A STUDENT GUIDE TO ENQUIRY-BASED LEARNING

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1. What is EBL?

1.1 Welcome to a different kind of learning!

Enquiry-based Learning (EBL) is an active kind of learning being implemented in higher education institutions across the U.K. and world-wide. It is being used across university courses, in myriad subjects as diverse as Medicine, Geography, English and Engineering. EBL gives students the opportunity to take control of their own learning, and get what they want and need from their university education.

This basic guide to EBL has been written by a student for students. In order to produce this guide, students have been consulted about EBL as they have experienced it, and used it as a tool for learning. The product of these discussions is this guide. In an attempt to make this a useful resource across the disciplines, all the hints, tips, problems and discussions have come from real life student EBL experiences. It's here for you, to help you on your yellow brick road to practising good EBL. In here, you'll find basic information, hints and tips, questions and answers, quotations and opinions from students about EBL.

1.2 What exactly is 'EBL'?

EBL is a kind of self-directed learning whereby the student takes hold of the learning process, and takes an *active* role in knowledge acquisition.

The Centre of Excellence in Enquiry-based Learning at the University of Manchester has described EBL as

> 'an environment in which learning is driven by a process of enquiry owned by the student. The tutor establishes the task and 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 out relevant evidence and take responsibility for analysing and presenting this appropriately, either as part of

a group or as an individual supported by others. They are thus engaged as partners in learning.' (CEEBL 2005)

Students have argued that EBL facilitates a deeper learning experience, as essentially you're 'not just sat in a lecture with an old guy with a beard droning on about stuff you're not going to remember' (Linguistics student). EBL involves students playing an active role in learning, by leaving behind dusty lecture halls, to find out about their subject. This is done through interaction with other students and academics, and evidence found in places, books, the internet, and the big wide world itself.

1.3 Two examples

EBL can take many shapes and forms in different disciplines; however, the principles of EBL remain the same. EBL involves taking control of your learning, and trying things out for yourself rather than being spoon-fed through lectures and reading lists. Broadly speaking, this is likely to involve a tutor giving a group of students a task or research aim. The students would then split into smaller groups and go and research the task in the way they see to be best. The tutor is there to guide rather than dictate. It is the student's job to go and learn and research and present back to the group and complete the set work by the specified time. As you will see in the second example, EBL can also been done by individuals working on individual projects.

Below is a team-based example that may be used as part of a geography course. For other examples from other disciplines and please see appendix 1.

Example 1: Geography

Dr. Bobbins sets a research project about gentrification. One group of 5 students was given the Ancoats area of Manchester as their study area. Their

research aim was to discover what effect gentrification has had on the Ancoats area of Manchester.

The students decided to take an EBL approach to this problem, so rather than sitting in the library looking at books (which they chose to do as part of their research after the initial 'fieldwork'), the students went out on a walking tour round the city. They took photographs, read newspapers and publications, visited relevant museums, spoke to residents, *placed themselves* and got close to their research. Dr. Bobbins was there to guide them in this process if they had questions. To meet the assessment criteria, the group had to produce a presentation and a group-written piece of work. When the students presented back to the group, they had photographs, newspaper clippings, interview excerpts and media publications to support what they had learnt from academic literature.

How did they achieve this?

Stage 1

After they has been set their task, they swapped email addresses and mobile numbers. They discussed and emailed round an agenda and time for their first meeting.

Stage 2

The students met up in a quiet coffee shop in Ancoats (their field work site) to start work on their project. They followed the agenda. This can be seen below.

Meeting 1 Agenda

Present: Bill, Ben, Matt, Lucy and Milly.

Items to be discussed

1. **Ground rules for effective team work**
2. **Division of labour**
3. **Aims to be achieved for next meeting**

4. **Date of next meeting.**

The group first set the ground rules of the team work. They agreed that each member would contribute to the project equally, and if one member were unable to do so, they would communicate the problems they were having with the rest of the group. They decided to meet twice a week, at the same time on the same days, to report back on what they had achieved and to get feedback. This also made sure that there was no confusion over times and places of meetings. Each group member was assigned a role with the team, and within the research. These were as follows:

Name	Team	Project
Bill	Chair	Interviewer of residents
Ben	Scribe	Newspaper researcher
Matt	In charge of distributing meetings notes	Interviewer of residents
Lucy	Academic literature collector	Chief photographer
Milly	Academic literature distributor	Visited all relevant free museums in the area

Stage 3

All members read 3 academic pieces regarding the research collected and distributed by Lucy and Milly. All group members carried out their role (e.g. interviewing residents, taking photographs, going to Museums) and reported back and got feedback from the group twice a week.

Stage 4

Once the period of field work was completed the group met up to discuss the structure of the presentation and worked together to collate what they had researched. After the group presented their findings, they got feedback from

other students and their tutor. They then had another meeting to discuss how they would tackle the written piece. They decided that 4 members would write an equal amount of words and the fifth would edit the piece and add in images and other media collected on fieldwork. They used the presentation they had already completed extensively throughout this process.

Example 2: A dissertation.

EBL can be done on an individual basis as well as in teams. A good example of individual EBL work is the dissertation or final year project many students have to complete. Within these pieces of work, individuals must plan, research and write up a project. The way in which this process is executed within disciplines across the university is radically different; although a lot of projects involve the following steps (illustrated through example) listed below. The steps are not listed in any particular order as research is a messy fluid process, and hardly ever goes the way it is planned! So the list below is not representative of how research pans out in real life; but it gives an idea about how EBL can be executed on an individual basis.

A student who has the task of writing a dissertation is likely to go through the following stages at some point in the research process. Each stage is highlighted through example.

- Generate initial ideas, think about the topics that interest you within your discipline and isolate them. **My degree is in geography and I'm interested in hydrology.**
- Once you have isolated a topic, try to focus down again on areas that interest you. **I'm interested in the formation of oxbow lakes and there is one near my mum and dads house I could use as a research site.**
- Formulate initial research questions. **1. How was the Oxbow lake formed? 2. What anthropogenic influences have affected**

the lake? 3. What environmental influences have affected the lake? 4. What is likely to happen to it in the future.

- Read relevant literature. **Seek advice from tutors and raid the library and electronic resources!**
- Ethical considerations/risk assessment. **I need to think about my own safety whilst on fieldwork and ethical environmental concerns.**
- Collect data. **Collect field data**
- Read more and augment literature reviews. **Re-read literature and add to what already been read**
- Write up

These examples of EBL read like fairy tales; however, they do not aim to be completely realistic of the EBL experience. The aim to give a flavor of the kinds of processes and steps you *may* experience whilst doing EBL. Doing EBL and engaging in learning with your peers is not as always straightforward; it is often a long, difficult and arduous process. Section 2 is designed to give you some hints and tips about the EBL process, and explore the techniques outlined in the example in more depth.

2. Doing EBL

This part of the booklet explores the problematic and frustrating elements associated with 'doing EBL'. The sections 2.1-2.3 deal with communication and group work, then different kinds of problems are explored with suggestions for resolution in the problem pages in section 3.

2.1 Group Work

Within EBL exercises, group work is often an integral element. So at an individual level, 'the tutor doesn't just stand at the front saying this is this and that is that…there is more personal communication between students' (English literature student). As a student practising EBL, you're not just being

spoon-fed ideas, notes and information. YOU have the chance to think for yourself, to develop opinions and a position on issues important to you. Moreover, one student pointed out that it also gives the *tutor* an opportunity to listen to *your* ideas.

Initial considerations for group work

Group work can be scary especially if you do not know your peers very well, so below are a few hints and tips from the students I spoke to on how to get you started .

- Get to know your group. If possible, try to have a social event before the work begins. Have your first meeting as 'getting to know each other session' (Engineering student), maybe meet for a coffee or go for a drink. The better you know each other, the better you'll be able to interact. But make sure you are sensitive to the needs of your peers. If you are working with someone who doesn't drink alcohol, go somewhere where they will feel comfortable and are able to have non-alcoholic drinks.
- When arranging your first meeting email round the group and collectively put together an agenda for your first meeting, and stick to the time allocated. Meetings can drag on when you go off the topic and nothing is achieved and you end up having 'meetings about meetings'. This is unproductive and can be frustrating.
- The first agenda item at your first meeting should be to establish some ground rules for the group that everyone must abide by. This should help to ensure good working practice, and let each group member have a role and feel involved in the learning process. Each group's rules will be different depending on the task in hand.
- Have someone chair the meetings and have a scribe to make notes that can be circulated round the group after each meeting so everyone knows where they're at in the research process. Let the chairperson organise meetings, and organise them as you go along. So

at the first meeting organize the second and so on. Or it may be useful to have the meeting at the same time every week in the same place to minimise confusion.

- Try to stick to deadlines and not let your team mates down. Everyone is trying to achieve a similar goal so be supportive.
- If you cannot complete the task you've been set, speak to someone else in the group and help each other out. That's what team work is all about.

Group work isn't always a struggle. The students interviewed also highlighted the benefits of working together as a team

- You meet new people. This is great especially if you're on a big course.
- Competitiveness goes because you are working as part of a team.
- You get to work with loads of different people and have varied and dynamic learning experiences.
- Group work is good because you can pool ideas together. Different people have different ideas and see different problems; you can work together to overcome these.
- You have to be responsible for other people and their work as well as your own. This can help promote good management skills that will be useful in later life.
- You don't run the risk of being closed-minded and bored with your own ideas.
- You have others to talk to and share ideas with, discuss and debate with.

2.2 Communication Issues

EBL often involves a lot of communication between you and your team mates, with members of academic staff and sometimes with members of the public. Hence, communication skills will be utilised and enhanced through this kind of learning. Moreover, one student argued that this kind of learning has wider benefits, specifically because of the communication skills used. He argued that we speak to people, and communicate with people everyday,

and to translate that skill into a learning environment is beneficial for wider life skills. He argued that as you learn how to communicate in different ways through EBL, you will develop and tune your communication skills so that you can speak appropriately with different people about different topics.

2.3 Cultural barriers

You may have language and cultural barriers within EBL groups as you'll probably be working with a diverse group of people. The ability to work successfully with different people is a valuable life skill that can only be gained through experience. One student spoke of working with students who spoke a different first language to himself, and there were communication problems within his group, as he had difficulties physically speaking to his team mates. However, this was overcome though diplomacy and team work, both vital skills for post-Uni life.

3. Problem pages

But what happens when you feel that you've done everything you can for your group and everything is still going wrong? Or you feel that you cannot contribute to the group because you feel lonely and left out? Section 3 hosts a series of thematically organised issues associated with EBL, these may help you when you find yourself in a tricky situation; or maybe you are just in need of a bit of help.

This section of the booklet is split into 4 parts to help you to solve the issues relevant to you. All of these problems and solutions came from the students interviewed who have been through the EBL process. Although the problems emanate from specific disciplines, they are (unfortunately) transferable across disciplines; however (fortunately) so are the possible solutions!

3.1 Group work problems: This section deals with problems associated with group work and its myriad issues. **pp**

3.2 Assessment and Award Problems: This section deals with problems of individual and group awards and assessments. **pp**

3.3 Individual: This section deals with problems encountered by individuals in group settings and throughout the EBL process **pp**

3.4 Process Problems: This section deals with issues that students face as they go through the process of EBL. **pp**

3.1 Group work problems

What do you do if a member of the group will not participate in activities and will not attend or contribute to the task? In this situation try to ascertain if there is a genuine reason why the individual is not contributing; for example, It may be due to a personal issue. If there is no obvious reason why s/he is not taking part, suggest that s/he might like to, as it is not fair on the rest of the group. If s/he still does not deliver, take the issue to your tutor, so it's out of your hands and ask him/her to deal with the matter.

What do you do if one of your group members takes over the project and begins to dictate all the ins and outs of the project and you feel you will not get the mark you want if you carry on this way?

Advice from students suggests that it might be an idea to group together with your team mates and insist that an agenda at the next meeting is followed, and on that have a speaking time for each team member. Make sure you have a good chair and attempt to get your ideas across this way. If you do not wish to do this, pick the member of your group with the best communication and diplomacy skills and ask him or her to speak to the individual one on one. If all fails contact your tutor.

People might be scared to make any decisive action to kick start the EBL process. Many of the students interviewed said that, once they had spoken out for the first time, they felt more comfortable; a social event to kick start the process might also be a good idea. Also remember that you are allowed to make mistakes, it's part of learning. Everyone is in the same boat so go for it!!

Groups often don't want to give the weaker person the difficult yet essential tasks, so those people always get the easier jobs and as a result may not learn as much as the rest of the group Again as suggested by students interviewed, these kinds of problems can be alleviated by good communication between the students themselves and with their tutors. Try to support each other through learning and help each other learn new skills, but also be realistic about your objectives and discuss what's important to you individually, as well as what's important to the group.

3.2 Assessment and award problems

People sometimes feel they are doing most of the work and not getting enough recognition or reward. Try to divide up the work evenly, and at each meeting go through what has been achieved by the group, and what needs to be done. Make sure everyone is involved in the research process.

It's difficult to trust some people to do the tasks properly, and rely on them to get the work done, as it can affect individual marks. Speak to your teammates about the work being done in the group and go through it together so you're all sure of what you're learning. Support from the leaning facilitator will be useful at this point as they will be able to help if what you are learning as a group is inadequate. Don't be afraid to ask for help.

When working in a group, you sometimes end up covering for others so their poor work doesn't affect your mark. If you are finding yourself in this situation, then you need to address why you are covering for another student. Peer assessment can help to counter this; your tutor should be aware of this method of assessment whereby your contribution to the group affects your mark. If you are not assessed this way, maybe ask your tutor about introducing it to make it fairer. Also speaking to the student in question or your tutor about your group dynamic and situation may help you.

3.3 Individual problems

What do you do if you feel that you are not fitting in well, for example if you are a naturally shy person and feel that you cannot relate to the rest of the group? Suggest a social to the group in a place that you would feel comfortable with, or ask a group member who you feel is the most approachable if you can work together on the next task. Using these tactics you may slowly be able to integrate into the group. On top of this, volunteer to work on parts of the project. Your team-mates will be glad of your help. Everyone finds speaking in public and sharing ideas nerve-racking at first and the sooner you get involved the more fulfilling the

experience will be for you. If you really feel you cannot do the above, go and speak to your tutor as lack of contribution from team members may affect assessment and final marks. **EBL doesn't always facilitate people to talk. People are nervous about speaking in front of others, especially people they don't really know**. Try to have a good chair and plan meetings so everyone gets a say, try to involve students. Work in a comfortable and neutral environment. A social before the group work actually starts is a good idea too. All the students interviewed suggested that once they had spoken once and got to know their team a bit, speaking in public became much easier.

3.4 Process problems

Help! **I'm scared we're not going to meet our deadline!** Meeting the deadline as a team can be tricky but everyone has a responsibility to get the work done. Pool work and resources, work out as a team if it's better for one person to 'edit' the whole project (this may be their central role within the group) or for the group to do it as a whole then do that. It can be hard to make the work coherent, especially if you have big groups of people, so leave time for a good editing session. Try to make sure your contributions are equal; sometimes you'll find people who do work well before deadlines and those who work close to the deadline in your group. Work out your group dynamics and try to work with them rather than against them and each other.

There's often lots of ambiguity with EBL, so what do I need to learn? It's too fuzzy! Not knowing exactly what you're supposed to be learning can be stressful! But it needn't be a fault, just have clear learning objectives within your task. These can help reduce ambiguity levels. Also check with your tutor that the work you're doing as a group is useful before you embark on any massive research projects.

4. The benefits of EBL

The tips in section 3 will hopefully be useful to you, but our students did much more than complain about the problems of EBL. They gave advice on how to do good EBL. Their words can be seen below. This should prove helpful when you feel you're feeling let down by this method of learning.

4.1 Why EBL is Good for learning:

- You remember more if you learn through EBL because you have to talk about it. It's also easier to apply to the 'real world'

- It promotes responsibility for your own learning
- You become a more confident researcher, you become more methodological, and you often look at different aspects of the problem and are less intimidated by 'research'.

4.2 Good for Personal development

- EBL helps you to have the confidence to work with others, speak out and share ideas.
- This method of learning also develops more confident graduates as they not only have hands-on skills and academic expertise, but also have excellent interpersonal skills
- You get to know people socially a lot better than through lecture based learning
- If you have to give presentation, it makes you do it and realize that it's not scary. This reflects the multitude of skills that can be gained through practising EBL.

4.3 And remember:

- Through EBL you get more used to sharing info and deciding which bits to use.
- You don't just have to grin and bear it on your own. Speak to your group and your tutor
- Involve everyone in the group work, so everybody has a chance to participate

5. A final note…

EBL can be a fun, innovative rewarding way to learn. But it can also be frustrating, time consuming, unrewarding, lonely and difficult. So when you've lost all hope, you hate the topic you're working on and you feel lost and alone in your group, just remember the words of students who've been through the process. They say that 'it's worth it in the end, when you realize how much you've learnt and that lots of ideas have been exchanged' (Medical student). And also keep in mind, that it's as fun as you want to make it. The processes of EBL, are influenced by the attitude of those participating. As one history student said: 'it's a lot about attitude, if you have a positive attitude everyone will catch that'. Moreover, it's important to remember that it's just a different way of learning. Learning is always going to be something fairly difficult, as it throws up intellectual challenges and obstacles. EBL is just one method of facilitating the learning process in a way that develops interpersonal skills as well as academic knowledge. It's also a great way to enhance transferable life skills; EBL throws up all sorts of problems that you may otherwise not experience at university.

So finally, the feeling I got from our students was essentially…

Don't be afraid to speak out, EBL provides you with an experience to learn together, and allow students to feel valued through their contributions. More importantly, EBL allows students to have ownership over their learning, to take control of their university experience and mould it to fit their needs. The overall message is

GO FOR IT! THE REWARDS ARE GREAT!

So go forth into your university courses, meet your peers and team mates and get ready to *really learn*.

Appendix 1: EBL examples

EXAMPLE 1

Fourth year engineering maths course

With thanks to Paul Grassia

Aim

To explore various classes of equations (hyperbolic, elliptic, and parabolic) and the mathematical tools to solve them.

Group work or individual

Group work

Process

- Examples of equations worked through on the board during lectures and tutorials.
- Students divided into three groups by tutors (hyperbolic, elliptic, and parabolic) and each group was assigned a physical problem from the respective equation class.
- Students were told to research a solution technique appropriate to their problem and come back and teach the technique and problem to their peers.
- Students met with the module leader once per week, early meetings ensured students had the correct solution techniques for their problems (which were covered in the syllabus).
- The module leader provided hints where necessary.
- Subsequent meetings checked progress and tutors advised students on preparation for teaching the course material to peers.
- Students became partners in learning through dissemination of knowledge to peers

Assessment

Exam

Grades of students better than in lecture based course covering the same material

EXAMPLE 2

Dental Public Health Project

With thanks to Albert Yeung

Aim

To undertake a group project on an assigned dental public health topic. The project involved literature review and assimilating the findings as an oral presentation in the form of a debate

Group work or individual

Team work, debating teams

Process

Each group within each Term was assigned the same Motion. The debate consisted of two teams of two members, taking place on the last day the group meets.

Motions

Term A

"This house believes that the dental profession has only a limited role to play in smoking cessation within the dental surgery."

Term B

"This house believes that 6 monthly dental check-ups are an important part of improving the dental health of the population."

Term C

"This house believes that oral health education within the dental surgery would improve oral health for the general public."

Term D

"This house believes that the introduction of water fluoridation is the way forward for tackling dental caries in young children in Greater Manchester."

Assessment

The assessment was divided into three parts: Style, Content, Strategy & Summation Speech. A grade of A-E was awarded for each part and an overall grade A-E determined using established matrix. Therefore each individual speaker (student) will have been given two overall grades i.e. one from each adjudicator. If these two overall grades are the same, then this will be the Overall Agreed Grade for that student. However, if these two overall grades are different, the two adjudicators are required to hold further discussion and to agree a final overall grade, which then becomes the Overall Agreed Grade.

EXAMPLE 3

Medicine: Clinical Endocrinology

With thanks to Neel Sharma

The pathogenesis of pituitary tumours: assessing the benefits of computer aided learning (CAL)

Introduction

Over the past two decades, an ever increasing number of computer aided learning packages have been utilised as a learning resource in various scientific fields. The educational interaction of computer-administered instruction has been defined as,

"A man-machine interaction in which the teaching function is accomplished by a computer system without intervention by a human instructor. Both training material and instructional logic are stored in computer memory" (Salisbury, 1971 in Joint 2003 p324)

Aims

To supplement final year medical students' knowledge of pituitary tumors through design of a computer aided learning package. The main objective was to determine whether the package enhanced students' knowledge and understanding of pituitary tumour pathogenesis and clinical case scenarios.

Group work or individual

Individual work as part of a Pharmacology BSc (Hons) degree.

Methods

- A multiple choice quiz on this field was distributed to twenty three final year medical students.

- Students were asked to complete the quiz.

- A questionnaire was then distributed to the same twenty three students assessing whether there was a need for a CAL provision.

- Taking into account their responses, a website was designed focusing on the mechanisms involved in the pathogenesis of pituitary tumors as well as common clinical conditions allied to the topic.

- Respondents were later asked to work through the package and then complete the multiple choice quiz for a second time.

- This was to determine their final level of knowledge and understanding.

- A final questionnaire was distributed assessing their views on the newly constructed CAL package

Process

- Ran from September 2005 to April 2006

- Production of the CAL package involved the construction of a project plan/ storyboard. This involved detailing the various components of the package and how they were interlinked.

- Production of such a story board allowed the development phase to function more efficiently. The scientific content was presented mainly as a continuous flow of text under specific sub headings.

- The package was designed using Microsoft Publisher. The package contained numerous animations downloaded from Microsoft Office Online or constructed using Microsoft Power Point.

- A quiz was incorporated into the package using the ePBL system.

- With respect to the clinical aspect of the package two videos were incorporated into the website to illustrate two conditions covered during the module. They were fully consenting patients who had been

filmed previously at the Manchester Royal Infirmary and had given their permission for their case to be used as a teaching aid.

- Two hypothetical clinical case scenarios were included. These were designed as a Problem Based Learning format using Microsoft Power Point. Students were presented with a brief patient history and were required to choose appropriate investigations and management. Users were only able to progress after selection of the correct answer, with feedback given after incorrect choices.

Outcomes

Assessing students' knowledge and understanding of a particularly difficult area of endocrinology through the use of computer aided learning has provided an insight into whether such a style of learning delivery is a successful method to adopt.

The study also highlighted areas where much improvement is needed with regard to current lecture material provisions which tutors can then focus on in order to maximize the quality of the content delivered.

From the study, analysis of students' views on the current lecture material available indicated that a CAL resource would be beneficial and helped to drive production of the online package. If implemented as a future core teaching aid students will greatly benefit as results from this demonstrated enhanced knowledge and understanding of pituitary tumor pathogenesis through computer aided learning.

Assessment

Project was marked by a Professor and is now being utilised as a teaching aid for both medical and life science students.

Reference

Joint, N. (2003) Information Literacy Evaluation: moving towards virtual learning environments *Documents in information science* 4 pp322-334

Personal web page for Neel Sharma
http://personalpages.manchester.ac.uk/student/neel.sharma

EXAMPLE 4

Eighteenth-Century English Poetry

With thanks to Bill Hutchings

Problem: publishing a booklet

ADVERTISEMENT

The English Tourist Board is initiating a campaign to attract people back into the countryside after an outbreak of foot and mouth disease. As part of this campaign, it is sponsoring an exhibition documenting and demonstrating the responses of writers and visitors to the English countryside through the ages. The exhibition is to be called,

"The eye of the beholder: landscape description, 1700-2000"

The English Tourist Board is also sponsoring a booklet to accompany the exhibition. This booklet will complement the exhibition by providing representative examples of landscape description in poetry from the three

centuries, together with explanatory commentary and notes. The booklet will be aimed at a wide public, but is intended to be scholarly and informed.

The English Tourist Board invites teams to apply for a contract to compile the booklet. Applicants should submit a rationale for the selection of passages from the eighteenth century and a specimen example / specimen examples (also from the eighteenth century) with commentary and notes.

(Length of submission to be 3000 words x number of students in the group)

GROUP

Four students

TIME-SCALE

Four weeks

PROCESS

- First meeting: A general discussion among the four of us of what we saw as the key issues. What constitutes a successful selection? How will we find the examples? What kind of commentary and notes will be needed? What would the target audience expect and enjoy? How should the booklet hang together? Substantial use of facilitator!
- Division of tasks: one of us to find and examine guides and other material produced by the English Tourist Board (or similar agencies, such as the National Trust); one of us to find and examine existing selections of eighteenth-century poetry; two of us (working together) to look for

examples of eighteenth-century landscape poetry. Exchange of e-mail addresses and mobile phone numbers to facilitate communication between meetings.

- Second meeting (week two) to collate materials and consult facilitator. Decisions made about the format and register of language of the booklet, about the length of examples, level and format of commentary. Search of examples of landscape poetry had produced far too much material, so we decided that all four of us would look at the list and come up with a suggested selection, with some linking factor. Interim meeting needed to bring these suggestions together for decision.
- Interim meeting (end of week two). Big argument about which selection looked best. Selections were: (i) one of poems written about the Lake District; (ii) one of poems written about rivers around the country; (iii) one of poems by well-known writers; (iv) one of poems written in different forms (blank verse, sonnet etc.). Decision finally to go with (ii) on the grounds that this would have the widest appeal nationally to a broad audience. Allocation of writing roles: one to write rationale/introduction to booklet; three others to divide up the agreed examples.
- Third meeting (week three). Each of us brought the first draft (or part of it) of our section for the others to read. Realized that we needed time to ensure that the sections were coherent in format and style: interim meeting agreed, after second drafts exchanged by e-mail.
- Interim meeting (end of week three). Editing of all sections with suggestions for improvements.
- Final meeting (week four). Submission of final submission. We gave an informal presentation to the other groups and to the facilitator, explaining why we had decided to produce the selections. Other groups did the same, leading to general discussion and argument!

OUTCOMES

Production of written rationale and booklet examples.

ASSESSMENT

Each of us took responsibility for one section: one of us wrote the rationale for the selection, and the three others wrote examples, with commentary and notes. These sections provided the materials for assessment.

Example 5:

Classics

With thanks to Nisha Patel

The Problem

Design a website in a small group (3 people X Y and Z) which chronicles the activities of a character you have created through the city of Rome (circa. 1 AD). This is was preceded by a group presentation and an individual essay. Historical accuracy, cultural relevance and architectural details were of paramount importance, by technical acuity, creativity and presentation were also considered through assessment.

Group work or individual

The class was divided into 5 groups of three people.

Process

Group members first allocated roles within groups according to areas of expertise. The three main roles were: technical, research and presentation. The group arranged a regular time to meet to update each other as well as a 'research meeting place' so if were we all in university together at certain times in the day, we were able to meet and chat about progress. Free spaces in timetables were also identified in case the group needed to meet

as a matter of emergency. Phone numbers and e-mail addresses were also exchanged.

Buildings of civic importance in Rome was the topic chosen by the group for presentation. Each group member was allocated 1 building to research. The research fell into 3 areas: Historical facts relating to the building (i.e. date of construction, what it was for and who built it); cultural context (i.e. what went on within it, when and who performed/funded ceremonies, events etc.); architectural importance (i.e. location, size, construction material, adornment etc.). Research was discussed between group members, the group streamlined the findings and created a PowerPoint presentation with handouts. Each member spoke about the particular building they had researched. This all contributed to the content of the website we had to produce.

The group chose a character, researched a potential background and reason for journey and together chose the route through the city as well as the buildings/monuments we would pass.

Following this, more buildings were allocated to group members and tasks were divided. Person x did most of the technical work i.e. coding, pop-ups, deciding content on each page as well as the basics such as contents page, intro, glossary.

Person y did lots of research i.e. collected the books/resources we required. She also reminded us of the group deadlines we had made as well as keeping a mini journal.

Person z created attractive formats and ensured the pages and content looked presentable, person z also ensured we did not work too hard and made sure we took enough breaks and were motivated.

Outcomes

- There were some big arguments and raised tensions in the final few days before the deadline but attributed these to stress and working in close proximity to people.
- It was difficult to stick to allocated times as sometimes is it was felt we did not need or want to meet up. Communication issues were also present; emails were sent so frequently the group was not always sure which emails contained the most up to date information.
- Despite the above, each group member pulled their weight and came together to work hard. The group felt a definite sense of unity and a job well done.
- The group achieved the highest joint mark on the course.

Assessment

- Tutors assessed the presentation, group and individual marks were allocated. The group mark counted for more.
- Essay marks were allocated to individual students
- The website was marked as a group project, the team had to write a review about how the group functioned, problems experienced and personal contributions.
- The group felt the assessment was fair as both group and individual marks were allocated.

Example 6:

Engineering: Water Rocket

With thanks to Shaya Grosskopf

The problem

It is possible to create rockets from lemonade bottles filled with water if the bottle is pressurized. Water can be ejected from the end of the rocket at speeds of up to 50 metres per second, which is ample to propel the bottle through air.

The group was asked to design a rocket, which would be judged on how far the rocket was shot into the air. This height was measured using an electronic sensor, which was attached to the rocket and gave real time feedback to a ground station. The group was also asked to design a parachute system, which would keep the bottle in the air for as long as possible. There were awards for the most innovative design of the rocket and parachute.

The group was also asked to do several tasks around the design and manufacturing of the rocket. These included:

- running a computer simulation of the rocket to determine appropriate fin sizes (which were required for stability) and the optimum ratio of water to air in the bottle (low air, leads to low pressure; low water leads to less 'fuel' and hence impulse).
- determining the drag coefficient (a measure of 'streamlinedness') of the rocket, using a wind tunnel.
- calculating, the maximum pressure which could safely be applied to the bottle.

Process

The rocket was split up into component bits, and each group member was assigned responsibility for the design and manufacture of their component. In practise, the more assertive group members manufactured the rocket ad hoc, and then drew up designs afterwards. Because so little thought was required for the design, it seemed much more natural this way.

A lot of the team time was wasted on trivial detail such as what shape the fins would be. This was a waste of time as it held little of significance to the rocket's performance. We also had interminable team meetings because there were marks awarded for holding them. This achieved exceptionally little partially because there was exceptionally little to achieve. Team meetings, while never downright nasty, were tense affairs, with personality clashes. The allocation of leadership roles was particularly fraught

Outcomes

The rocket ascended to a reasonable height, but the parachute failed to deploy. Practise showed that a minimalist design performed best.

Assessment

Assessment was based on the rocket's performance (which was so unpredictable it seemed unfair) and the analysis of wind tunnel and simulator data. The simulator had a margin of error of around 100% and was quite useless as a design tool. Analysis of the wind tunnel results depended on knowledge of the Bernoulli equation, which had not been taught, and so would have been flawed even if the rocket had not blow apart in the wind tunnel! The group marks were modified by peer review of each group member, which exacerbated tensions.

Appendix 2: resources

Reference:

CEEBL (2005) *What is EBL?* Available from:
http://www.campus.manchester.ac.uk/ceebl/ebl/ accessed 22nd July 2006

Resources

Website for The University of Manchester's Centre for Excellence in Enquiry-based Learning
http://www.campus.manchester.ac.uk/ceebl/

Website for The University of Manchester's Centre for Excellence in Enquiry-based Learning resource bank, an exhaustive listing of EBL based papers and resources
http://www.campus.manchester.ac.uk/ceebl/resources/

Resources available from the CEEBL website:

Enquiry-Based Learning

Kahn, P and O'Rourke, K (2004) *Guide to Enquiry-Based Learning,* University of Manchester
Available from:
http://www.heacademy.ac.uk/resources.asp?id=359&process=full_record&section=generic
This guide focuses on curricula designed around processes of enquiry and is informed by reports from a programme of staff development that supported lecturers as they carried out a small-scale project designed to impact on the learning of their students.

Jackson, N (2003) ***A personal perspective on Enquiry-Based Learning,*** **LTSN Generic Centre**

Available from:
http://www.heacademy.ac.uk/resources.asp?process=full_record&section=generic&id=328

A reflection on issues arising from the EBL conference in September 2003 organised by the University of Manchester

McKenzie, J (1994) ***Grazing the Net: Raising a Generation of Free Range Students,*** **From Now On Journal**

Available from: http://fromnowon.org/grazing1.html

An article for educators with students beginning to investigate problems using the internet.

Inquiry Resources and Case Studies, McMaster University

Available from: http://www.mcmaster.ca/cll/inquiry/inquiry.resources.htm for

A range of resources on processes of learning based on inquiry from McMaster University.

A Questioning Toolkit, From Now On Journal

Available from: http://www.fno.org/nov97/toolkit.html

A framework for developing essential questions for student research.

A 'How to' guide to Problem-Based Learning, University of Manchester

Available from: http://www.parable.man.ac.uk/

A guide to problem-based learning in 8-steps.

Case Based Learning in Politics, University of Huddersfield

Available from: http://www.hud.ac.uk/cbl/

Pilot real world case scenarios available for download and reuse.

The Students On-Line in Nursing Integrated Curricula project (SONIC)

Available from: http://www.uclan.ac.uk/facs/health/nursing/sonic/

A partnership of four universities developing web-based resources for Problem Based Learning scenarios.

Interdisciplinary Journal of Problem-based Learning

Available from: http://docs.lib.purdue.edu/ijpbl/

New PBL journal first published May 2006

Online resources that could be useful for EBL projects

Archives Hub

http://www.archiveshub.ac.uk/

A national gateway to descriptions of archive collections in UK universities and colleges

ARKive

http://www.arkive.org/

An online digital library of films, photographs and audio recordings of the world's species

British Universities Newsreel Database

http://www.bufvc.ac.uk/databases/newsreels/

Contains 170,000 records of British newsreel and cinemagazine production and a large collection of digitised documents. Hosted by BUFVC.

Education Image Gallery

http://www.edina.ac.uk/eig/
Provides access to a collection of 50,000 images drawing on the Hulton ARchive, Photodisc and Getty Images® News Service. Images are copyright-cleared for use in learning, teaching and research. Hosted by EDINA

Education Media Online

http://www.emol.ac.uk/
A JISC-funded set of collections of film and video available for download for use within learning, teaching and research. Hosted by EDINA

ISI Web of Knowledge

http://wok.mimas.ac.uk/
Single point of access for UK Education to ISI Web of Science, ISI Proceedings, Journal Citation Reports and others. Access depends of individual institution subscriptions. Hosted by MIMAS

Newsfilm online

http://newsfilm.bufvc.ac.uk/
3,000 hours of television news and cinema newsreels, taken from the huge collection of the ITN/Reuters archive, is to be made available online in high quality format for teaching, learning and research. Hosted by BUFVC

Resource Discovery Network (RDN)

http://www.rdn.ac.uk/
The Resource Discovery Network is a free national gateway to Internet resources for the learning, teaching and research community. The service currently links to more than 100,000 resources via a series of subject-based information gateways (or hubs).

SCRAN

http://www.scran.ac.uk/

The SCRAN learning resource service hosts over 336,500 images, movies and sounds from museums, galleries, archives and the media, copyright cleared for educational use

UK Data Archive

http://www.data-archive.ac.uk/

The UK's largest collection of digital data in the social sciences and humanities. Provides resource discovery and support for secondary use of quantitative and qualitative data in research, teaching and learning