

USING STUDENT PRESENTATIONS OF CLINICAL CASE STUDIES TO INTEGRATE KNOWLEDGE, REVISE CONCEPTS AND DEVELOP GRADUATE ATTRIBUTES

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Abstract

Clinical case studies are frequently incorporated into medical and nursing courses that use problem-based learning to encourage students to discover and integrate knowledge. Generally such studies are introduced early, with their contents effectively defining the syllabus. We employed case studies in a different way in Immunology, a third year course, offered to biomedical, biomolecular and science students within the School of Biomolecular and Physical Sciences at Griffith University. Immunology is a complex science, involving a vast array of cells and their subsets, signalling and controlling molecules, intricate relationships between various arms of the immune system, and rapidly evolving research. As such, it presents a challenge to students to learn the immunological language, understand underlying molecular mechanisms and gain insight into the interactions of all elements. To help the students learn the basic concepts and master immunological terms, the course was initially presented using traditional lectures and follow-up workshops. In the first week of a three week rotation, four hours of lectures covered the basic concepts for two major topics. The following week the students did a one hour workshop designed to ensure that they understood terms and concepts. In the third week, a two hour workshop emphasised application of learned principles. Although this process assisted students with terms and understanding of underlying mechanisms, it tended to compartmentalise knowledge. To encourage application and broad integration of this knowledge, the final two weeks of the semester were used for oral presentations by the students of six immunological case studies. Students were randomly assigned to a team of 4-6 students and allocated one of the case studies early in the semester, and asked to prepare a 15 minute presentation for the final weeks of semester. Tips on what constitutes a good presentation were issued. Clear guidelines on the marking of the presentation, which included a peer assessment mark, were provided. We chose case studies that effectively revised and integrated concepts from the previously presented modules. We also provided about seven questions at the end of each case study to help the students identify its key features and to ensure that they would need to explain the underlying immunological mechanisms. After each presentation there was time for questions from the students and the teaching team. The teaching team ensured that any errors present in the talk were discussed and corrected. They also asked questions of the class as a whole that highlighted topics and interrelationships that had been covered in the teaching modules. In this way, the case studies became a valuable revision tool. Additionally, corrected versions of all the talks were uploaded onto the course web site for all students to access. The requirement to give these talks aimed to both enhance student learning and develop several desirable graduate attributes, such as skills in oral and written communication and ability to work in a team. Additionally, the need to explain a case study helped to focus the students on really understanding the underlying immunology. Surveys showed that the majority of students enjoyed, and believed that they had benefitted from, doing the case studies. As one student commented: *"I found case studies really beneficial and interesting. Our group took so much time preparing for it and we learned a lot from it"*.

Keywords: case studies, PBL, case-based teaching, Immunology teaching, graduate attributes, communication skills

1 INTRODUCTION

Clinical case studies have been recognised as a potentially valuable component of many health-oriented courses since the first implementation of problem based learning (PBL) in the late 1960's [1]. Their introduction can promote problem solving, clinical reasoning [2], and synthesis of information across traditional discipline-specific boundaries [3], often as part of a transition from traditional didactic teaching methods to PBL [4]. Case-study-focused courses may emphasize specific aims such as

increasing integrated knowledge and skills by working through real-life clinical issues. They may also have generic aims such as fostering the students' commitment to teamwork, clinical reasoning and professional development [4].

Other medical disciplines such as veterinary science have embraced the use of case-based studies to bridge basic science and clinical literacy [5], or have integrated the studies into more traditionally structured courses to enhance students' understanding of important concepts [6] [7]. Some of the courses have used the case-based approach to foster a deep understanding of pathological processes [8] [9] and others have found that case-based writing assignments may increase student engagement and learner confidence [10].

Clinical case studies are the core of PBL courses in medical education; however, the term PBL has many interpretations [11]. The central philosophy to PBL is that it is a student-centred method of learning. Clinical cases serve as challenges for self-directed, independent and cooperative study in a small group setting. The students have a large influence on identifying the important issues and hence directing the learning focus, under the non-directive guidance of a tutor. A 2009 study of the short-term outcomes of a near-full PBL curriculum at a medical school reported good learning outcomes from this style of instruction, with students gaining a deep knowledge of the diseases encountered in PBL [12]. However, the students also strongly identified concerns that they knew very little of other diseases not covered by the PBL cases, and contrasted their total knowledge unfavourably with students of other (non-PBL) schools. Others have reported similar concerns about the perceived lack of effectiveness of PBL to contribute to the knowledge base and clinical skills of medical students [13] [14]. One approach to these challenges has been to design courses with both traditional and PBL elements. Schoeman *et al.* [5], for example, structured an "Introduction to Clinical Studies" veterinary course that commenced with traditional lectures (~4 h) (to enable the students to approach the practical sessions with sufficient theoretical knowledge to examine veterinary patients), followed by three weeks of practical work (applying the learnt theory) and only then proceeded to the introduction of the student-centred, case-based component of the course. This section was preceded by a lecture explaining the objectives and structure of this component. Once issued with the case study, small groups of students (~7/group) first identified learning issues (e.g. meaning of terminology) and independently provided answers, then worked through a series of steps with the guidance of a tutor to eventually report back on the case, in a 30 minute session. Overall the students were positive that the course enabled them to understand difficult concepts. Their confidence to tackle unfamiliar ideas in the future and to apply learnt skills and ideas to other circumstances also increased.

In this paper, we report how we used a strategy similar to that of Schoeman *et al.* [5] to enhance student learning by integrating case studies into an undergraduate course in Immunology. Our aims were to first present basic concepts and the language of immunology in a lecture/workshop format and then to encourage application and broad integration of knowledge through use of the case studies. The content of the case studies was chosen to effectively revise and integrate concepts from the previously presented modules. By requiring the students to work in small teams and to prepare a talk on their individual case study for presentation to the larger group, we also hoped to develop several desirable graduate attributes, such as skills in oral and written communication and ability to work in a team. We undertook surveys to gauge the students' responses to this unfamiliar teaching format, and report the outcomes here.

1.1 Background to the introduction of Immunological case studies

The Immunology course is a third year undergraduate course offered to biomedical, biomolecular and science students (87 students enrolled in 2011) within the School of Biomolecular and Physical Sciences at Griffith University. The course spans one 13 week semester.

Immunology is a complex science, involving a vast array of cells and their subsets, signalling and controlling molecules, intricate relationships between various arms of the immune system, and rapidly evolving research. Many students find mastering the content of the course very challenging and their perception that the knowledge remains at an abstract level impacts on their degree of motivation and engagement with the subject. They need to learn the immunological language, understand underlying molecular mechanisms and gain insight into the interactions of all the elements. The emphasis in the course is on the basic science of Immunology rather than on its clinical aspects, although clinical examples or details of current research projects are frequently incorporated into the teaching, to contextualise the theory.

To enhance the learning experience in this course it was decided to include student presentations of relevant case studies to further contextualise the immunological concepts learned.

2 METHODOLOGY

2.1 Course Structure

The course was divided into eight modules covering the major topics in Immunology. The material was presented using four 3 week cycles (2 modules per cycle) of lectures and workshops. The final two weeks of the course were used for student presentations of case studies.

The course used an associated Blackboard-based web site where study guide notes and other resources for each module were available. The study guide referred the students to specific sections of the textbook and other information complementing the teaching and learning activities. The guide set out learning objectives, and activities were provided for each topic so that the students could gauge their own progress in course mastery.

In the first week of each cycle, two keynote lectures that introduced two modules were presented. Lectures provided an overview of each topic, explained key concepts and provided opportunities for interactive discussions between lecturer and students.

In the second week of the cycle, students attended one 1 hour workshop that focused on content issues. In week 3 of each cycle students attended one 2 hour integrated teaching workshop that focused on processing issues and problem solving. Workshop group size was approximately 30 students. The workshops examined and discussed material in greater depth to allow the students the opportunity to develop and consolidate their learning and test their knowledge of the subject material.

For the case study section, students were assigned to small groups within their workshop, and allocated one of six case studies for presentation to their workshop group in the last two weeks of the course. The case studies were chosen for their applicability to the topics presented in the six modules that followed the introductory information in the first two modules. The studies were either written by one of the lecturers (based on clinical experience) or based on case studies presented in a clinical companion for Immunology texts [15]. Questions at the end of each case study helped the students to focus on the important underlying immunological concepts, which were expected to be incorporated into the student talks. The case studies also required integration of knowledge from several modules, and helped the students to discover the clinical application of some of the theoretical information covered in the lectures.

2.2 Organisation of Case Study Presentations

2.2.1 Group allocations and guidelines

At week 6 in the semester, within each workshop group, students were randomly allocated to a team of no more than 5 students, and each team was allocated one case study. Guidelines for preparing and presenting the material were available on the students' web site and discussed in lectures. Each student group had an associated Discussion Board on their web site, and a Group Page that allowed file exchange, email and use of the Wiki resources for that group. The students were asked to prepare a 15 minute PowerPoint-based talk, to be presented to the larger workshop group in weeks 11 or 12 of semester.

2.2.2 Preparations for the Presentation

Students were previously issued with a list of terms encountered in every case study, and asked to research and write notes on all of them prior to a workshop in week 10. This requirement was to ensure that the whole class had read all the case studies and was familiar enough with specific terminology to understand presentations from all the groups, without need to waste time on definitions or descriptions of techniques during the final presentations. Part of this workshop was devoted to a quick discussion of these terms.

Students were asked also to have a rough outline of their presentation headings ready for this one hour workshop which provided an opportunity to discuss their work with a tutor. The general allocation of tasks within each team was left up to the students (e.g. different group members might choose to

research particular questions; one team member might want to take on a significant organisational role, another might be very good at preparing attractive PowerPoint slides). Irrespective of this allocation, it was emphasized that each person should be familiar with the entire presentation, not just the section that they concentrated on. Additionally all teams were expected to benefit from all presentations, as their content was chosen to revise concepts from the course, and the information from all the talks was examinable.

The students were responsible for independently arranging group meetings and/or using their Group Pages for communication, leading to a final presentation ready by week 11.

2.2.3 Uploading of Presentations

All presentations had to be finalised by the day prior to the second workshop in week 11, and uploaded onto the Group site. The convenor was then able to transfer all the final files to the computer in the tutorial room, rather than having students waste time uploading files on the day.

The teaching team also had access to these files to check for factual errors. Once all workshop groups had given their presentations in weeks 11 and 12, the final, edited versions were all uploaded to the students' web pages in week 13, as a learning resource. Three versions (one from each workshop) ensured full coverage of particular topics, so that any information missed from one presentation should have been found elsewhere. The different presenters also approached each topic from a slightly different perspective, and these different approaches potentially enhanced understanding by the other students.

2.2.4 The Presentations

The presentations occurred during two 2 hour workshop sessions (three talks per session) in weeks 11 and 12. The order of presentation was determined randomly for each workshop by drawing out a number. Thus, all groups had to be prepared to present in week 11 of semester, but may not have been selected until week 12. Each group was allowed a maximum of 15 minutes to present, with all group members expected to participate in the presentation. This was followed by up to 15 minutes questioning from the audience and the teaching team. This period gave the teaching team time to uncover misunderstandings, correct any errors, guide the students in their answers and understanding, and emphasize the underlying immunological principles.

2.2.5 Assessment of Case Study Presentations

Students were given the marking criteria for their talks and also asked to complete peer assessment sheets. Three independent markers graded each talk, the marks were averaged and all members of the group received the same averaged mark (maximum 15 marks). The students from each group provided a peer assessment mark (maximum of 5 marks).

2.3 Evaluating Outcomes

At the end of the final student presentation session, students were invited to complete an anonymous survey. Eight defined statements to examine the students' views on the value of the case studies component were rated using a 5-point Likert rating scale ["Totally disagree" (1) through to "Totally agree" (5)] (Fig. 1); open questions sought to identify beneficial features and those that could be improved.

3 RESULTS

The majority of students completed the survey on the value of the introduction of case studies into the third year undergraduate Immunology course. All aspects that were assessed were viewed positively by the majority of students, with Likert ratings ranging from an average of 3.54/5 (statement 8) to 4.04/5 (statement 5) (Fig. 1). The results indicated that most students enjoyed the case study presentations, believed them to be useful and that they had helped them to learn concepts. Although still receiving an average rating greater than 3, the perceived value of the case studies as a revision tool rated slightly lower than their perceived value in helping students to learn concepts. Both the understanding of the objectives of the case studies and the clarity of instructions on their completion were rated highly by the majority of the students.

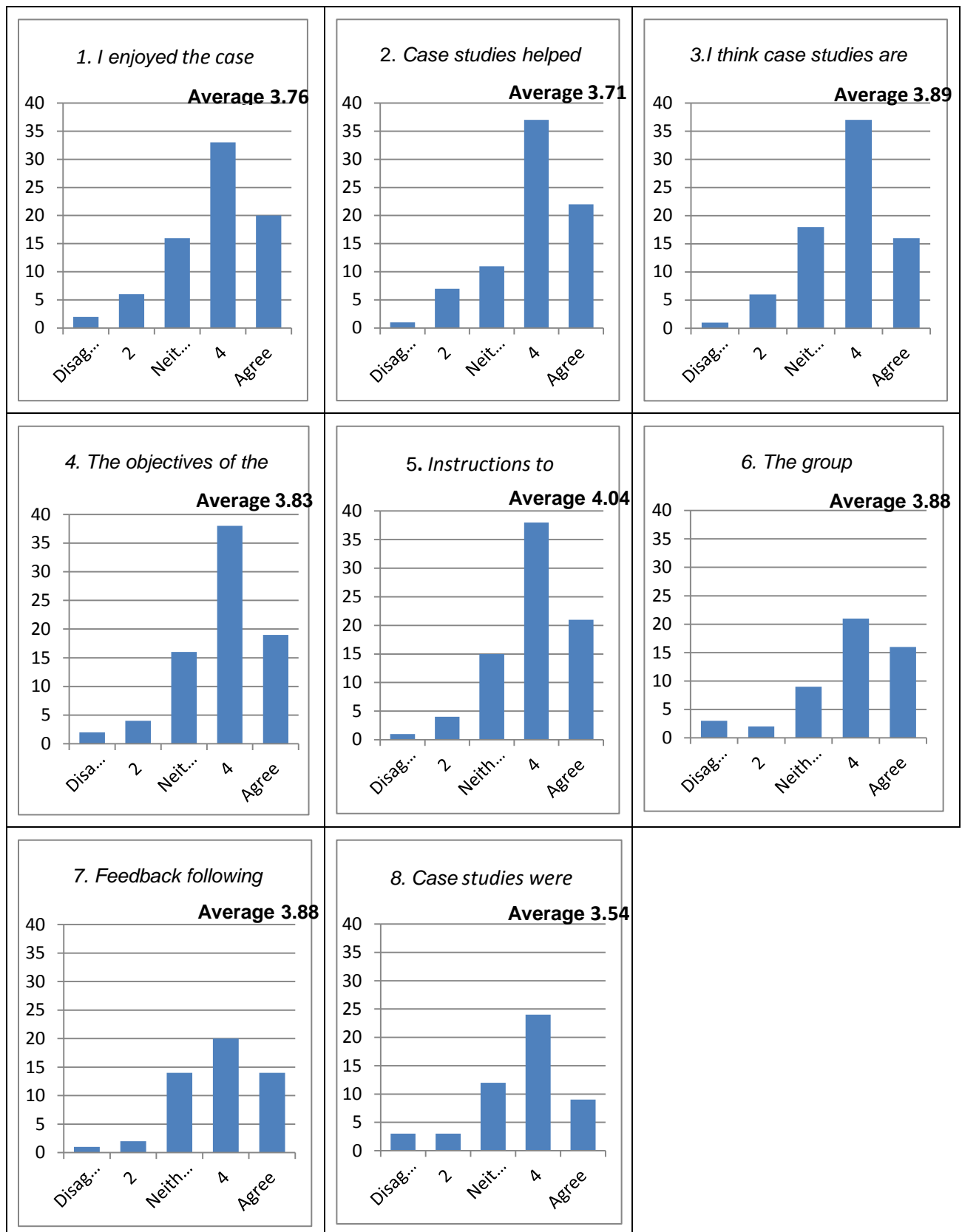


Fig.1: Students' views on aspects of case study presentations that were introduced into an undergraduate third year Immunology course. From the total of 87 students enrolled, 79 students responded to statements 1-5, 51 students responded to statements 6-8. Five point Likert scale, from 1 (Totally disagree) to 5 (Totally agree). Vertical bars represent the number of students providing that grading.

The open question on the most beneficial aspects of the case studies elicited a range of responses. The most common remark was that the case studies had helped the student to apply the previously learnt theory and review the course content. One student remarked: *"It allows us to explore immunology in a more real life scenario and really tested us in seeing if we understood the concepts of what we learnt. Working in a group was also quite good, as we learnt new ways of study and different thinking processes."* and another student liked: *"Working through material learned through the course as an integrated part of the case studies"*.

Other common themes to emerge were the benefit of exposure to real life applications (*"Researching the information and answering the questions in a 'real' sort of application"*), the value of group discussions in preparing the talks, and the discussions, questions and answers that followed the presentations (*"After researching an area within my topic, I had an incorrect response, the discussion afterwards was invaluable for my learning"* and *"The actual presentation and the discussion after the presentation clears any doubt and makes me understand better"*).

One student commented that the seminar presentation built confidence in speaking.

Various suggestions were offered for improvement to this aspect of the course. Although some students had listed group work as beneficial, a greater number commented that they did not like group work and would prefer to be given individual marks for their presentation. Several students felt that the 15 minute time limit for their presentations was too short. The questioning session after the talks proved challenging to several students although others highlighted this session as particularly beneficial.

4 DISCUSSION

In deciding on the best approach to teaching an undergraduate (third year) Immunology course, we took into account the heavy factual content and the specialised terminology that is part of this discipline. Consequently the case study component of the course occurred in the last three weeks of the course, after we had used lectures combined with content-focussed then issue-processing and problem-solving workshops to familiarise the students with basic immunological language and concepts. Others in disciplines such as veterinary science have opted to use clinical case studies as the entire basis for learning in their subject, citing evidence that learning benefits are greater if problems are given to students prior to them having much specific knowledge [16]. However, in a professional program such as veterinary science, by third year the students have already been exposed to relevant terminology and concepts in prior and concurrent courses, whereas the students enrolling in our Immunology course came from a range of programs and with only limited specific immunological knowledge gained in other biochemistry and molecular biology courses. Our intention was to initially help them to learn the immunology "alphabet" before proceeding to application and integration of knowledge. This principle was also adopted by Schoeman et al. [5] in teaching a veterinary course that combined lectures, laboratory work, and student self-learning and guided tutorials.

The students' comments for both open and defined statements (Fig.1) indicate that the structure of the course and inclusion of the case studies fulfilled an established principle of learning, namely that development of competency in a discipline requires a deep foundation of factual knowledge, organised in a conceptual framework [17]. The formally structured section of the course provided the factual knowledge organised into major topics and subtopics, and the case studies showed how these related to each other. The case study format provided the chance for the students to view and discuss concepts from a different perspective, a process that has been shown to increase understanding and improve reasoning skills [18]. Discussion occurred both during the group work, and at the end of each case study presentation when there was time (15 minutes) allocated for questions, clarification and revision. Several students nominated the question and discussion sessions after the presentations as the most beneficial aspect of the case studies. The choice of the case studies therefore seems to have satisfied a recommendation that case studies not only help students to understand big pictures and elucidate troublesome concepts but also engage students in questioning and monitoring their own thinking [17].

The defined statements on the value of the case studies for learning of concepts and as revision of the whole course (Fig. 1, statements 2 & 8) were rated positively. Many students provided comments in the open questions specifically citing the value of being able to apply knowledge to explain the cases:

"Able to learn more in depth and apply the immunology concept into the case study which is very useful"

"Made you critically analyse problems and apply concepts taught in the course"

"Puts in perspective concepts taught throughout semester"

"Helped me understand the concepts of immunology more"

Many students commented on how much they valued the clinical nature of the case studies (*"The clinical and medical aspect I found very effective and was a relevant way to go over the concept learnt in Immunology"*). This is not surprising in a class that had a high percentage of students enrolled in an undergraduate biomedical science degree, who hope to proceed to a post graduate medical program. However, the finding that students are interested in real life applications is a consistently positive feature of using case studies in a variety of both theoretical and practical courses [19].

Responses to our open questions revealed some lack of understanding regarding the reasoning behind the way we had structured the case studies section of the course. Six groups within a larger workshop group were given a different case study to work on and subsequently to present to the entire workshop group. Each case study had been selected for the need to use underlying basic immunological concepts to explain the clinical presentation of a patient and as such, we expected the students to be involved with all the case studies, not just the one that their group was presenting. To ensure ready understanding of all case studies during the presentations, the students were expected to fill in a workshop sheet explaining any unfamiliar terms or concepts from all the case studies. These were discussed at the workshop immediately preceding the student presentations. This tactic proved to be less successful than we had hoped, with many students failing to do the background research for all the case studies, instead concentrating on their own study and passively relying on the discussion during the workshop. This misunderstanding of our objectives is evident in the suggestion by one student that we should *"Discuss more aspects of the case studies during the course prior to presentation so more educated when speaking and listening."*, and another who wrote *"Maybe if we were all required to have a basic understanding of all the cases so that the presentations would not be completely new information as it was now"*.

Concerning the actual presentation sessions, a small number of students failed to realise that (indirect) revision was occurring as the groups and teaching team discussed the case studies (*"I don't think we should have to know all case studies. We should be able to just choose our case study in the exam and answer the questions accordingly. Plus the last two weeks would have been much better spent on revision!"*) or they wanted more explicit descriptions of what concepts were covered by the case study (*"More focus on studying for course relation to case study, so lecturer review is better prepared for"*).

These comments reflect the more general lack of preparation by many of the students for engaging with all the case studies. This finding is at odds with the general students' perception that *"The objectives of the case studies were clear"* (Fig. 1, statement 4); clearly we failed to fully explain that the case studies had been chosen to illustrate basic knowledge covered in the whole course and that we expected the students to use all the studies to help integrate and revise the course content. Also, most students did not realise the value of the preparatory workshop to prepare them for critical analysis of subsequent presentations. Problems with unclear objectives have been identified previously in a non-traditional student-centred course using case studies [5] and will be something that we aim to improve in future course offerings.

The quality of the students' presentations was rated independently by three staff members involved with the introduction of the case studies, with marks awarded being remarkably consistent between the markers. The students were able to produce clear PowerPoint presentations and keep to the time limit for their talk. Most students spoke clearly with little need to read from notes. Some error correction was necessary but most post-presentation discussion sessions permitted highlighting of the fundamental concepts and revision of facts from a different perspective. It was felt by the teaching team that the requirement to present the case studies helped the students to develop valuable communication skills in report preparation, oral presentation and critical analysis and explanation. There was some resentment from students that under-performing members of a group received the same group mark from the assessors; however, the students also contributed a peer mark that should have reflected dissatisfaction with a person's performance within the team. Group work is often problematic and various approaches have been advocated to try to improve these interactions, with a

recognition that the ability to work effectively in teams is an attribute valued by employers [20]. Some modifications following these guidelines may be introduced into future presentations of this course.

Overall, the introduction of case studies into an undergraduate third year Immunology course was received positively by the cohort of students. They considered the case studies interesting, useful for reinforcing previously encountered concepts and revision, commented on the value and enjoyment of studying real life situations and found the discussions in preparing a group presentation, and questions and discussions associated with the presentation, to be very valuable. One of the students summarised the experience as follows: "*I found case studies really beneficial and interesting. Our group took so much time preparing for it and we learned a lot from it. It was so much fun. Our group was fantastic and we all contributed equally. And I learned a lot about it.*"

Some areas for improvement identified by the teaching team included the need to emphasize, and repeat, the objectives of the case studies themselves and the groundwork needed prior to the presentations. Additionally there is potential to improve group work dynamics and aspects of assessment. Overall, we consider that if case study content can be carefully aligned with course objectives, inclusion of case studies into a course has the potential to enhance student learning. Additionally the students can start to develop some valued graduate attributes (such as oral communication skills and contribution to team work) if they are responsible for presentation of their case study to a larger group.

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