

Using Enquiry Based Learning to Create an Engaging Learning Environment

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Abstract

This paper is a unique contribution from a team of lecturers and students who engaged with an enquiry based learning process in higher education. This approach was adopted across all four years of the Occupational Safety and Health Programme where lecturers worked in teams and merged interdisciplinary areas into scenario led sessions. The team worked with management to create an appropriate learning environment with round tables, flip charts, interactive whiteboard and computers to facilitate skill development in critical thinking, problem solving and team work. Each year of the programme undertook a mandatory enquiry based module and this paper reflects on the implementation and impact of this approach. Data was collected using interactive clickers from over 160 students and focus groups with lecturers.

The evaluation led to revision of the handbook templates and a reweighting of the process - product assessment criteria. This paper examines the steep learning curve for lecturers and students undertaking this approach and the supports required. The paper concludes with suggestions for future developments and lessons learned from practice.

Key words: enquiry based learning, interdisciplinary, resources, appropriate learning environment, interactive clickers, evaluation, templates

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Introduction

The paper seeks to share the experiences of the transition process our programme underwent in changing a fifth of their entire course to Enquiry Based Learning (EBL), engaging the learners and lecturers in interdisciplinary student centered learning. It identifies the rationale, the resources developed and the challenges facing a Programme in embarking on the delivery of EBL modules alongside the more traditional didactic modes of teaching and learning. The academic rationale for change stemmed from the fact that the B.Sc. is interdisciplinary in nature and logic would suggest rather than the student dealing with isolated modules they should be challenged to understand the relevancy of the knowledge and its application to real life situations. In addition, our students needed to be encouraged and stimulated to take responsibility for their own professional development in the mastering of transferable skills.

EBL is a mode of learning which represents a shift from the teaching paradigm to the learning paradigm (Barr & Tagg, 1995), where the tutor promotes autonomy and engages the students as partners in the learning process (Hudspith & Jenkins, 2001). (Hutchings, 2006) states that EBL environments are those where the learning is driven by a process of enquiry and the student takes responsibility for the learning. The tutor establishes the task and supports or facilitates the process, but the students pursue their own lines of enquiry, draw on their existing knowledge and identify the consequent learning needs. They seek evidence to support their ideas and take responsibility for analysing and presenting this appropriately, either as part of a group or as an individual supported by others (Kahn & O'Rourke, 2004)

There are many benefits from the EBL approach with suggestions that it can improve the student experience, enhance recruitment satisfaction and retention (Kahn & O'Rourke, 2004). The use of group work facilitates the acquisition of knowledge and several other non subject specific attributes such as communication skills, teamwork, problem solving, independent responsibility for learning, sharing information and respect for others (Johnson & Johnson, 1989). EBL encompasses group work and hence equips students with not only knowledge but also a set of

desirable graduate attributes which are known as transferable skills). This approach to teaching promoted autonomous learning, transferable skills and attendance when compared against traditional ways of teaching (Backx, 2008). However, it should be mentioned that students and staff need to be supported when making transitions in adopting or adapting to new approaches to teaching, learning and assessment, especially with the more open-ended approaches involved in EBL (Kahn & O'Rourke, 2004). In many ways, the challenge is to find effective ways to support students within this process so that the enquiry is able to yield effective outcomes. It is not enough to ask students to complete a finished product; the process needs to be supportive, as recognised by (Edelson, Gordin, & Pea, 1999) .

The Innovation

At the outset it must be acknowledged that fostering and encouraging student centered learning was a key objective set by Management within the School of Science and support was given from the Institutes' Educational Development Unit (EDU). Our team recognised a difficulty in meeting the National Framework Qualifications (NFQ) standards relating to skill and competence using traditional didactic methods hence we redesigned our programme changing one fifth of it to EBL with learning outcomes relating to transferable graduate skills, interdisciplinary problem solving and professional competence. Radical organisational and structural changes were made within the programme to accommodate these changes.

The B.Sc. Degree in Occupational Safety and Health is a semesterised 3 year programme with an option to progress onto the one year add on, Level 8, all EBL modules are mandatory. A decision to title the modules as Occupational Safety and Health Enquiry Based Learning (OSH- EBL) ensures students identify these modules as been course specific and they see a laddering approach building on the modules taught from semester to semester across each course year (see Table 1). In first year a greater credit weighting is given to the EBL modules than in the subsequent years, this is because the transition for the learner from didactic teaching styles to this new approach requires significant effort and autonomy on their part. Assessment of all

EBL modules is through continual assessment and reduces the final examination load on the student at the end of the semester.

Table 1: Layout of EBL Modules in B.Sc. Occupational Safety & Health Programme

Year	Semester	Module Title	Timetabled Hours	Credits
Year 1	Semester 1	OSH EBL 1	5Hrs	10 credits
	Semester 2	OSH EBL 2	5Hrs	10 credits
Year 2	Semester 1	OSH EBL 3	5 Hrs	10 credits
	Semester 2	OSH EBL 4	5Hrs	10 credits
Year 3	Semester 1	OSH EBL 5	5 Hrs	5Credits
	Semester 2	–	–	–
Year 4	Semester 1	OSH EBL & Workbased Studies	3 Hrs	5Credits
	Semester 2	OSH EBL 6	3 Hrs	5Credits

A team of fourteen academic staff facilitated seven mandatory modules of OSH-EBL to undergraduates starting in the first semester of first year, through to the final semester of fourth year. The academic staff who teach the students on a particular semester are also the facilitators for the OSH-EBL modules and are responsible for setting the enquiries or scenarios, hence the EBL enquiries for a specific OSH EBL module will reflect on the subject matter being delivered in that semester. The role of the tutor changes to facilitator and the responsibility for enquiring and learning is shifted from lecturer to student. While we recognised that best practice would be to introduce significant changes in teaching and learning on a phased basis, this option was not available which resulted in a steep learning curve for both the students and

staff. Many of the lecturers involved had individually engaged in Problem Based Learning (PBL) and group based projects with their students but none had prior experience of acting as facilitators to groups of students who were being assessed on a continual basis through group work. It was widely recognised by the academic staff that the students may resist this radical new approach to modules where group work was compulsory.

Despite the significant volume of literature available on EBL we found little guidance as to the resources required or the supports needed to guide both facilitators and students in this process. This led the team to seek designated rooms with timetabled facilitated sessions and develop a student handbook which held templates to guide the students through the EBL process. A significant evaluation of the entire process was carried out after the first semester with each student group and among all the facilitators involved in that semester. This feedback allowed the facilitators to hold workshops where the focus was on incorporating student and facilitator feedback to enhance the learning experience ease the transition and continually improve the process for the future.

How it Works in Practice

The programme sought two flat class rooms one larger than the other to be equipped with networked computers and housing round tables and moveable chairs. Each room held a fixed interactive whiteboard, projector, a number of moveable white boards, flipcharts and dedicated storage space. The larger room had 16 dedicated computers while the smaller room had 12. Timetabling of EBL modules was given priority in these classrooms with the larger room almost dedicated to first, second and third year undergraduate EBL modules; the smaller classroom was a dedicated fourth year undergraduate classroom where all their classes were timetabled.

The students are timetabled for 5 hours per week of EBL in the dedicated classroom. Students were assigned to no more than 4 per group with a student: facilitator ratio of 12:1. The groups move among facilitators so that all experience similar enquiries

and complete the overall module learning outcomes. The final year undergraduates had 3 hours of EBL per week.

Scenarios in semester 1 were presented to the group on a 2 week cycle and assessment of the modules was continuous with an individual attendance mark factored in. As this approach to learning in the first Semester was new and introduced across all course years the student groups were given a handbook designed by the OSH-EBL team which contained templates to prompt them through the basics of a problem solving process. To support the students in the process the first eight weeks of all course years dealt with scenarios designed around communication, group dynamics and basic problem solving skills. The groups were asked to assign roles within the group for each of the scenarios i.e. leader, spokesperson, scribe and timekeeper.

Assessment of OSH EBL Modules

Assessment of the modules is by continuous assessment and an individual attendance mark is factored into each students mark. In the first Semester the assessment was broken down into 60% for the process (group work and individual reflections) and 40% for the product. The student group were given a template designed by the health and safety team which contained tools to prompt them through a problem solving process and this template was marked by the facilitator through out the process. This template required the group to brainstorm, concept map, identify learning gaps, create action plans, conduct individual and group learning and storm a solution which resulted in final product development. In the first semester a scenario ran over a two week period. At the end of each scenario the individual was asked to reflect on the learning process and the group dynamics in a learning log. Significant formative feedback was given to the groups and facilitators reported they got to know the students better as a result of the modules with one EBL facilitator of a first year group saying, 'I know each student by name from having them in EBL and feel I know them now, its great to see them becoming more confident each week'. Facilitators were able to share their experiences and noted if particular individuals

were finding the module challenging so additional supports could be focused on encouraging them.

Evaluation

The outcomes have been evaluated through a process of integrative evaluation which combines responses from surveys, questionnaires, (Draper, Brown, Henderson, & McAteer, 1996) observations, discussions with staff and student focus groups to provide insight on the student experience. The perspectives of students and staff across all four years have been triangulated however for the purpose of this paper the data presented will represent the views of the students and facilitators on their experiences of engaging in this new mode of teaching and learning and lessons learned from practice.

A range of evaluation methods used including learning logs, pre and post survey questionnaires distributed in September 2008 and May 2009. Interactive clickers were used to stimulate discussion during the focus group sessions in December 2008 and May 2009. The data examines the perceptions of students to EBL, skill development, structure of EBL and resources provided. Some facilitator perceptions relating to the process will also be examined. The response rate varied as is represented in table 1 below.

Table 2 Response rate to the mixed methods approach.

Method	Number	Participation Rate
Pre Survey Sept '08	160	100%
Student Interactive Clickers Focus Group Dec '08	141	100%
Lecturers Interactive Clickers Focus Group Dec '08	8	100%
Post Survey May '09	92	100%
Student Interactive Clickers Focus Group Dec '09	79	98%
Learning Logs	164	100%
Staff Team Review Day	8	100%

Total Number of Students partaking in EBL Modules =164

Findings

These findings present perceptions on the implementation and impact of this approach on learners' experiences. These are themed under:

1. Perceptions of EBL and its benefits
2. Perceptions of learning through EBL
3. Perceptions of assessment and attendance
4. Satisfaction with resources for EBL

1. *Perceptions of EBL and its benefits*

The learners' reaction to enquiry based learning has changed throughout the course of first year. In December 2008, 36% found it positive, 44% found it negative and 40% were unsure. In May 2009 there has been an increase in support with 48% ranking it a positive experience and only 21% finding it a negative experience. The majority of negative responses came from the 4th year group which may be related to their resistance to such a change coming in their final year at college. Students reinforced the use of enquiry based *"because its hands on and what you learned is put into practice so you can understand fully"* negative comments emphasised the difficulty learners have with taking personal autonomy for the learning process *"Being given all the information would put less stress on us to find it"* and *'when you ask a question, you are answered with another questions that leaves you confused'*).

EBL supported a range of skills development with team work being the primary skill developed. The learners perceptions of skills development changes as learners progress through 2nd, 3rd and 4th year with linking theory and practice being the top skill gained by 4th year learners.

Almost half the respondents indicated that the best benefit was in getting to know their classmates better. This was especially striking in the 4th year group. Increased confidence has been reported in focus groups with one student reporting *'I'm not afraid to ask questions in my group anymore not like i was first, and don't feel as nervous presenting EBL has helped with all this stuff'*. In relation to professional skills one 3rd year student in an on line post survey commented *'at first i hated EBL with a passion but now I know that*

with empathetic listening, good teamwork and pooling our knowledge that it does work, you shouldn't be let out to the workplace without it.'

A question asked in the Post Survey in May '09 indicated that over 63% of the groups found that the EBL modules helped them with other modules and 67% of the respondents found that EBL modules helped them see the relevance of science to Occupational Safety and Health.

2. Perceptions of Learning through EBL

Overall 35% of students perceived they learned less in EBL modules compared to their learning in traditional taught modules the perceptions of 1st year and 2nd year groups were they learned more or couldn't compare the learning. 53% of the 4th year group responded they learned less which may be as a result of associating learning with being given information. This is captured by a 4th year student and summed up in her comment *'how are we expected to have time to learn when we spend so much time searching for information and then you won't tell us if its relevant or not'*.

As EBL modules are assessed continuously the students are expected to put in a continuous work effort and this may account for the fact that 40% of them indicated their workload was more than in other modules, however it would be unfair not to reflect that significant concerns were raised by facilitators regarding students feedback and their own workload for EBL. A decision to increase the scenario cycle from 2 to 3 weeks was made when over 75% of facilitators and 87% of students felt the scenario length should be increased with the 78% stating the optimum length for a scenario being three weeks.

3. Perceptions of assessment and attendance

A big concern in any group based work is its assessment. In December 2008 over 70% of students indicated their marks in Semester 1 were not a fair reflection of the groups' effort, 20% said yes and 10% were unsure. In May 2009 this improved in that 48% said yes their marks were a fair reflection of the groups' effort and 41% said no they weren't. Assessing group work is possibly one of the biggest challenges in EBL and as a result of the students'

feedback the team changed the marking scheme in semester 2 with more individual contribution being given which may have accounted for the improved response.

Overall 60% of students felt that attendance should be factored into the overall mark being given to an individual with one student summing up *'if your not there you won't know whats happened and others have to do the work so thats not fair'*. Significant comments related to the amount of marks deducted for attendance ... *'marks deducted for missing classes shouldn't be so high'*.

A significant consequence of implementing EBL has been on class participation rates which are now at 87% for first year EBL modules and approximately 78% for EBL modules among the other course years. Learners were asked has the EBL module improved your attendance at college and over 64% indicated it had.

Feedback from students in Semester 1 indicated that over 85% wanted to switch groups at least once during the semester. In semester 2 all groups were randomly assigned once again and based on the feedback student groups were switched half way through the semester. Students' perceptions to switching groups reversed in Semester 2 with 51% of the students indicating it had a negative effect and disrupted the EBL process.

Overall in semester 1 over 53% of the students felt the feedback on EBL performance was poor but this improved with only 26% stating their feedback was poor in semester 2. The increased scenario length in semester 2 included a summative and formative feedback session which possibly accounts overall for the improved response. It should be noted that the majority of negative responses came from the 4th year group in semester 2 with 56% of that group indicating their feedback was poor, this is most likely attributed to the fact that their scenario in Semester 2 was a real work based enquiry which spanned the entire semester and only formative feedback was given with summative feedback given at the end of term.

4. Satisfaction with EBL

Over 50% of the students wanted to become more involved in sharing ideas to improve EBL, while 35% feel they have adequate involvement already, this enthusiasm to engage in the continual improvement of these modules is very much the partnership approach required for this type of learning.

Students rated resources in EBL as been good in all cases except with regard to the quantity of computers available. The availability of white boards and access to facilitators scored the highest ratings 65% and 52% respectively with computers scoring the lowest satisfaction rating of 16%. This overall positive response from students is most likely due to the approach taken by the Programme during the planning phase of EBL in making significant organisational decisions to ensure the programme resources could be harnessed with a central focus on this new approach.

Conclusions

Our findings support studies that EBL improves communication skills, self esteem, team work, attendance and promotes a sense of belonging among students. Our students reported that EBL improved their professional competencies and explored the links between modules.

Assessment of EBL like all group work is a significant challenge but is likely to be more acceptable to students and facilitators if the marking process is sufficiently flexible to adopt a range of marking strategies and the individual's contribution within the group process is given merit. EBL students and facilitators found applying an attendance factor to the timetabled group sessions to be acceptable and found that changing group members disrupted group dynamics over a 13 week period.

A well resourced team based EBL approach is a positive but challenging experience for academic staff but a sense of 'being in it together' supported by team dialogue and reflection on practice is rewarding and best summed up by comments made by a facilitator during a team reflection '*my biggest teaching reward has been EBL but its been my biggest challenge so far*'.

Areas of development were highlighted in this study and the team recognises the need to ensure learners are informed about the EBL process. This will be achieved by creating dialogue space for scenario evaluation to give the learners and staff opportunity to reflect on the learning and issues emerging. One of the learners captured the EBL challenge very well "*The idea and rationale behind EBL is good but the implementation is too hard and puts people off.*" The team will continue to be vigilant and cooperate to ensure that the implementation addresses the outcomes associated with these modules and creates a positive learning environment for staff and learners to enquire.

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