop, academic staff provided a supporting role, guiding and encouraging students, rather than transmitting knowledge.
- Providing for authentic assessment of learning within the tasks: Students were assessed on the group presentation, a written team report and as individuals for participating in reflective self- evaluation. Requiring individuals to participate actively in presenting was considered to be important for future assessment. There is also scope to include peer review in future assessment.

Student's engagement, learning and reflection were evaluated by means of a qualitative and quantitative survey. Results showed that students were very satisfied with their learning, level of critical engagement and feedback received from tutors and the HPRA. Knowledge related to their field of interest was the highest cited learning outcome, with competence in teamwork and communication highly scored also. In terms of know-how, students reported most learning in problem solving and planning, and critical thinking to a lesser extent. In terms of their own participation, student responses indicated satisfaction with their ability to work as part of a team, but less satisfaction in willingness to volunteer as a speaker and direct the group. Furthermore, when asked what areas would they focus on for professional development, presentation skills and public speaking was most commonly identified.

Student's advice to future students supports the idea that students have achieved a collaborative transformation (Amory 2014) in their understanding

of how to effectively mobilise a team to solve a workplace problem and promote professional development. They say: participate, actively manage the schedule and your resources, take time to clearly define the problem at the outset, prepare- anticipate the skills and competencies required, focus on key aspects and prioritise, practise presenting and don't be afraid to volunteer. To explore collaborative transformation more effectively, further studies comparing pre and post evaluation of student competencies are required.

We conclude that this blending learning approach taken, succeeded in promoting learning in the areas of knowledge, know-how and competence. Students reported dissatisfaction with the amount of preparation time given and guidance received. The narrow timeframe and guidance given were in order to promote problem solving skills and simulate a real work situation. That the students struggled with this highlights the need to embed these activities throughout the course structure.

We are encouraged by the words of one particular student: "*Do this more often - it engages students in critical thinking and helps them to better understand their potential.*"

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