SYLWER: O ganlyniad i newidiadau yng nyfoynion portffolio’r TUAAU, nid oes gan bob cylch dysgu a lwythir i CADAIR yr un nodweddiun. Mae’r bwysig bod y cyhoedd dysgu hyn yn cael eu defnyddio fel adnoddau yn unig, ac nid fel canllawiau i’r hyn sydd ei angen i fodloni gofynion y TUAAU. Os oes genych ymholiadau, cysylltwch â thestaff@aber.ac.uk.

PLEASE NOTE: Due to changes in the requirements of the PGCTHE portfolio, not all teaching cycles uploaded to CADAIR share the same properties. It is important that these teaching cycles are only used as a resource and not a guide to what is needed to fulfil the requirements of the PGCTHE. If you have any queries, please contact thestaff@aber.ac.uk.
3. Teaching Cycle 1 – development report format.
3.1 Improving student interaction in lectures – windows of learning opportunity?

Introduction.
Early experiences in final year lectures in 2003/2004 had been disappointing with respect to student interaction. First hand experience had revealed a great level of disparity in student interaction between practical sessions and ‘traditional’ style lectures that could not be solely attributed to inherent differences in the teaching methods. Informal discussion with students revealed that the ‘traditional’ lecture format was unpopular, especially with those in advanced years of study such as the group that is the focus of this report – final year undergraduate students.

Although I had attempted to encourage student interaction during these early sessions, by introducing a short question and answer session at the beginning and end of the lecture, response had been very poor. It was evident that there were barriers preventing students from interacting and it was obvious that this was not simply a case of student apathy. Many of the students could be seen to be mouthing correct answers and small group discussions revealed good understanding of the subjects. Discussion with small groups of students from the various classes revealed a number of issues. Firstly, the students seemed unsure as to the purpose of my questioning. Although I had stated that I was trying to evaluate their level of prior knowledge and to reflect on their learning at the end of the lecture, their perception was very different. Initially they felt that I was trying to ‘catch them out’ and were concerned about revealing ‘lack of knowledge’ to their peers. It became very apparent that many of the students knew the answers to the questions I was posing but felt insecure about answering in front of peers.

The module was team taught and I ‘appeared’ both as a new lecturer in the module and also as a new lecturer in the Institute of Biological Sciences at a relatively late stage in the students’ university career (sometimes at lecture 21 in a 30 lecture series). Several students had stated that other lecturers did not ask questions and they felt uncomfortable with my attempts to ‘include’ them in the lectures. They were also unfamiliar with my style of lecturing which introduced PowerPoint. Earlier lectures in that series had been more traditional, using ‘chalk and talk’ teaching methods. Thus it became obvious that there were a number of issues that would need to be addressed before I could even attempt to work towards my aim of improving student interaction in lectures.

Whilst the students had helped me to identify a number of issues that would require attention, I felt that I needed other objective professional opinions to ensure that these issues were indeed the ones on which I should focus. My mentor, Dr Iolo ap Gwynn, and Rose Lonsdale (Director of Staff Development), were invited to attend two different ‘traditional style’ lectures within this lecture series. Iolo and Rose kindly attended as objective observers and, as they are experienced lecturers, I was keen to receive feedback from them. In particular, I was interested to hear Iolo’s opinions on the scientific content of the lectures and Rose’s opinions on improving student interactions. Iolo’s observation is presented in section 4.1 and Rose’s observation in section 4.2. The observation, feedback and discussions with both my mentor and Rose confirmed some of the issues...
already identified and further reflection raised other considerations that I would need to address.

Students learn more effectively (encouragement of deep learning processes rather than shallow recall) if they are actively engaged in the learning process, rather than acting as passive 'receivers' of information (Fig. 1 and Burchell & Woolhouse, 1995). Many studies advocate the reduction of time spent simply imparting information in lectures and emphasize the need to encourage thinking through interactive exercises and reflective practice (e.g. Bligh, 1998). Such exercises emphasize the importance of experiential learning, and can be seen as 'windows of learning opportunity' which can encompass a variety of teaching and learning activities. These ‘windows of learning opportunity’ can be introduced as short interactive sessions within traditional lecture slots.

In this study the use of activity-based ‘windows of learning opportunity’ is explored with a study group of 95 final year undergraduates. The students were enrolled on a twenty credit module in parasitology (BS31820), delivered by the Institute of Biological Sciences during the 2005/2006 academic session. The sessions were delivered during ‘traditional’ lecture slots, in conventional lecture theatres.

3.2 Aims and Objectives.

Aim: To improve student interaction in final year parasitology lectures in the 2005/2006 academic session using ‘windows of learning opportunity’.

Objectives:

1. To familiarize students with the concept of interactive lectures by introducing interactive elements in Years 1 and 2.
2. To develop learning and teaching methods and resources to facilitate interaction in lectures.
3. To implement learning and teaching activities to encourage student engagement with the subject. These will be designed to explore the various levels of learning outlined in Bloom’s taxonomy and to facilitate various levels of autonomy in the learner.
4. To evaluate the learning and teaching developments introduced.
5. To reflect on this learning and teaching development.

3.3 Description of the lectures, plans for improving interactions and plans for evaluation.

3.3.1. Description of the lectures.

The lectures are a series of 10 lectures in a final year parasitology module (BS31820) delivered in Semester 1 in the 2005/2006 academic session. The lectures explore a variety of parasitological concepts. The concepts covered include introductory sessions on parasites and parasitism and life cycle lectures on specific groups of parasites. The lecture series build to include more complex and applied aspects, such as parasitic arthropods and their medical, veterinary and economic importance. Towards the end of these lectures emerging and novel areas of parasitology research are considered, such as parasite
immune evasion strategies. The lectures culminate in a seminar in which a topical, applied parasitological review article is considered.

The lectures are delivered in ‘traditional’ style tiered lecture theatres in conventionally timetabled slots. The ‘lecture slots’ are Monday 9am, Monday 11am and Thursday 9am.

3.3.2 Plans for improving student interactions in the 2005/2006 cohort.
Informal discussions with my mentor, colleagues and feedback from students enrolled on the course in 2003/2004 and 2004/2005 enabled me to identify several important issues which would need to be addressed in order to facilitate this learning and teaching development.

(a). Issues identified
(i). Introduction of interactive lecturing style would be required early on in the students career.
(ii). Provision of a ‘safe’ learning environment would be essential for facilitating interaction.
(iii). A range of learning and teaching methods would be required to appeal to the variety of learners enrolled on the course.
(iv). Various resources would need to be developed to facilitate different levels of learning.

(b). Development of learning and teaching strategies and resources.
It was evident that the students in the 2003/2004 cohort had been ‘surprised’ by my attempts at interaction in lectures and were uncomfortable with this approach. Therefore it was imperative that I introduced this style in years 1 and 2, well before the students were to become the focus of this study.

(i). Groundwork: Introduction of interactive lecturing style in years 1 and 2.
The groundwork was implemented in years 1 and 2 of study to enable students to become familiar with a more interactive lecturing style. The methods used are described below in section 3.3.2.

Once the students had entered year 3 and enrolled on the parasitology course, it was essential to create a ‘safe’ learning environment that could be used as a platform from which to explore some of the learning and teaching developments described in this report. An attempt was made to establish a ‘safe’ learning environment and is described in section 3.3.2 below.

When students began to participate more in the interactive format, the learning and teaching developments outlined in below were introduced.
Initially the worksheets were designed to test knowledge acquisition and reproduction (Bloom’s Taxonomy of learning level 1) through factual recall exercises.

(iv). Implementation of learning and teaching developments – Immune Evasion Crossword and Compare and Contrast Table.
The crossword was designed to assess and explore knowledge acquisition and reproduction (level 1 of Bloom’s Taxonomy) through factual recall. It also facilitates comprehension of the subject (level 2 of Bloom’s Taxonomy) and to some extent application of the key concepts (level 3 of Bloom’s Taxonomy). The compare and contrast table allows students to compare and analyse the immune evasion concepts (level 4 of Bloom’s Taxonomy).

(iv). Implementation of learning and teaching developments – Peer tutoring, group feedback and clinical scenarios.
The peer tutoring activity and ‘Clinical Scenarios’ allow students to analyse the key concepts and to synthesise and evaluate the information (levels 4, 5 and 6 of Bloom’s taxonomy respectively).

3.3.3 Plans for evaluation
Discussion with and feedback from the 2003/2004 and 2004/2005 cohorts of students resulted in the adoption of the following methods of evaluation for the learning and teaching developments that were implemented with the 2005/2006 group of students.

(i). Students were invited to provide informal anonymous feedback on specific teaching and learning developments at the end of the lecture in which the development was introduced. This was achieved by students providing feedback on ‘post-it’ notes that they attached to the door as they were leaving the room.

(ii) Students were invited to provide retrospective targeted feedback on specific learning and teaching developments by email.

3.4 Description of the Study Group and progress notes.

Figure 2. Gender bias

Figure 2. A gender bias exists.
A strong gender bias exists (Figure 2), with females comprising more than seventy percent of the group.

Approximately 40% (38/95) of the students are from the Institute of Rural Sciences (IRS, Figure 3).

Although there are no prerequisites for this course, strong elements of immunology are presented. In particular, the course explores the emerging and novel areas of parasitological research into parasite immune evasion strategies. These lectures are probably the most intellectually demanding of the parasitology lecture series.

Most of the IBS students have completed a second year IBS module in Immunology. However, a number of IRS students will not have had the opportunity to do so. Therefore a significant proportion of the learning and teaching activities, discussed within this development report, focus on facilitating and strengthening learning in this complex area.

The 2005/2006 cohort of Year 3 students provided the ideal study group as they entered University in 2002. They were the first group of students I had worked with through all three years. Thus I was able to introduce a more interactive style of lecturing in years 1 and 2 as groundwork for the parasitology lecture series in year 3. Murray & Brightman (1996) suggested that interactive teaching is more likely to be successful in later years of the academic programme when a firmer grounding in a subject has been achieved.

3.4.2. Teaching developments and progress notes


It became apparent that a considerable amount of groundwork needed to be implemented in order to facilitate the introduction of the planned learning and teaching developments. The 2003/2004 group of parasitology students had reported that they were uncomfortable
with the more interactive style of lecturing I had attempted to introduce with them. At this time I had only introduced a simple question and answer session at the beginning and end of each lecture. The 2003/2004 student cohort had also reported that they were uncomfortable about contributing in front of peers.

Other factors were also important. I was a newly appointed lecturer and as such was unfamiliar ‘territory’. The first time we had met was not only when they were already in year 3 but also part way through the lecture series. I had also introduced a different style of lecturing using PowerPoint. This group of students did not know what to expect from me, nor I of them.

The generous feedback from, and discussions with, students allowed me to identify that, in order to facilitate a ‘safer’ learning environment for Year 3 students in 2005/2006, I would need to implement some degree of interactions in lectures in Years 1 and 2. The groundwork implemented in Years 1 and 2, designed to facilitate the learning and teaching developments introduced in Year 3, are outlined below.

**Interactions in lectures in Years 1 and 2.**

**Year 1 - Hands up approach, Buzz groups & retrospective factual recall worksheets.**

(a). ‘Buzz groups’ to explore baseline knowledge and to monitor learning in sessions.

At the beginning of sessions students were asked either a general question about, or their perception/opinion of, a topic or concept relating to that particular lecture or a question building on ideas presented in previous sessions.

Students were then asked to ‘buzz’ over the question (discuss the question) with their neighbour. They were given three minutes to do this and then students were asked to feedback to the group. The collective answers/ideas generated from the ‘buzz’ were written on the white board. At the end of the session the ‘buzz’ was once again implemented to monitor learning progression and the outcomes were highlighted the board.

The ‘buzz’ group approach can be used to explore different levels of learning (e.g. knowledge, analysis, synthesis and evaluation) depending on the question posed. The power of the approach lies in the flexibility in the way that it can be used. For example, it can be used to explore simple factual recall, to allow synthesis of information or to evaluate student perception of wider issues (Bloom, 1956). This allows both the facilitator and learner to explore differing levels of learning and autonomy (Ecclestone, 2000). Whilst the ‘buzzing’ itself seemed to be perceived as a low ‘risk’ activity, feeding back to the group carried a higher perceived ‘risk’ for the students.
(b). Hands up approach to determine student opinion.

During the session a specific question was posed which may trigger simple factual recall or be used to explore the application of a particular concept. Sometimes alternative answers or scenarios are suggested by the students and/or facilitator depending on the type of question asked. Students were asked to express their own opinion by simply raising their hand to indicate the ‘answer’ that they feel most fits the question/scenario. Again, the flexibility of the activity is the key to its success allowing the exploration of a variety of levels of Bloom’s (1956) learning taxonomy, learning and autonomy (Ecclestone, 2000). This activity was usually perceived as low ‘risk’ and the majority of students contributed in this way.

(c). Retrospective worksheets.

Initially worksheets were designed to test factual recall (Bloom’s Taxonomy of learning level 1 – knowledge reproduction). Worksheets were distributed at the start of the lecture but students were encouraged to use them to enhance private study. It was also suggested that students should use them for lecture consolidation and revision. This activity was generally perceived as low ‘risk’ by the students but participation was highly student dependent. The active use of these worksheets was not monitored. Examples of year 1 worksheets are given in appendix 3.2.

One or more of these activities were implemented in each of the sessions that I taught/facilitated in Years 1 and 2. In Year 1 these developments were implemented in the following modules, which are core for the majority of degree schemes within IBS:

1. Principles of Animal Physiology
2. Introduction to Vertebrate Zoology

Year 2 – Buzz groups, & hands up approach, other physical activity & retrospective factual recall worksheets.

Similar activities to those outlined in (a - c) above were implemented in the second year of study. In addition to these familiar activities, other physical activities were encouraged.

(d). Physical activity to facilitate student learning.

Some key concepts in invertebrate systematics (relationships between different groups of invertebrates) can lend themselves to student activity. For example, phylogenetic relationships between different invertebrate taxonomic groups have been determined. However the correct classification and interpretation of these relationships depends on many factors. One of the key factors is the physical characteristic chosen for determining whether the animals are related or not. The choice and use of these characteristics can affect the final interpretation of the relationship. This is a difficult concept to explain but it can be illustrated using the following exercise.
Students were informed that we were attempting to classify the relationships between the organisms (the students) in a class (taxonomic term but also related to the group). We would do so by investigating whether or not individuals share similar physical characteristics (in reality the classification system may use anatomical morphology). The first classifying characteristic chosen was hair and eye colour. Students were asked to stand up if they had particular hair and eye colour combinations (e.g. blond hair and blue eyes). After identifying themselves, by standing up, they were asked to look around the room and identify other members of their group (classification) and then sit down again. This was repeated until all students were classified according to hair and eye colour and ‘belonged’ to a particular group (class). We then explored what happens to those groups (classes) if we change the classifying characteristic. This time height was chosen and the exercise repeated. Of course, this changes the groups (classes and their classification) completely.

This illustrated two points. Firstly that animal classification and the phylogenetic relationships between these groups are highly dependent on the choice of the classifying characteristic. Secondly that the characteristic chosen for classification should be something that remains constant within the same group of animals.

Although simple, the exercise explores comprehension and analysis of component parts of the argument (Bloom, 1956). The physical activity exercise described above is generally perceived as low ‘risk’ by the students but may be coupled with activities that are perceived as higher ‘risk’ such as feedback to class.

One or more of the activities (a-d) were implemented in each of the Year 2 core modules that I teach/facilitate:

1. Invertebrate Zoology
2. Vertebrate Zoology


In order to establish a ‘safer’ learning environment in which to explore the new learning and teaching developments, we revisited the interactive teaching methods (a-d outlined above) in the initial lectures in Parasitology in Year 3. The rationale was that students were revisiting activities that they had experienced and ‘practiced’ before. This was then used as a platform from which to explore the newer learning and teaching methods and developments.


To support some of the more mentally, theoretically and conceptually challenging sessions in parasitology, and in particular the series on ‘Parasite Immune Evasion’, interactive worksheets were developed. The first session in this series provides an
overview of vertebrate and invertebrate immunity. This provides a conceptual framework (or scaffold) from which to explore the material presented in subsequent sessions. These ‘lectures’ consist of a mini-series of 4 sessions exploring parasite immune evasion strategies.

As discussed earlier, some of the students had prior knowledge of immunity and others were without a basic grounding in the subject. The aim of the first session in the mini-series was to try and redress this imbalance. This offers the opportunity for revision and consolidation for those with prior knowledge and provides a basic knowledge platform for those without experience in immunology.

The worksheet used in this initial lecture in the Parasite Immune Evasion series was designed to test factual understanding and knowledge recall (Bloom, 1956). The worksheet was distributed at the beginning of the session. Instructions were given for students to examine the questions on the worksheet and to use them to help them focus on the content of the session. The session was divided into two twenty minute periods in which information was presented using PowerPoint projection. After the first twenty minute session, students were asked to spend 5 minutes attempting to answer the relevant questions on the worksheet. During this period I walked around the class to facilitate the use of the worksheets and answer any questions raised. The second twenty minute period again consisted of a PowerPoint presentation. At the end of that session students were again asked to attempt the relevant questions on the worksheet. It was also suggested that students could use the worksheet for checking revision progress. A further suggestion was made that, following private study and revision, students could compare and contrast their answers generated in class with their revised and expanded answers. The questions posed on the worksheet explored mainly factual recall but the different ways that the worksheet could be used allowed greater academic freedom and autonomy (Ecclestone, 2000).

At the end of the lecture, students were invited to provide anonymous feedback on the use of the worksheets by writing their comments on ‘post-it’ notes and sticking them to the door as they left. Original student feedback on the use of these worksheets is given in appendix 3.4.

The session material presented in PowerPoint and the Worksheet is presented in appendix 3.3).

(iv). Objectives 2, 3 & 4. Implementation of learning and teaching developments – Crossword and Compare and Contrast table.

Precise, technical terminology has been devised by parasitologists to name, classify and describe parasite immune evasion strategies. In the second session in the ‘Immune Evasion’ series we discussed the range of immune evasion strategies used by parasitic protozoa and helminths. Experience of marking exam scripts had revealed that students in previous years had understood the concepts underlying the different immune evasion strategies but had been confused by the correct naming and classification of them. In
order to support the terminology used by parasitologists an ‘Immune Evasion Crossword’
was developed. This was used during the session to aid retention of the technical terms
and hopefully will become a fun revision aid to support these sessions.

The crossword was distributed at the beginning of the session but students were told not
to use it until instructed to do so. The lecture was divided into two twenty minute periods
of PowerPoint presentations. After the first twenty minute session in which immune
evasion strategies of protozoa were described, students were asked to spend five minutes
attempting to complete the relevant parts of the crossword. During the second twenty
minute PowerPoint presentation, immune evasion strategies used by helminths were
described. Students were then asked to spend five minutes attempting the relevant
questions on the crossword. The crossword was used to explore, knowledge reproduction,
comprehension of the subject and its application to a new situation (levels 1, 2 & 3 of
Bloom’s Taxonomy, 1956).

In addition to the Crossword, a table for comparing and contrasting protozoal and
helminth immune evasion strategies was constructed. It was suggested that the students
use this table during their ‘lecture’ consolidation, in private study and during the
penultimate and final lectures in the mini-series (see also (v) below). This activity
explored knowledge, comprehension and analysis of the subject (levels 1, 2 & 3 of
Bloom’s Taxonomy, 1956).

At the end of the session, students were invited to provide anonymous feedback on the
use of the crossword by once again writing their comments on ‘post-it’ notes and sticking
them to the door as they left. Original student feedback on the use of the crossword is
given in appendix 3.5.

Formal feedback was not requested for the Compare and Contrast Table.

The material presented in PowerPoint, the Crossword and Compare and Contrast Table is
 appended to this report (appendix 3.4).

(v). Objectives 2, 3 & 4. Implementation of learning and teaching developments –
Peer tutoring, ‘Clinical Scenario’ worksheet and group feedback.]

In the penultimate and final sessions on Parasite Immune Evasion Strategies we discussed
detailed examples of parasites that use one or more of the immune evasion strategies
described in previous sessions. The parasites chosen for detailed study were ones that the
students were familiar with. Students had already studied the general biology and life
cycles of these parasites in earlier lectures in this module. We focused on the immune
evasion strategies of one type of helminth and one type of protozoan parasite. The
helminth example chosen was the schistosome, which the students had studied in detail
both in lectures and in a practical class (see teaching cycle 2). Amongst the parasitic
protozoa we studied the African trypanosomes in detail. The students already had
detailed knowledge of the basic biology of these organisms.
At the beginning of the session the students split into pairs and they were asked to nominate one person of each pair to be the ‘tutor’ and the other the ‘tutee’. They were informed that during the first 25 minutes of the lecture, experimental evidence supporting the use of the various immune evasion strategies of either schistosomes or trypanosomes would be delivered. After the 25 minute presentation, the peer tutor was required to teach their peer tutee a particular concept that had been covered in the session. The overall aim was that the tutee should be able to answer a specific, related, formative question, not merely repeat the information presented during the ‘lecture’. When both peer tutor and tutee were happy that they understood the concept, they were asked to feedback their ideas to class.

Subsequently, peer tutors and tutees then attempted the ‘Clinical Scenario’ worksheet together. This worksheet presented a clinical scenario which students were required to explain in terms of the immune evasion strategies that the parasites were using. This provided an opportunity to apply the concepts they had learned to a real life clinical situation and explore a ‘what if’ scenario (critical analysis, Bloom, 1956).

At the end of the session students were again asked to feedback to the group.

In the penultimate lecture we focused on the schistosome tegument as a unique immune evasion organ in this group of parasites. The peer tutor was required to explain the importance of the schistosome tegument in immune evasion and outline the experimental evidence supporting this. The tutor’s role was to facilitate learning in their tutee to enable the tutee to answer the following formative question:

- Why are 3 of the 4 schistosome vaccine candidates internal antigens?

The answers were fed back to class.

When both tutee and tutor were happy with their level of understanding they were asked to attempt to explain the following clinical scenario:

1. A patient with schistosomiasis does not have a strong immune reaction to adult worms in the blood. However, the main pathology associated with schistosome infection is due to host immune responses to the eggs. Discuss this in the context of schistosome immune evasion strategies.

The final session in this series followed the same format. However, the peer tutor and tutee swapped roles to ensure that each had an opportunity to participate in each role. This time the focus was on an immune evasion strategy known as antigenic variation. The example used was that of the African trypanosomes. The peer tutor was required to explain the importance of antigenic variation in immune evasion of the African trypanosomes and outline the supporting experimental evidence. The tutor was required to facilitate learning in their tutee to enable the tutee to answer the following question:

- Why do patients have waves of parasitaemia & fever?
The answers were fed back to class.

When both tutee and tutor were happy with their level of knowledge and understanding they were asked to attempt to explain the following clinical scenario:

2. A patient with African trypanosomiasis (Human Sleeping sickness) has characteristic waves of parasitaemia and fever before eventually succumbing to the disease, if left untreated. Explain these symptoms in the context of trypanosome immune evasion strategies.

The lecture material presented in PowerPoint in these two sessions and the ‘Clinical Scenario’ is appended to this report (appendix 3.6).

At the end of the session students were invited to provide feedback on the learning and teaching methods by responding to a short questionnaire that was emailed to the class (appendix 3.7).

3.5 Feedback from students and self.

Objective 4. To evaluate the learning and teaching developments introduced.

Student feedback.

3.5.1 Interactive worksheet.

Of the 95 students enrolled on the course 65 attended the first immune evasion lecture. Anonymous feedback on the interactive worksheet was invited and was provided by 72.3% of those attending (n = 47).

![Figure 4. Student opinion of interactive worksheets](image)

Approximately 98% of the respondents provided positive feedback for the worksheets (Fig. 4). The remaining 2% (1 of the 47 respondents) provided feedback that was not related to the worksheet (Fig.4).

The original feedback provided by students for this activity can be found in appendix 3.3.
3.5.2 Immune Evasion Crossword.
Informal feedback was sought both from colleagues involved in team teaching on this module and PhD students involved in parasitology research. The crossword was sent to these ‘volunteers’ before being piloted with the undergraduate study group. The volunteer group was asked to envisage that they were final year students and evaluate whether, after attending the immune evasion sessions and using the supporting material posted on the website, they would be able to complete the crossword. The generous feedback from the volunteers was extremely positive. However, several had attempted to complete it without reference to the ‘lecture’ material or website information and these respondents had reported that it made them realize how little they knew about the subject. Their honesty was refreshing and much appreciated.

Fifty six students attended the session in which the Immune Evasion Crossword was piloted. Observation of the students engaging with the activity revealed that the majority of the students were making good progress with it – a real credit to them. Sixty percent (37/56) of those attending provided feedback on the crossword. Ninety seven percent of the respondents (36/37) provided positive feedback for the crossword (Fig. 5). However two students (~5%) stated that they preferred the worksheet style of activity (Fig. 5). One of these students felt that the crossword was good for revision but made the point that they had become easily distracted by trying to complete it. The other student in this group felt that the crossword was ‘good for spelling’. The only respondent (1/37) who had not explicitly stated whether they had liked or disliked the crossword was also able to make constructive criticism. This student stated that the crossword ‘needs better clues’ and that there was a need for ‘smaller words to look for as well.

The original feedback provided by students for this activity can be found in appendix 3.5.

3.5.3 Peer tutoring, group feedback and ‘clinical scenario’ worksheet.

Fifty six and sixty three students attended the third and fourth sessions on immune evasion respectively. Disappointingly, only twelve students (~ 21%) responded to the email questionnaire (appendix 3.7). However, a variety of different responses were recorded (Figure 6).
Approximately 50% of the respondents enjoyed tutoring whilst ~16% reported that they had not enjoyed this activity (Fig. 6). In addition to the responses to the specific questions asked in the survey, other comments were also recorded. One student reported that they found the activity difficult and “did not really know what to say” to their tutee. Another student remarked that the activity was “interesting” and that they had not encountered it in any other lectures. A third student reported that although they initially felt concerned about lack of knowledge, the exercise made them aware that they understood far more than they were giving themselves credit for. This student went on to report that this increased their confidence. Only a single student reported that they had not understood the concept and therefore could not teach it to their tutee.

More than 77% of the tutees reported that they had learned from their peer tutor (Fig. 6). Two students expressed that they had learned no more than was initially presented in the session. However, interestingly, more than 90% of the respondents reported that the tutoring activity had reinforced their own learning (Fig. 6). All respondents reported that their tutee had been able to attempt to answer the formative question, and that in the majority of cases the question was answered correctly. One hundred percent of the respondents reported that they were able to apply the information learned (both from the traditional ‘lecture’ and the peer tutoring) to the applied ‘Clinical Scenario’.

Figure 6. Student opinion of peer tutoring.

One student (respondent 7, appendix 3.7) reported that “even for reasonably outgoing people the switch from passive learning to active participation can be difficult (Monday mornings aside!)”. As the groundwork for active participation had been put in place in Years 1 and 2, in preparation for this final year module, this comment required further exploration. The AStRA profile for this student revealed that the student was a mature student enrolled on a degree scheme from IRS. This student had not been required to
enroll on any of the Year 1 and 2 modules in which the interactive ‘lecturing’ style had been introduced. Thus this student had no experience of my teaching methods. Despite this, the student had actively engaged with all of the teaching and learning methods introduced and had a 100% attendance record for the parasitology module. Furthermore, this student made suggestions for improving some of the teaching activities.

In addition to the specific feedback requested on the learning and teaching developments, module evaluation forms also revealed further student opinion (appendix 3.8). Students made several comments that they enjoyed the interactive teaching methods more than the ‘traditional’ lectures. This is encouraging but the novelty factor must also be considered. One of the most exciting comments was that the course contained “lots of useful information, not only for the course but also for life”.

**Self feedback**

The generous and constructive criticism, of the learning and teaching developments, by students and colleagues has been invaluable in further developing interactive sessions. Analysis and personal reflection on feedback received has encouraged further development of the parasitology sessions as outlined below.

**3.6 Development of lectures following feedback and reflection.**
**Objectives 4 & 5. To evaluate the learning and teaching developments introduced. To reflect on this learning and teaching development.**

**Interactive Worksheets.**
Based on the positive feedback received for the interactive worksheet format (see also section 3.4 and appendix 3.4), worksheets were developed for other lectures in this module. Examples can be found in appendix 3.9. However formal feedback was not requested for these activities.

Whilst interactive worksheets are useful for information recall, they must be used with other teaching and learning strategies that allow synthesis of information and encourage deep thinking (Bloom, 1956). In the immune evasion sessions this was achieved by engaging with the different teaching and learning activities. However, in the newly developed parasitology worksheets (appendix 3.9) the questions have been ‘graded’ to provide opportunities for simple recall tasks which lead into critical appraisal, encourage deeper thought and allow the students to demonstrate synthesis of information (Bloom, 1956). It is envisaged that this ‘grading’ of questions will facilitate differing levels of student autonomy (Ecclestone, 2000)

**Immune Evasion Crossword.**
The single respondent (1/37) who had not explicitly stated whether they had liked or disliked the crossword was also able to make some constructive criticism. This student stated that the crossword ‘needs better clues’ and that there was a need for ‘smaller words to look for as well’. The former criticism is a good point and perhaps a future development could be more explicit clues. However, I feel it is important to offer a
graded range of ‘difficulty’ in order to provide broad appeal and ensure that both of the polarised ends of the learning spectrum, as well as those within the normal distribution of learners, are equally catered for. The latter comment from the student cannot really be acted upon. The aim of the crossword was to support and reinforce the technical terms used by parasitologists to describe parasite immune evasion strategies. By their very nature, these words are rather long and technical. The aim was to attempt to reinforce these terms and add meaning to them, not simply to provide light relief from teaching and learning.

Two students commented on the numbering system used. Whilst the Immune Evasion Crossword does not follow the conventional crossword numbering system, students were informed of this and I do not feel that this detracts from its use as a teaching and learning aid. It is important to recognize that the crossword was designed to fit a particular teaching and learning purpose by allowing the use of technical terms such as ‘antigenic variation’ and ‘anatomical seclusion’. It is in no way intended as a competitor for the Times crossword! However, it is possible to revisit the numbering system and attempt to make it more ‘conventional’.

3.7 Personal reflection on learning from this development.
Objectives 4 & 5. To evaluate the learning and teaching developments introduced. To reflect on this learning and teaching development.

My early experiences with attempting interaction via ‘questioning’ techniques were disappointing. Some studies had suggested that the use of ‘buzz groups’ could be more effective with large groups, working in tiered lecture theatres, where less structured forms of interaction, such as questioning, might be difficult (Alien et al., 1999 cited in Huxham, 2005). My early experiences of introducing ‘buzz groups’ to first and second year students were difficult. Initially students were reluctant to participate and feedback to the group. However, perseverance paid off and the ‘buzz’ became an accepted learning and teaching method. It was imperative to ‘set the scene’ in Years 1 and 2 for the introduction of the ‘windows of learning opportunity’ in the final year.

The learning and teaching developments implemented were, on the whole, received enthusiastically by the students. However it is impossible to use any single teaching method to appeal to all of the different learning styles, preferred by individuals, in such a large and diverse group. I attempted to introduce a range of activities to facilitate learner transition through the different learning levels (Bloom, 1956) and to promote autonomous learner behaviour (Ecclestone, 2000).

There are potential disadvantages of making ‘lectures’ more interactive. For example, the introduction of these ‘windows of learning opportunity’ meant that session content had to be reduced and required considerable reorganization of course material. However, the reduction of content delivered during the session provided an opportunity for tutor-facilitated and self-directed learning and increased student autonomy. Students were expected to read more widely. Feedback indicated that rather than being perceived as a negative element, students understood the value and purpose of the method.
Some studies have reported a preference amongst students for ‘traditional’ lectures over those with interactive elements (Van Dijk et al., 1998; Lake, 2001). However, studies by Tam et al., 1993, Goldfinch, 1996; Sander et al., 2000, and Huxham, 2005) reported a student preference for interactive lectures. The results presented in this study indicated that this cohort of parasitology students preferred interactive sessions to ‘traditional lectures’ and viewed the ‘windows of learning opportunity’ as positive elements. However, when evaluating these comments it is important to consider the influence of ‘novelty’ value of the interactive sessions.

There is also a risk that the use of some interactive methods may reduce the accuracy of information transmission (Huxham, 2005). In this study, the combination of the interactive learning opportunity with more formal presentation of information in PowerPoint minimized the risk of inaccurate information transmission. The more formalized elements were posted on the parasitology website with supporting materials so that students can revisit the information as often as required.

Attentiveness varies during lectures with items at the beginning and end most likely to be recalled (Holen & Oaster, 1976). Therefore timing in the sessions was important. Formal information was presented at the beginning of the sessions. Interactive elements typically took place mid-way through sessions, when attentiveness to formal information, would have been waning. Interactive elements, such as feedback to the group (a summarising and consolidating activity), typically took place at the end of the session.

Student evaluations alone do not provide sufficient grounds for changing teaching practice and the current study would benefit from robust statistical analysis of performance data. However, as the module is team taught and presented as a blended learning environment (see teaching development 3) there are too many variables contributing to overall ‘student performance’, to be able to dissect out the impact of these individual teaching developments.

On reflection, it is easy to see that I had initially underestimated the task in hand – to improve student interaction in ‘lectures’. Ideally the study would have been conducted as a ‘scientific’ experiment with half of the group participating in the interactive elements and half only having ‘traditional’ lectures. This would have enabled statistical analysis of performance data of the two groups. However, this poses ethical issues and could not be done in this study. Whilst student evaluations have been generally positive, statistical analyses would provide experimental rigour.