# Tutorials for Enhancing Skills Development in First Year Students Taking Biological Sciences

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## Abstract

In order to increase engagement and to consolidate skills, a tutorial-based skills course (module) was introduced as a compulsory component of first-year in the School of Biological Sciences, University of Aberdeen. We evaluated whether students had attained certain 'graduate attributes' during the course, comprising: transferable and generic skills and intellectual curiosity. Student feedback from course evaluation forms, student diaries and focus groups indicated that the course increased students' confidence in questioning accepted wisdom and helped students to develop generic skills. Feedback forms generally indicated a strong appreciation of interactions with tutors, and also of learning in small groups, interacting with peers within degree programmes, personalised learning, and developing generic skills. The quality of students' experience varied, probably due to differences among students themselves as well as with their tutors. Students' use of the course website indicated strategic use of materials to enhance the development of transferable/generic skills. Activity on the course website tended to be greatest among those students who went on to achieve higher overall course marks. Tutors were more cautious than students in claiming that students were more ready to question information having done the tutorial course. Intellectual curiosity among students was more apparent later in the course, suggesting that students had been learning critical thinking skills.

**Keywords:** engagement, intellectual curiosity, student-centred learning, transferable skills

## Introduction

Successful transition into higher education continues to be a major challenge for first-year students and for the academics who teach them (Moir 2010a, Bovill *et al.* 2011, Torenbeek *et al.* 2011). This difficulty may be more acute now that student cohorts are becoming more diverse (Whittaker 2008). A greater proportion of students may be the first in the family to

attend higher education, and may lack the 'cultural capital' (an awareness of the demands of higher education) to make a smooth transition (Luzeckyj *et al.* 2011). These issues are further compounded by traditional teaching of first-year courses in large, anonymous lecture theatres (Black 2005). Retention of students has become a major issue in the higher education sector (Thomas 2002) and a common reason given for student withdrawal is lack of contact with academic staff (Yorke & Longden 2008). Consequently, the emphasis in higher education now is to provide first-year students with an engaging, flexible and rapid integration into their degree programmes (Moir 2010a,b). One approach to this is teaching by tutorials.

Tutorials are apparently not widely or routinely used for teaching science courses with large student numbers (Neumann 2001), or at least their use is under-reported. In those universities that use tutorials in the teaching of sciences there is acknowledgement that this form of teaching can be expensive (Exley & Dennick 2004), while it can also be 'priceless' (Palfreyman 2002).

There is evidence to indicate that students often value tutorials and other small-group work over more formal, large group teaching (Sander *et al.* 2000). It is clear that, given the undisputed value of tutorials, they should at least be considered more widely in the teaching of biological sciences. While staff/student ratios may be ~1:20 in some universities (Palfreyman 2002) a tutorial system may be possible in some courses, some of the time, particularly if post-doctoral or even post-graduate students are used as tutors (Dawkins 2002). We describe a tutorial system in this paper but unlike the Oxford model described in Dawkins (2002), we are not prescribing one-on-one, individual tutorials.

In the School of Biological Sciences, University of Aberdeen, we decided to use tutorials in a new approach to teaching our first year students. In particular, we wanted to enhance student engagement while teaching generic skills in the biological sciences. Student feedback from previous years had suggested that students did not always feel included in the school community from the outset. In order to address this issue, we developed a new first-year course (module) on generic skills, called 'Biology for Undergraduates' ('BUGS'). The course used small tutorials to promote engagement of students with each other, and with specialist academics, within their degree programme.

The emphasis within these tutorials was on student-centred learning. The intention in designing this course was also to instil a sense of collegiality among students and academic staff within the department. Enhanced relationships with staff (Thomas 2002) and a structured learning environment (Thayer 2000) have been identified as being important in increasing retention and both have been incorporated into the BUGS course at Aberdeen. At the same time, the University of Aberdeen had recently introduced 19 graduate attributes (GAs) into teaching. These attributes included the following, which we felt could be delivered more effectively using small groups and student-centred teaching:

- GA2 'an intellectual curiosity and a willingness to question accepted wisdom and to be open to new ideas'. This is one of the University of Aberdeen's group of attributes in the group 'Academic excellence'.

- GA6 'a diverse set of transferable and generic skills'. This is one of the University of Aberdeen's group of attributes in the group 'Critical thinking' and 'Effective communication'.

Both sets of attributes, GA2 and GA6, are developed at different rates among a typical student cohort. Consequently, we felt confident that in this study we would observe a range of responses among individual students. We selected GA6 because we felt that it embodies a range of relevant skills, some of which could be developed from existing skills or acquired

during the tutorial course. GA6 is readily measureable and easily recognised by the students, not least because the assessments were based on them. In contrast, GA2 is not so easily quantified and may not be so apparent to students. We chose GA2 because, in our view, it is precisely within small group teaching that intellectual curiosity can be encouraged. GA2 and GA6 are complimentary because they are both important during the transitional stage that first year students experience.

The aim of this project was to assess the extent to which students had, as a result of participating in the compulsory first-year 'BUGS' course, acquired or developed these two GAs. It was anticipated that among the students who followed the course, the extent to which they acquired or developed these GAs would be variable. In addition, we aimed to explore the benefits of the course from increased staff contact in small groups and engagement with course materials.

## Materials and Methods

The extent of aspects of engagement of first-year students in the School of Biological Sciences, University of Aberdeen was evaluated within a compulsory course taken by all 131 students who commenced in the academic year 2010–2011 (Table 1). The course ran throughout the academic year and consisted of twelve 1.5-hour tutorials held fortnightly. The four main themes, each with a corresponding block of three fortnightly tutorials and a plenary session, were:

- Scientific literacy (scientific peer review publishing; literature searching)
- Scientific communication (writing, editing, presenting)
- Data handling (writing hypotheses, experimental design, descriptive statistics)
- Projects (developing and integrating the skills above; team working)

Material used throughout the course was made relevant to each student's degree programme by allowing each tutor to choose what case studies were used for contextual information or to use the tutor's own material. The purpose of this was to make otherwise generic skills teaching more subject specific. Using highly relevant course content, and an informal, interactive delivery, we sought to promote student-centred learning at this critical stage in the students' transition to higher education.

Each student was assigned to a tutor group with approximately four other students, based on their degree programme. In total, there were 31 tutorial groups. Staff tutors were allocated to groups where students shared a similar subject orientation to the member of staff. The tutorial groups remained together for the entire year, and had a different tutor for each of the two semesters.

Each tutorial was themed (Table 1), though tutors could choose how to develop the theme. Materials were available on the course website, both for students and tutors. We emphasised to tutors that they could use as little or as much of the support material as they wished. Tutors who were very busy or those with limited experience in teaching first-year undergraduates often made extensive use of the support material. In contrast, tutors who preferred more autonomy developed their own material, some of which was shared by the teaching term. The tutors were a mixture of academics that the students would encounter on other taught courses and those that they would not; this is one reason that we wanted each tutor group to experience two tutors.

A range of methods, outlined in this section, were used to assess the acquisition of the two selected GAs within this student cohort. Measurable parameters, relating to GA6, were evaluated by the four summative assessments during the course (see Table 1). To evaluate

**Table 1** Structure of the Biology for Undergraduates (BUGS) course, 2010–2011

| Semester 1 (first tutor) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Tutorial 1 | | Tutorial 2 | | Tutorial 3 | | Tutorial 4 | | Tutorial 5 | | Tutorial 6 | |
| Literacy | | | | | | Communication | | | | | |
| PL 1 | | | | PL 2 | | | | | | PL 3 | |
| | | | | AS 1: Review writing | | | | | | AS 2: Presentation | |
| **Semester 2 (second tutor)** | | | | | | | | | | | |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Tutorial 7 | | Tutorial 8 | | Tutorial 9 | | Tutorial 10 | | Tutorial 11 | | Tutorial 12 | |
| Data handling | | | | | | Project | | | | | |
| | | | | PL 4 | | | | | | PL 5 | |
| | | | | AS 3: Data handling online test | | | | | | AS 4: Presentation & report | |

Note: Tutorials 1–12 were taught at fortnightly intervals during the 24 weeks of the University of Aberdeen's academic year (numbered in the table). During each of the two semesters, there were two themes, each covered by three tutorials. Each theme also had an associated assessment (AS) and plenary (PL); there was also an introductory plenary at the start of the course.

the perceived attainment of both GA2 and GA6, both staff and student opinions were canvassed. Also, empirical data on student engagement within the course website (virtual learning environment, VLE) were collected. Attitudes of students inevitably involve strong subjective elements. Consequently, to increase confidence in the results we used a triangulation of methods (Creswell & Miller 2000), both qualitative and quantitative.

## Student course evaluation forms

Students manually completed a mid-term student course evaluation form (SCEF) at the end of the first semester (December 2010, 84/131 responses). At the end of the course they completed a post-course SCEF (May 2011, 69/131 responses). SCEFs were given out, completed and returned by the students at timetabled plenary sessions to which the whole class was expected to attend. These SCEFs are standard to all courses within the university so students were familiar with the format. In addition to the standard questions the course team added some statements concerning the GAs we were interested in assessing:

- My intellectual curiosity has increased
- My willingness to question accepted wisdom has increased
- I am more open to new ideas
- I have learnt some transferable and generic skills

The students scored each of the above statements with a five-point Likert scale; strongly agree, agree, neither, disagree and strongly disagree. We worked on the assumption that students would understand these questions.

SCEFs were administered by departmental secretaries, who had no direct interest in the results. The forms were scanned and summarised by machine and, subsequently, written comments were typed up by secretaries. All SCEFs were completed anonymously.

## Course website data

From the outset, and at intervals throughout the course, students were strongly encouraged to use the VLE website, which for this course was Blackboard WebCT. The website was demonstrated to the whole cohort of students in the first plenary, before tutorials commenced. Information on accessing and using the site was also outlined in the course manual. Resources on the course website included information documents, links to external websites, and self-evaluation formative assessment quizzes. Typically, each tutorial was supported by at least two (sometimes several) 'fact sheets' written by the delivery team, each of which included references. Each tutorial also had associated extension material available, for more motivated or able students. The number of resources available was almost certainly much greater than those provided on the websites for other first-year courses in our department. As an essential part of the BUGS course, students were, with or without their tutor's involvement, expected to access material before, after or even during the corresponding tutorials.

Use of the website by all students was monitored using a tracking tool, as a means of profiling individual students in terms of their willingness to engage with course materials and performance in formative assessment tests. As a working hypothesis, we assumed that online engagement correlates well with overall course performance (e.g. Beer *et al.* 2010, Mehdinezhad 2011), and that this engagement is an indication of intellectual curiosity. Within this study, tracking was regarded as potentially useful because it provides insights into students' autonomous learning. A further advantage of tracking course website activity, compared with other metrics used in this study, is that it was an objective measure of student engagement with course materials and not subject to self-referential bias.

We used the following metrics: (a) participation in optional online assessments, (b) patterns of website activity over time, and (c) the relationship between course website activity with the students' overall course performance. In addition to any time-outs from internet service providers and campus computers, the VLE for this course had a default time-out (60 minutes) which students could not override; nor did it seem likely that students should want to do so. We therefore assumed that 'website activity' was a reliable indicator of student activity.

## Student focus groups

Twelve students from across the School were invited by e-mail to participate in a focus group session. They were selected randomly and although not every degree programme was represented by the invitees, the sampling achieved representation of the major groups of degrees. BSc Zoology, the largest degree programme, was represented by three students, BSc Biology and Marine Biology were represented by two students each and the other students were invited from BSc Conservation Biology, Forestry, Ecology, Environmental Science and Wildlife Management.

Only four students voluntarily participated in a mid-term (November 2010) focus group entitled 'Encouraging intellectual curiosity and a willingness to engage'. The group consisted of two students studying for a degree in Zoology, one in Biology and one in Conservation Biology. The focus group was conducted by Sarah Dalrymple, one of the teaching team and co-author of this paper. The focus group was semi-structured in that students were asked questions regarding GA2 and GA6. Examples included:

> 'the BUGS course is trying to give you an experience of small group teaching where you can explore [your degree subjects]. So have you found that the course is actually doing that?'

*'so if your tutor said something that you didn't agree with ... would you feel comfortable enough to challenge your tutor?'*

The focus group was conducted in such a way as to be exploratory and supportive. Some planned questions were not used because the students covered the subjects without prompting. The one-hour session included an introduction and reiteration of the assurance of anonymity that had been described in the e-mail invitation. The session was recorded and 48 minutes of speech was transcribed. The four themes that emerged as a result of iterative content analysis were: skills, acquisition of new knowledge and understanding, engagement, and questioning received information. A report containing anonymous quotes from the students was made available to the research team undertaking this work and organised according to the generated themes.

## Student diaries

At the beginning of the course, 20 students chosen at random were asked by e-mail whether they would be willing to complete student diaries over the year about their progress through the course. The names of students invited to complete diaries were shared with Sarah Dalrymple to ensure they were different to those approached about the focus group. Five students agreed to take part but only one responded to every call for a diary entry (Table 2). One student, having agreed to participate, did not continue to respond. We are aware that students who completed diary entries were likely to have been among the most motivated students since they took part through choice. When prompted to submit a diary entry, students were asked to give their overall impression and also to consider aspects such as 'what have you learned so far?' and 'how has the course affected your confidence?' Diaries were anonymous; students sent e-copies to an intermediary after every call for a diary entry. The intermediary coded any identifying features within the responses and forwarded them to the research team.

**Table 2** Summary of student submissions of diary entries

| Student | November | December | February |
| --- | --- | --- | --- |
| A | Response | No response | No response |
| B | Response | Response | Response |
| C | Response | No response | No response |
| D | Response | No response | Response |
| E | No response | No response | No response |

## Tutor questionnaire

A questionnaire was sent out to all course tutors (staff) at the end of both the first and second semester. Questionnaires were sent out in an electronic format and their responses sent to an intermediary and again coded to ensure anonymity. Questionnaires asked about students' engagement as well as whether staff believed that the students were gaining GAs concerning generic and transferable skills and intellectual curiosity.

# Results

## Student course evaluation forms

Among those who completed the SCEF survey, feedback on the BUGS tutorial course was overwhelmingly positive for both the mid-term (i.e. at the end of the first semester) and

post-course (end of the second semester) evaluation forms. The following percentages relate to the proportion of students selecting parts of the Likert scale corresponding with the percentage of students answering 'strongly agree' or 'agree'.

Students generally felt that the course aims were clear (mid-term 82.1%; post-course 79.7%), the teaching was effective (mid-term 82.1%; post-course 73.9%) and the feedback on assessments was helpful (mid-term 76.2%; post-course 88.4%). Most students stated that they enjoyed the course after the first semester (mid-term 82.2%), but this number reduced towards the end of the course (post-course 66.7%).

Thematic analysis (Table 3) indicates that tutor interactions were regarded as important, and this increased between the mid-term and end of course SCEFs. Linked with this was the high value ascribed to small group size. In response to the question 'Were there any good things about the course which other similar courses might benefit from?' students mainly stated that they had enjoyed working in small groups (Figure 1; Table 3). Less explicitly, interactions with tutors and peers were deemed important (Table 3). The development of generic skills was valued particularly in the first part of the course but less so in the second part (when the skills were applied; Table 3).

In terms of the specific GAs we were investigating as part of our study, students felt very positively at the mid-term SCEF that they had achieved them (Figure 2). The level of agreement with these statements increased within the post-course SCEF with more students strongly agreeing with the GA statements.

We are confident that, while it is possible that some students did not fully understand one or more of the questions in the survey, any such issue is likely to have affected only a few students.

## Course website data

There was substantial variation among students in frequency, duration and interaction with course materials. There were widely differing levels of engagement with the formative assessment quizzes. Participation in any of the 15 available online assessments was optional; however the majority (72%) of students completed at least one self-evaluation test over the course of the year. Use of formative assessments was highest for the topics of literature searching (42%), descriptive statistics (35%), and comparative statistics (26%). Participation was lowest for the 'peer reviewing' test (6%).

A focus on the first half of the course shows fortnightly fluctuations in both visit number and duration of visits (Figure 3). Activity was significantly higher in Fortnight 1 and Fortnight 3 than in the other periods shown (Kruskal–Wallis, $H = 168.22$, df = 4, $p < 0.001$); Fortnight 3 corresponds with the first assessment on the course (see 'AS 1', Table 1).

During the period 27 September 2010 – 2 March 2011, usage varied among students within and among overall performance levels. There was a strong correlation between total duration of visits to the course website and the number of website elements viewed (Pearson correlation $r = 0.823$, $p < 0.001$). Therefore it was deemed appropriate to only use the total duration of visits to the course website to compare with overall course performance. There were significant differences between student's overall course grade and the median number of course website elements viewed (Kruskal–Wallis, $H = 10.94$, df = 3, $p = 0.012$). Post-hoc analysis revealed that students who went on to gain a higher grade for the course (i.e. first or upper second) tended to have been significantly more active on the course website than those with a lower achievement (third or fail), while those obtaining a lower second did not differ from the others (Figure 4).

**Table 3** Thematic analysis from students' mid-term (December 2010) and post-course (May 2011) SCEF comments in response to the same statements in each case: (a) Were there any good things about the course, which other similar courses might benefit from?; (b) Did you enjoy the course?; and (c) General comments

| Theme (number of responses: mid-term, post-course) | Representative quotes from students (verbatim) | |
| --- | --- | --- |
| | **Mid-term (end of first semester)** | **Post course (end of second semester)** |
| | *Positive comments* | |
| Interactions with tutor (9, 20) | Opportunity to interact personally with lecturers. | Contact with members of staff in your degree focus area so early on in the degree programme. |
| Small group size (14, 12) | The tutor approach was greatly helpful, smaller classes helped me feel able to ask more questions | Small tutorial groups are very useful and productive. |
| Developing generic skills (14, 8) | Teaching use of data and how to think like a scientist. | Everything from making presentations and reports to analysing your own data. |
| Interactions with peers (6, 4) | Social interactions with people on course. | It was good to get everyone on the same page, and I think other courses could benefit from adopting a similar strategy. It was also nice to meet others from my course degree programme. |
| Personalised learning (7, 1) | Just the right amount of work, were able to chose topics that were of interest to you. | |
| Relaxed learning environment (4, 0) | The tutor approach was greatly helpful, smaller classes helped me feel able to ask more questions. | |
| Collegiality (1, 2) | Getting to know a specific tutor for the entire semester. | Meeting the staff was great—I feel part of the department. Definitely getting to spend so much time with staff. |
| Relevance to my degree (1, 1) | It was very specific at times in terms of species and topic which I liked for a change instead of general topics discussed. | |
| | *Negative comments* | |
| Unnecessary parts (5, 1) | Plenaries were pointless and a waste of time. | Could have been put all into one semester rather than spread over two. |
| Repetition (3, 2) | It wasted a lot of my time on topics we already know a lot about. | Already knew stuff |
| Different tutor expectations (1, 0) | ... what was expected by different tutors appeared to vary greatly. | |

Note: Themes are prioritised in the table according to how many 'hits' they scored.

## Student focus group

The four students who were interviewed felt that participating in the course had improved their generic skills, and increased their confidence in working independently. Interestingly students also stated that they felt more confident than their peers in other schools and
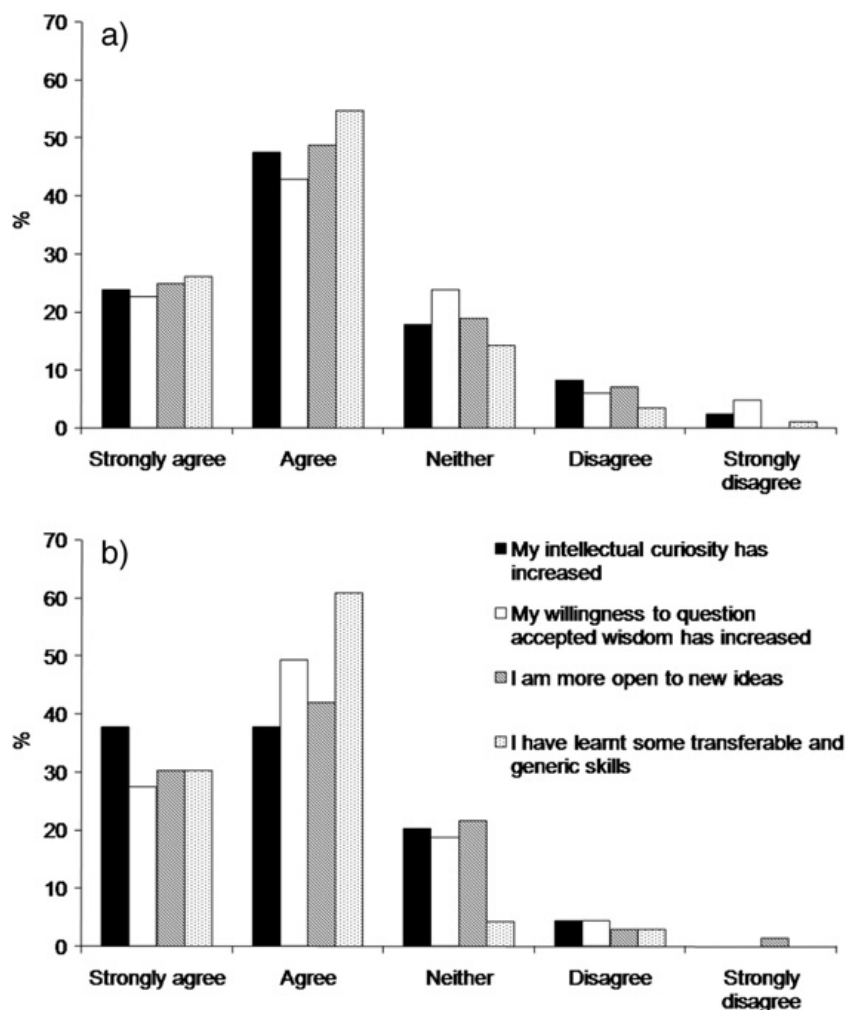
**Figure 1** Wordle<sup>TM</sup> generated from mid-term (end of first semester, December 2010) and post-course (end of second semester, May 2011) SCEF comments in response to 'Were there any good things about the course which other similar courses might benefit from?'. Biology for Undergraduates (BUGS) tutorial course (2010–2011), School of Biological Sciences, University of Aberdeen.

more senior students within the school. Focus group participants particularly felt that they could take on the challenge of deciding what information is important and relevant when tackling the research portion of an assessment.

> 'One significant thing to me is how to do the research ... getting all these sources and trying to fit the pieces together is a new challenge ... We have to learn totally different new skills to high school.'

The assessed oral presentation helped the students in developing their transferable communication skills. Despite being nervous, students felt that they could develop the skill within a supportive small group environment.

> 'Nobody wants you to do badly, everyone wants you to do well and you just have to remember that everyone is in the same boat.'

One of the main areas for discussion was that the students enjoyed the opportunity to consider different points of view and to question what they were learning. They also felt that they had gained confidence in questioning the 'accepted wisdom' of their tutors which links to GA2.

> 'In Uni we always get to question whatever we learn, lots of opportunities to ask around.'

> 'I actually would [question my tutor], especially if I felt comfortable with the subject ... you expect to be listened [to] ... so I would be happy asking for more explanation.'

> 'It's good to know that your tutor can learn things from you.'

**Figure 2** The level of agreement with four graduate attribute statements from mid-term SCEFs, December 2010 (a) and post-course SCEFs, May 2011 (b) for Biology for Undergraduates (BUGS) tutorial course (2010–2011), School of Biological Sciences, University of Aberdeen.
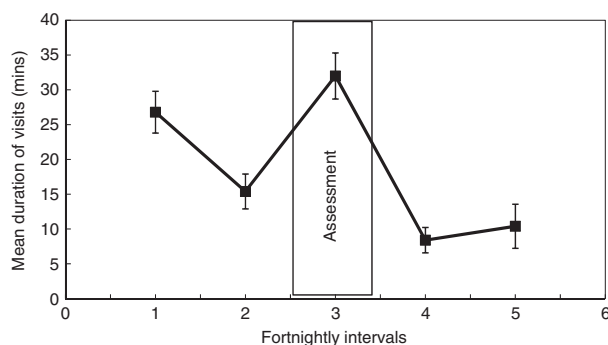


**Figure 3** BUGS website usage during the first semester of the Biology for Undergraduates (BUGS) tutorial course course (27 September–5 December 2010). Data show mean duration (in minutes) of visits (± standard error) during five fortnightly blocks for n = 131 students. The occurrence of an assessment, six weeks into the course, is shown.
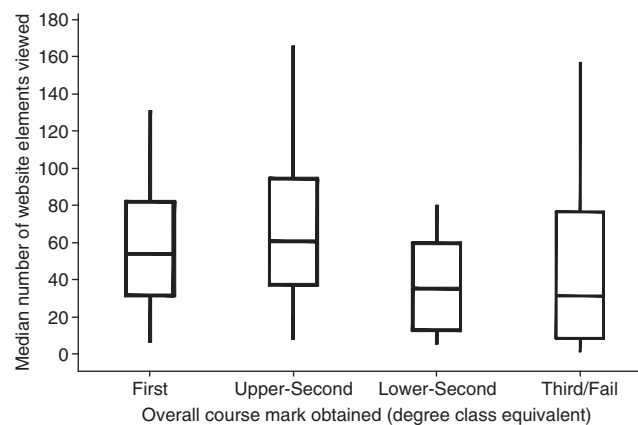
**Figure 4** Median number of content items viewed on the course website, grouped by students' overall mark on the Biology for Undergraduates (BUGS) tutorial course (27 September–24 November 2010).

There was some disagreement among the students in the focus group regarding whether the amount of freedom for discussion that they received was 'good' or 'bad', as it was felt that some students can be bewildered by too much conflicting information. One focus group participant felt that he needed more guidance in choosing independent study subjects.

> 'our tutor hasn't given us much direction so the papers I've chosen are on the stuff we're doing in the general biology course.'

There was also a general feeling that there was more opportunity for independent learning and student–tutor engagement in small groups. However, the extent to which students got to know their tutor varied substantially among tutorial groups.

> 'It does make you feel like we're doing the work on our own. At first it's really hard but as you go along it gets easier and easier and suddenly this is like, hey, this is my own research work. It makes me feel like I'm actually at Uni life.'

> 'I'd like my tutor to talk about his [research] area a bit more.'

## Student diaries

In their student diaries, some students suggested that skills learnt on the course were useful on other courses that they were studying, both within Biological Sciences courses as well as in other subject areas. Students also reported that the course had improved their confidence in their abilities. In particular, they referred to increased confidence in their presentation skills. These results suggest that the course has successfully contributed towards development of generic and transferable skills (GA6). One student suggested that the small group tutorials made them feel that they had a support network in place from the beginning of their studies.

## Tutor questionnaire

The number of tutors responding to the questionnaire in the first and second semesters was 14/31 and 18/31, respectively. Tutors generally rated the tutorial experience highly for both staff and students and were also positively surprised by the abilities of the students. They reported that most students were engaged and contributed during tutorials while only

very few did not contribute to discussions. Furthermore, staff reported that most students' engagement improved over the course of the tutorials.

Tutors rated very few students as having improved in terms of critical thinking. They reasoned that this was because some missed tutorials, because the focus of tutorials was skills training rather than critical thinking or because students already had good critical thinking skills and so their improvement was negligible. However, second semester tutors rated more students as questioning information from the literature, other students and their tutor than first semester tutors. This suggests that the students' willingness to question accepted wisdom (GA2) improved over the year.

# Discussion

Evidence from student and tutor feedback, as well as website tracking, indicates that the tutorial course has been generally regarded as successful in promoting the development and consolidation of generic skills, increasing the willingness of students to intellectually engage, and in collaborative working with peers and academic staff within their discipline.

We recognise that, however valuable a tutorial course is, there are potentially substantial logistical constraints. In particular, it can be difficult to recruit sufficient numbers of tutors. This is a widely-acknowledged issue (e.g. Bonanno *et al.* 1998) and therefore from the planning phase it was expected that all staff participate unless they had specific reasons which had to be outlined to the Head of School. We were also conscious of the possibility of academic 'resistance' to teaching first-year students (Jones & Galloway 2011). Nevertheless, we have now had enough tutors to run the tutorial course for three consecutive years.

Some tutors on the BUGS course were researchers and professors who would otherwise do little or no teaching. As part of the course development, mentoring was offered to those who requested it. In addition, two courses on small-group teaching were offered to tutors (one in each semester), taught by staff from the University of Aberdeen's Centre for Learning and Teaching. We also held briefing meetings with all tutors, for instance to emphasise that students would expect, and value, an intellectually challenging experience. Support material for tutors encouraged them to be creative with the tutor time, and to be alert to differing student needs. Such preparation is likely to be important in engaging staff in tutorial teaching (Jones & Galloway 2011).

The flexibility of the tutorial format also, potentially, promoted a greater use of research-led teaching (Gartland & Wood 2008). We viewed the opportunities for tutors, including or especially those who do little teaching, to share enthusiasm for their research directly with students (Brew, 2010). Furthermore, we hoped that this would provide an incentive to participate in the course for those academics who usually did not teach undergraduates, at least at first year.

The SCEF responses were the main channel for student feedback on the BUGS course. From this feedback, reported comments indicated that several students felt that the BUGS course had been successful in developing particular GAs in the School of Biological Sciences at the University of Aberdeen. Students felt that they had developed intellectual curiosity (GA2) and attained transferable skills (GA6) and were aware of this acquisition both part-way through and at the end of the course. It seems likely that such students, and their tutors, recognise that these key skills are likely to correlate with their overall academic performance (Carroll & Feltham 2007). Since first-year students arrive at university with a wide range of skills (Jones 2011), a potential benefit of the tutorial course is to ensure that all students are similarly academically-prepared for future courses. Furthermore, early development of skills is likely to be important, since acquiring them can be a long process

(Torenbeek *et al.* 2011). Tutorials can allow students to develop such skills, and staff to assess them, in a non-threatening environment.

Students' approaches to learning transferable skills (GA6) appear to be at least partly tactical, rather than to have been driven by intellectual curiosity (GA2). For example, our data show an increase in use of the course website in the period leading up to an assessment, followed by a decline. Similarly, online tests on some topics appear to be strategically targeted. This may be because these areas are perceived to be more important, difficult or less familiar. However, it was clear from the survey element of our study that students valued the prospect of being able to apply these skills in other courses. Furthermore, some of the BUGS coordinators are involved in delivering courses at the second and third years that build directly on the students' experience in the first-year tutorial course.

In contrast, the very high levels of website activity among a few students may demonstrate real intellectual curiosity and engagement with the course materials. A relationship between online activity and student performance has previously been reported (Beer *et al.* 2010, Mehdinezhad 2011) and there is some evidence in this study that students who ultimately achieved higher grades in the BUGS course had been more active, and spent more time, on the course website. The range of online activity both within and across performance groups ('first', upper second', etc.) was variable. This reinforces the view (e.g. Bates 2008) that online resources can offer opportunities for a first year student cohort that is typically heterogeneous in abilities and aspirations. Overall performance of students on the tutorial course was likely to have been a function or both intellectual capacity and 'personality factors' that include, in particular, conscientiousness (Busato *et al.* 2000, von Stumm *et al.* 2011). Conscientiousness may also be an expression of intellectual curiosity (GA2) and, on this tutorial course, may be evidenced by autonomous activities such as using course materials as well as by active participation in tutorials themselves.

Working within small groups and forming relationships with peers and, especially, tutors emerged as being very important to students taking the course, and one of the core features of their first year experience. Our data indicate that the value of tutor interactions tended to gain wider appreciation as the course progressed. Group work was an important feature of the tutorials, particularly during the project phase of the course. It is recognised that group work is an important student attribute (e.g. Bonanno *et al.* 1998) but that it is typically acquired only slowly during the first year. This is possibly because students take time to adjust to the social dynamics of tutorials. We feel confident that this collaborative experience may have had, at least in some students, a lasting effect on achievement during the course and in the students' subsequent undergraduate career (Torenbeek *et al.* 2011).

The small group environment and acquisition of transferable skills (GA6) also appeared to boost student confidence, allowing the development of intellectual curiosity, willingness to question, and openness to new ideas (GA2) within a 'safe' environment. Confidence, especially during the later stages of this first year course, is likely to be a critical factor in determining academic success (Goldfinch & Hughes 2009). We saw evidence, from the focus group and diary comments, that already motivated students were keen to consolidate and develop their understanding (McMillan 2010). Direct contact with staff and peers within small tutorial groups was likely to have encouraged most students to participate, to feel valued, and to develop an 'academic identity' (Jones & Galloway 2011). Even reticent students may have gained enough confidence to outwardly, or inwardly, become open to new ideas (Chanock 2010).

We only have indirect or incomplete information about those few students who struggled to engage with the course. The voices of such students are often not heard. Only the course website data provides some insights on this study. Such students did not participate in the

focus group or the diary projects, and may not have been present when SCEF surveys were conducted.

We believe that this study indicates a potentially useful model for enhancing student engagement from an early, critical stage in higher education. We suggest that teaching at least one first-year course by tutorials can promote a sense of belonging among students, as they join their new academic community. The use of tutorials in biological sciences is a core part of teaching in some elite universities but tutorials are either not widely used or are under-reported within the higher education sector as a whole (Neumann 2001).

The main constraint in delivering a tutorial course to an entire year-cohort is likely to be logistical. However, we suggest that creative deployment of human resources might allow this model to be applied elsewhere, in other departments within the higher education sector. For example, graduate and post-doctoral researchers can be used. Tutorials can also be highly effective when led by the students themselves, and sometimes even without tutors (Powell 1974, Exley & Dennick 2004).

From this study, there appears to be a good case for continued and sustained study of the costs and benefits of running large-scale tutorial courses in biological sciences (and beyond). We also suggest that there would be value in conducting longitudinal studies into any lasting gains for cohorts of students who have experienced a first-year tutorial course.

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