

An example of large group drama and cross-year peer assessment for teaching science in higher education

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An example of large group drama and cross-year peer assessment for teaching science in higher education

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Abstract

Undergraduate students spanning three years of a marine biology degree programme (n=86) experienced a large-group drama aimed at allowing them to explore how scientific research is funded and the associated links between science and society. In the drama, year one students played the 'general public' who decided which environmental research areas should be prioritised for funding, year two students were the 'scientists' who had to prepare research proposals which they hoped to get funded and year three students were the 'research panel' who decided which proposals to fund with input from the priorities set by the 'general public'. The drama, therefore, included an element of cross-year peer assessment where level three students evaluated the research proposals prepared by the level two students. Questionnaires were distributed at the end of the activity to gather a) student perceptions on the cross-year nature of the exercise b) the use of peer assessment and c) their overall views on the drama. The students valued the opportunity to interact with their peers from other years of the degree programme and most were comfortable with the use of cross-year peer assessment. The majority of students felt that they had increased their knowledge of how research proposals are funded and the perceived benefits of the large group drama included increased critical thinking ability, confidence in presenting work to others and enhanced communication skills. Only one student did not strongly advocate the use of this large-group drama in subsequent years.

Large-Group Drama

This study examined the usefulness of a large group drama in allowing undergraduate students to explore how science is funded within the UK funding system. It has been suggested that drama can be a successful vehicle to learn about science in the context of society, enhancing higher order learning skills and allowing students to explore attitudes and perceptions (Alrutz, 2004; Ødegaard, 2003). In addition, personal involvement in an issue is likely to be more meaningful than simply reviewing the situation impersonally from the outside (Bailey and Watson 1998). Drama provides a cooperative learning environment (Christofi and Davies 1991; Kase-Polinsini and Spector 1992) where students get to think and use science in a real situation (Sparks-Linfield 1996).

In our drama, distinct roles were played by three different year classes in a degree programme, B.Sc. Marine Biology at the University of Plymouth. Each role was designed to reflect the appropriate level of scientific knowledge for that particular year class and through the large group drama it was intended that each year class would develop a different set of skills and learning outcomes. The overall concept of the drama was that in groups, year two undergraduate students would play the role of researchers wishing to get their science funded and prior to the day of the drama were asked to prepare a funding application in the form of a poster. For the year two students (n=32), this piece of work represented an assessed piece of coursework.

On the day of the drama, the year two students presented their posters during a two-hour lunchtime conference session and were required to verbally defend their work to students from years one and three. Year three students (n=21) were asked to take the role of the

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3 scientific panel judging the funding proposals due to their greater level of scientific
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5 experience. Year one students (n=32), at the start of their degree programme, were asked to
6
7 input their views in the role of the educated general public as to which subject areas were
8
9 most important to fund. The year one students were required to attend the large-group drama
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11 as a timetabled activity but the year three students were asked to attend the day voluntarily.
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13 We hoped that by utilising such dramatisation of the concepts involved in funding biological
14
15 research within the UK, we would allow collaborative pursuit of goals (Catterall, 2007).
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21 The year one students were four weeks into their degree programme and we envisaged that
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23 taking on a role as a year group would allow them to discuss and develop their attitudes and
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25 perceptions about science in society and how scientific research is funded as they became part
26
27 of the academic community. We also wanted to allow them the opportunity to explore, in a
28
29 safe environment, their abilities to make informed decisions about which areas of biology
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31 they believed were particularly important for funding allocation and to encourage them to
32
33 think critically about the social consequences of scientific activities. **Butler (1989) highlights**
34
35 **that in using drama techniques it is important to be sensitive to the need of the students to**
36
37 **have confidence and trust in the situation in order to engage appropriately with the activity.**
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42 The role of the year two students was central to the drama and they were the only year group
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44 required to prepare work in advance. In presenting and defending their research proposals to
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46 the two other year classes we aimed, through the social nature of drama, to encourage them to
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48 think about ways of communicating their ideas to a mixed-ability audience and how they
49
50 might foster understanding of their research proposals by their peers. In a study looking at the
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52 effectiveness of drama in teaching, Metcalfe et al. (1984) showed that students within an
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54 experimental group that were taught through drama, although they showed no greater ability
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3 in factual recall than a control group, developed a better ability to offer explanation and
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5 interpretation of concepts.
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9 In casting the year three students in the role of the scientific panel, brought together to judge
10 the funding proposals, we aimed to foster their critical thinking skills. Ødegaard (2003) argues
11 that science education needs to offer students an insight into the value of critical reflections
12 within science. One type of critical thinking highlighted by Bailin (1998) is to be able to think
13 critically about the principles and criteria by which something is assessed. Critical thinking
14 requires a level of background knowledge and we expected this of the year three students who
15 would have gained an understanding of the principles by which scientific work is judged
16 through previous feedback on their own scientific assessments. With the aim of giving them a
17 sense of ownership of their role and also to promote this type of critical thinking we asked the
18 year three students to develop their own criteria for evaluating the research proposals of the
19 year two students.
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35 36 **Peer Assessment** 37

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40 Peer assessment is being increasingly utilised in higher education (Gatfield 1999) for a variety
41 of reasons including the idea that it represents part of the preparation for life that a university
42 education gives (Brown et al. 1997; Ellis 2001). There are many advantages of peer
43 assessment including the opportunity to reflect on own performances (Dochy et al. 1999;
44 Papinczak et al. 2007) and to develop critical reasoning skills (Falchikov 1986; Searby and
45 Ewers 1997). Peer assessment may also stimulate subject matter discussions between students
46 (Berg et al. 2006) and aid collaborative learning (Prins et al. 2005). However, asking students
47 to evaluate the performance of peers can potentially have some shortcomings. In particular,
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3 students may be uncomfortable criticising friends and may be influenced by existing
4 relationships within the cohort (Cheng and Warren 1997; Papinczak et al. 2007).
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9 In our study, the evaluation of the year two research proposals by year three students allowed
10 us to introduce an element of peer assessment which as defined by Topping's (1998) typology
11 of peer assessment was between different years of study. Peer assessment in our drama
12 differed from the majority of studies on peer assessment where assessment is conducted
13 among students of the same year class. Here peer assessment was implemented across, not
14 within, year classes. By employing cross-year peer assessment we attempted to minimise
15 potential problems with students feeling uncomfortable criticising friends or colleagues within
16 their own degree class. Particularly for the year three students (assessors), we hoped that this
17 form of assessment would still foster critical thinking and reflection on their own assessment
18 approaches. For the year two students (assesseees), we envisaged that through the presentation
19 of their work to year three students they would potentially invest greater effort into their work
20 as noted in other types of peer-assessment (Pope 2005) and that they would also benefit from
21 collaborative learning.
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41 **Cross-Year Interaction**

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44 Our drama involved a cross-year approach where all three years of a degree programme
45 participated. We hoped that this would enable students to draw on the importance of
46 'communities of practice' in learning processes as an environment where novices can interact
47 with the more expert (Lave and Wenger, 1990). The drama was located at the beginning of
48 the academic year so as to maximise potential benefits of the peer-interaction for each of the
49 year classes. First year students had just commenced their degree studies and as such were
50 well placed to be comfortable acting as members of the general public. The year two students
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3 had recently completed a field course where they had been given guidance on how to
4
5 implement a research project and communicate the outcomes; hence their role in the current
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7 drama was timely with their current studies. Year three students were already undertaking
8
9 their final year independent research projects which require critical evaluation of existing
10
11 scientific literature. Therefore, it was hoped that all years would feel comfortable with the
12
13 roles they were allocated, an aspect important to the success of drama activities (Hargreaves
14
15 and Hadlow, 1997). Additionally, by participating in this cross-year drama and interacting
16
17 with more experienced students on the same degree programme, we anticipated that the year
18
19 one and two students would gain a clearer picture of the learning experience in the three years
20
21 ahead of them and that this would aid their learning progression (Catterall, 2007).
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28 **Outline of the drama**

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31 The drama was realistically grounded in current research funding scenarios and here was
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33 specifically aligned with one of the UK's major research councils, the Natural Environment
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35 Research Council (NERC). The drama was facilitated by two members of academic staff and
36
37 a representative from NERC to help students connect to the reality of the roles they were
38
39 playing. Prior to the main drama, in small groups (each with two to four students) the level
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41 two students were given two weeks to develop a research proposal that they hoped to get
42
43 funded. They were given a maximum hypothetical amount of money that they could apply for
44
45 and a timescale in which the proposal would have to be carried out if it was funded. Although
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47 in this specific drama there was no funding available, various small grants and funds are
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49 available to students at this stage in their education and so the event had a clear grounding in
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51 reality. The students were asked to prepare their proposals in the form of an A0 poster and
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53 were asked to clearly identify on the poster:
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- 4 a) their research question.
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- 6 b) the necessary background information to support this question.
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- 8 c) the appropriate methods/experimental design for achieving their research proposal.
- 9
- 10 d) how their research proposal related to current research council funding priorities.
- 11
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14 At the time of the drama, NERC had seven funding priorities highlighted within their remit.
15 These were (i) biodiversity, (ii) climate system, (iii) sustainable use of natural resources, (iv)
16 environment, pollution and human health, (v) earth system science, (vi) natural hazards, (vii)
17 technologies. Of these, we felt the first four were the most appropriate to the degree
18 programme involved and that the students would possess adequate background knowledge of
19 these topics. Therefore, for part (d) of their poster, the year two students were asked to tailor
20 their proposal towards at least one of these four priorities. Although the priorities we used
21 were specific to NERC, they represent current global priorities in biological sciences. The
22 content of our drama was specific to our discipline; however, it could easily be adapted across
23 a range of disciplines to match research priorities in a whole range of different subject areas.
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25 During the two weeks when the students were preparing their posters, they were given access
26 to a technician who provided help in using PowerPoint to create a poster and in getting their
27 poster professionally printed.
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45 **Implementation**

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49 The day of the drama began in the morning with a plenary briefing session for all three years
50 facilitated by the NERC representative. Students were provided with an overview of how
51 science is funded in the UK; where the money comes from and how decisions on its allocation
52 are reached. They were then guided through the structure of the day and the parts they would
53 be playing. Each student was given a timetable of the sessions they needed to attend and were
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3 provided with a discussion area to be used during non-timetabled events where tea and coffee
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5 were provided.
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9 Year two students were allocated their own stand in the conference hall and were allowed to
10 display their work and prepare for the lunchtime conference. Year one and year three students
11 were then briefed on their respective roles in separate workshops. In the year one workshop,
12 students were given the opportunity to debate the science issues facing the UK today and to
13 decide on their funding priorities as members of the general public. As a conclusion to this
14 debate, they were given the four research council priorities which the year two students had
15 already been given as part of their initial brief, two weeks earlier. Year one students then
16 ranked these topics as a class in order of their perceived importance to the general public. The
17 ranking was later used to help decide which research proposals to fund. In the year three
18 workshop, students debated what they considered to be good science, and how they might
19 evaluate this within a research proposal. Facilitated by staff, these discussions were
20 encapsulated as a research grant assessment form that could be used to generate a numerical
21 score. In peer assessment, it is considered important that students are involved in the criteria
22 setting to allow full understanding of the criteria which they will use to evaluate other
23 students' work (Sivan, 2000). Students from years one and three were then brought together
24 and placed into 'research evaluation' groups consisting of two students from each year.
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48 The two-hour conference session then commenced and research evaluation groups circulated
49 around the year two stands. During this exercise, level one students were mainly present in an
50 observational role while level three students acquired information against the criteria on their
51 research grant assessment form for each proposal, based on the poster and its oral defence.
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53 Each research evaluation group was required to complete an assessment form for every poster
54 but were allocated two specific proposals that they would have to discuss in detail at the
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3 subsequent panel meeting. This resulted in every research evaluation group visiting every
4 poster and additionally every poster received two more detailed independent peer-evaluations.
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8 The time frame for this process was relatively short. The concept of tension in drama can add
9
10 an attitude of value and worth of the task (Butler 1989) and here we were best able to
11
12 manipulate tension by manipulating time. The time constraints were such that the students
13
14 were able to obtain their goals but to do so they needed to engage with the process efficiently.
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17 The research grant assessment form designed by the level three students listed five primary
18 criteria. These were:
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23 a) is the proposal broadly feasible within budget?
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27 b) is there a clear question with methods appropriate to the hypothesis?
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31 c) is the wider significance and originality included?
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34 d) is there evidence of understanding of the relevant background?
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38 e) is there clarity of presentation?
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41 On the assessment form, each evaluation group could comment on these points and then
42 generate a score for the proposal on a scale of 1 to 10 where 1 was unfundable and 10 was
43 excellent. They finally needed to grade the proposal according to whether it fitted with the
44 four priority topics that the year two students were given where (A) was completely aligned
45 with NERC priorities, (B) was aligned with NERC priorities and (C) was not aligned with
46 NERC priorities.
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56 Following the conference session, a confidential panel meeting was convened for year three
57 students only. The panel was chaired by the representative from NERC. Funding proposals
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3 were taken in turn and as each was tabled, the two groups that had prepared detailed
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5 evaluations were initially asked to present their scores and then debate the strengths and
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7 weaknesses of the proposal. The remaining groups were then allowed to contribute to the
8
9 discussion of that research proposal in order to reach a representative final score. This process
10
11 identified proposals which were eligible for funding based on their scientific merits and those
12
13 that were not eligible. The year three students were then provided with the information on
14
15 how the year one students had ranked the four NERC funding priorities and were also
16
17 informed that there were sufficient funds to support two proposals. The priorities identified by
18
19 the year one students earlier in the day were then used to rank those proposals which the panel
20
21 had deemed eligible for funding based on scientific merit. The two highest ranking proposals
22
23 in terms of scientific merit and priorities for funding were highlighted as successful proposals.
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25 On the day, evaluation by the year three students with input regarding funding priorities from
26
27 year one students were the only contributing factors to the final ranking of the grants.
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29 Subsequent to the day of the drama, two members of academic staff marked the posters in
30
31 accordance with their university's School Marking Criteria, and used the ranks generated by
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33 the peer evaluation to contribute 10 % of the final mark. Overall, there was strong agreement
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35 between the marks of the academics and those from the peer assessment toward both the top
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37 and the bottom of the marks distribution.
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47 The day was concluded with a plenary session attended by all three year classes where the
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49 outcomes of the research funding panel were announced by the NERC representative. The key
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51 events of the day were summarised and discussed across all activities, and prizes were
52
53 awarded to the two successful year two teams.
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57 **Evaluation**

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3 At the end of the event, each student was provided with a questionnaire to evaluate their
4 perceptions of the drama. Students were asked to respond to several questions using a rank
5 scale from one to five (where 1= disagree strongly and 5=agree strongly), which covered
6 topics ranging from the extent to which they had benefited from interactions with year classes
7 above and below their own, whether they felt comfortable evaluating the work of others and
8 the extent to which the drama had influenced their understanding of how science is funded.
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10 There was also the option for general comments and reactions. Ethical approval to use student
11 evaluations in this research had previously been obtained from our host institution.
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23 **Questionnaire Results**

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27 Of the 86 students involved in the drama, 85 students completed the questionnaire. These
28 were 21 level three students (8 male, 13 female, ranging in age from 20-25), 32 level two
29 students (10 male, 22 female, ranging in age from 19-32) and 32 level one students (14 male,
30 18 female, ranging in age from 18-28).
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38 **Student Perceptions of the Large Group Drama**

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41 It was evident during our observation of the year three panel meeting, that the drama had
42 promoted substantial critical thinking. One type of critical thinking challenge is to think
43 critically about the criteria used in evaluation (Bailin, 1998). Feedback indicated that the
44 drama had encouraged year three students to critically think about their own work and to
45 reflect on how best to approach their own ongoing final year research projects. The ability to
46 critically reflect on their own work is an improved learning benefit of drama also highlighted
47 by Dochy et al. (1999). One student reflected that '*It was a good experience and helps [you]*
48 *to be more critical of your own work*'. Most level three students thought that the drama had
49 improved their ability to debate opinions and make decisions and all thought that their ability
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3 to critique scientific research had improved. Comments from the students included
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6 *'Evaluating others' work and discussing it helped see other views clearly leading to a deeper*
7
8 *understanding'*, and *'I've been able to see how you would critically approach a project and*
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10 *will therefore be better able to see weaknesses in my own projects'*; the first comment here
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12 illustrating that drama can promote collaborative learning (Kase-Polinsini and Spector 1992)
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15
16 The presence of a NERC representative and the use of a conference-style drama appeared to
17
18 enhance the student experience and many students recognised that the drama was set as close
19
20 as possible to reality which we had intended in order to allow the students to enter the
21
22 exercise as fully as possible (Moss, 2000). Comments from level three students regarding the
23
24 conference-style of the drama included *'Good experience of conference environment for all*
25
26 *years'* and from the year two students *'It was a good way to meet other students and*
27
28 *represents a real conference giving us an idea of what to expect should we enter research*
29
30 *careers'* and *'(I feel) more confident about presentations and explaining work orally, writing*
31
32 *scientifically and the conference environment and how it works'*. In particular, the third year
33
34 students felt that the presence of the NERC representative added realism to the drama
35
36 reflecting that *'She made the situation realistic'*, *'It was realistic and gave an idea of how*
37
38 *things are done in the professional world'* and *'Made the council meeting more official as it*
39
40 *showed what it would really be like'*. Year one students thought that she gave *'a more*
41
42 *important and official feel to the day'*. On the day it was obvious that the majority of the
43
44 students really entered into the exercise. One example of this is that the students themselves,
45
46 instigated before the event by the level two students, chose a smart dress code and one student
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48 commented *'It was an enjoyable day, I think the smart dress code helped'*.
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58 Our initial aim in running this large-group drama was to allow undergraduate students to
59
60 explore how science is funded within the UK funding system. There were numerous

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3 comments within the questionnaires highlighting that the students perceived they had learnt a
4
5 lot about how to get their research funded. The year one students were still quite early on in
6
7 their careers to be contemplating applying for research funding and yet they still grasped how
8
9 important it was to understand how science is funded. Comments included *'I was able to*
10
11 *understand what sort of things would get funded and why'*, *'I feel a lot more confident about*
12
13 *entering the scientific career track when I leave university'* and *'I now understand more about*
14
15 *the funding and other opportunities available'*. For the year two students who had
16
17 experienced writing their own proposals, they felt that they had learnt a lot about how
18
19 research is funded and how this might apply outside of their academic studies. One student
20
21 wrote *'[I gained] an insight into what is involved and what a research scientist does and*
22
23 *challenges faced'* and another said *'It was a good preparation to show what is involved in a*
24
25 *much larger proposal for the real world'*. Comments from the level three students, those
26
27 closest to embarking on their own careers, suggested that they had begun to perceive how
28
29 competitive and challenging applying for research can be. **Previous studies have also found**
30
31 **that drama helps students actually see the influence of scientific debate within the real world**
32
33 **(Duveen and Solomon 1994)**. For example, some of the level three students reflected that
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35 *'[The day] gave insight into the competitiveness of research proposals'*, *'I have learnt how*
36
37 *hard it is to get funding and how dedicated you have to be'* and *'[I] now know how hard it is*
38
39 *to get funding and have a better knowledge of why funding might be approved/refused'*.
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50 **Student Perceptions of the Peer Assessment**

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53 Peer assessment in the current drama differed from the majority of studies on peer assessment
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55 where assessment is conducted among students of the same year class. Here assessment was
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57 conducted between different years of study and was compulsory for assessees (year two) but
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59 not assessors (year three), who attended the day voluntarily. Although, year one students
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3 participated in the conference session, they were not directly involved in the final ranking of
4 the proposals. Peer discussion about the proposals was face to face, although feedback and
5 discussion was not. Peer evaluation was the only contributing factor to the final ranking of the
6 grants on the day and these ranks were subsequently used to inform staff assessment of the
7 proposals which generated the final academic grades. Year two students were aware that the
8 final academic marking would be primarily based upon staff marking and this perhaps eased
9 the stress which has been associated with peer assessment (Pope, 2005). Other studies on peer
10 assessment have used normalisation of marks to remove any inherent problems with student-
11 generated marks (Li, 2001). It has also been suggested that peer assessment may be
12 considered a primary tool for learning rather than a tool of summative assessment (Brown et
13 al. 1997).

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30 In general, year two students did not feel uncomfortable in having their work evaluated by
31 their peers (Figure 2a) and many felt that they gained from this experience. Comments
32 included *'It was great to be able to answer questions from 3rd year students as it was nice to*
33 *share my knowledge with them even though technically they are more qualified than me'*, *'It*
34 *was extremely useful to have questions to answer especially since I had no idea what they*
35 *could be. It's been a really useful experience'* and *'It's good to have students look at the work*
36 *as opposed to just staff [as this equals] different opinions and questions'*. Due to the
37 conference-style nature of our large group drama, research evaluation groups of years one and
38 three students circulated around the year two poster displays. It is clear from the comments on
39 peer assessment that there was a variety of approaches used by the evaluation groups meaning
40 that some students had mixed perceptions of the peer assessment. For example, one student
41 wrote *'Some comments were useful constructive criticism; however some seemed as though*
42 *they were questioning just to catch you out as opposed to being focussed on the investigation'*
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3 and another wrote *'Most of the 1st and 3rd years provided good criticism and questions but*
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5 *many weren't allowing you to explain your point'*.
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9 Two year two students perceived the aspect of peer assessment as purely negative. One said
10
11 *'3rd years didn't have many positive things to say. They focussed too much on the negatives*
12 *which made it seem as though they were not interested in our project, just criticising it'* and
13
14 another that *'It was a lot of negative critical feedback hardly any positive from 1st and 3rd*
15 *years, off-putting and down heartening. Didn't get on with my group members which affected*
16 *my reasoning when doing the poster'*. In the latter case, social interactions within the year two
17
18 group appear to have clouded the day in general and these emotions may well have impacted
19
20 on the perception of peer assessment. Although these comments are in the minority, it is clear
21
22 that there is a difficult balance between asking students to critically review the work of others
23
24 and being able to communicate criticism constructively. Here cross-year peer assessment
25
26 created the potential problem that peer assessment was not reciprocal i.e. the assessment of
27
28 year two work by year three students was unidirectional. Although critical discussion of the
29
30 research proposals occurred behind closed doors in a research panel, the face-to-face
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32 interaction during the poster conference allowed the opportunity for negative critical feedback
33
34 to occur. Throughout their degree programme, the level three students rarely encounter peer
35
36 assessment and are not given much opportunity to formally assess other pieces of science.
37
38 Indeed one level three student wrote that they appreciated the *'chance to critically review*
39
40 *studies – something that I feel is lacking in other teaching through the course but is obviously*
41
42 *important'*. We feel that a useful addition to the large-group drama would be a session in the
43
44 initial workshop for level three students on how to communicate critical comments in a
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46 positive and useful way and to give constructive feedback on scientific research.
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3 Broadly speaking year three students did not feel uncomfortable in conducting these
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5 evaluations (Figure 2b) with comments such as *'Even if it was hard it is a great opportunity*
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7 *to use the different skills we have'*. Several students obviously valued the fact that the main
8
9 deliberations about the research proposals were behind closed doors with comments like *'In*
10
11 *some cases [I felt uncomfortable] but generally it wasn't too bad because it was a*
12
13 *confidential meeting with peers'*. One student indicated that the initial thought of critiquing
14
15 the level two students work was daunting, but that this changed during the course of the day *'I*
16
17 *found this exercise very helpful – I started the day feeling I may not know enough to evaluate*
18
19 *but this changed while doing it'* and only one student highlighted that they were
20
21 uncomfortable with the cross-year peer assessment saying *'I felt a little judgemental and*
22
23 *thought that I could not have done much better than the 2nd years did'* a feeling that has been
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25 recorded in previous studies (Orsmond and Merry, 1996).
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33 **Student Perceptions of the Cross-Year Approach**

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35 Responses from the student perception questionnaires suggested that the cross-year element
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37 was a positive aspect of the drama. Interactions either with peers in year classes above, below,
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39 or in the case of level two students both, were considered to be beneficial (Figure 1).
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42 Supporting written commentaries from the students relating to this question gave a further
43
44 insight into their responses. One of the main benefits perceived by the year one students was
45
46 anticipatory; looking ahead to where they would be and the quality of work they would be
47
48 producing in a year's time. Comments included *'It gave me a bit of an idea of what to expect*
49
50 *in the future, it was also beneficial to see the high quality of work produced by those who*
51
52 *have only done one year (i.e. level two students) so far on the course'* and *'Good experience*
53
54 *to see what scientific methods we are going to be using and how these research projects are*
55
56 *set up. It was also good to make new friends and get advice from the 2nd and 3rd years'*. For
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3 most, this was extremely positive allowing a much greater appreciation of the quality of work
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5 which they could achieve during their degree programme. For example, one student wrote ‘As
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7 *a first year student learning what was expected of the presentation and the questions being*
8
9 *asked was a good experience*’. Year one students also valued the opportunity for scientific
10
11 discussion with other year classes. One student wrote ‘*It was interesting to mix opinions with*
12
13 *older students as they had different viewpoints*’ highlighting the benefits the drama provided
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15 for collaborative learning and in creating an environment where novices can interact with the
16
17 more expert (Lave and Wenger, 1990). As a consequence we hope that the students should be
18
19 able to develop linkages between different aspects of their academic study as they progress
20
21 through the degree programme rather than purely retrospectively. For some students these
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23 future standards were perceived as challenging reflected in the comment ‘*I personally*
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25 *wouldn’t feel comfortable in the position of the 2nd years. But I can see that it is a good*
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27 *experience in the future*’. So, nonetheless, this student appeared to see the benefits of the large
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29 group drama for their future career development.
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37 Year two students also felt they benefited from being able to look ahead explaining that ‘*It*
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39 *was good to hear about what’s ahead of me*’, ‘*It’s been useful for me to ask questions about*
40
41 *the 3rd year and what it is like. It’s also been fun to pass on experience of the 1st year*’ and ‘*It*
42
43 *was interesting to see the level of knowledge of those one year ahead of us to see where we*
44
45 *will be in 12 months*’. In most cases the level two students actually took this a step beyond the
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47 level one students, and identified ways in which the day’s activities would directly enhance
48
49 their future studies. For example, one student wrote ‘*It’s a good way to develop your*
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51 *presentation skills and your ability to further your skills in research development which will*
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53 *be useful for later life and particularly 3rd year*’. Most level two students valued the
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55 opportunity to present their work to peers above and below them in the degree programme as
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3 they recognised the importance of being able to communicate their science to a diverse
4 audience which was reflected in the comments such as '*Having questions from people who*
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they recognised the importance of being able to communicate their science to a diverse audience which was reflected in the comments such as '*Having questions from people who maybe look at things from a different perspective was good*' and '*It made me understand how difficult it can be to communicate how important an issue may be to people who have no previous experience*'. Again, the drama appeared to create clear benefits of cross-peer interaction and the ability to bring together students with a varying range of expertise. For year three students, the drama did not offer the opportunity to look ahead in terms of their degree programme; however it did allow them to reflect on their educational journey and how much they had learnt in the previous two years allowing '*recognition of how our knowledge has advanced through the course*'.

Conclusions

When asked the question, should this event be repeated in subsequent years, we received an overwhelming positive response (Figure 3). We believe that integration of drama, like the one used here, into the science curriculum in higher education could have a positive impact, with a larger proportion of graduate students leaving university better informed about how scientific research is funded and the links between science and society. As ambassadors for their discipline, whether or not these students go on to become practicing scientists, policy makers, or informed members of the general public in an alternative occupation, consideration of these ideas during their studies may pave the way for greater understanding in the future.

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4
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11 References

12
13
14 Alrutz, M. (2004). Granting science a dramatic licence: exploring a 4th grade science
15
16 classroom and the possibilities for integrating drama. *Teaching Artist Journal*, 2, 31-39.
17

18
19
20
21 Bailey, S., & Watson, R. (1998). Establishing basic ecological understanding in younger
22
23 pupils: a pilot evaluation of a strategy based on drama/role play. *International Journal of*
24
25 *Science Education*, 20, 139-152.
26

27
28
29 Bailin, S. (1998). Critical thinking and drama education. *Research in Drama Education*, 3,
30
31 145-153.
32

33
34
35 Berg, I. van den, Wilfried, A., & Pilot, A. (2006). Peer assessment in university teaching:
36
37 evaluating seven course designs. *Assessment & Evaluation in Higher Education*, 31, 19-36.
38

39
40
41 Brown, G., Bull, J., & Pendlebury, M. (1997). *Assessing Student Learning in Higher*
42
43 *Education*. London, Routledge. 317 pp.
44

45
46
47 Butler, J.E. (1989). Science learning and drama processes. *Science Education*, 73, 569-579.
48

49
50
51 Catterall, J.S. (2007). Enhancing peer conflict resolution skills through drama: an
52
53 experimental study. *Research in Drama Education*, 12, 163-178.
54

55
56
57 Cheng, W., & Warren, M. (1997). Having second thoughts: Student perceptions before and
58
59 after a peer assessment exercise. *Studies in Higher Education*, 22, 233-239.
60

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Christofi, C., & Davies, M. (1991). Science through drama. *Education in Science*, 141, 28-29.

Dochy, F., Segers, M., & Sluijsmans, D. (1999). The use of self-, peer, and co-assessment in higher education: A review. *Studies in Higher Education*, 24, 331-350.

Duveen, J. & Solomon, J. (1994). The great evolution trial: use of role-play in the classroom. *Journal of Research in Science Teaching*, 31, 575-582.

Ellis, G. (2001). Looking at ourselves - self-assessment and peer assessment: practice examples from New Zealand. *Reflective Practice*, 2, 289-302.

Falchikov, N. (1986). Product comparisons and process benefits of collaborative peer group and self assessments. *Assessment & Evaluation in Higher Education*, 11, 60-69.

Gatfield, T. (1999). Examining student satisfaction with group projects and peer assessment. *Assessment & Evaluation in Higher Education*, 24, 365-377.

Hargreaves, R., & Hadlow, J. (1997). Role play in social work education: process and framework for a constructive and focused approach. *Social Work Education*, 16, 61-73.

Kase-Polisini, J. & Spector, B. (1992). Improvised drama: A tool for teaching science. *Youth Theatre Journal*, 7, 15-19.

Lave, J., & Wenger, E. (1990). *Situated Learning: legitimate peripheral participation*. Cambridge, Cambridge University Press.

Li, L.K.Y. (2001). Some refinements on peer assessment of group projects. *Assessment & Evaluation in Higher Education*, 26, 5-18.

1
2
3 Moss, B. (2000). The use of large-group role-play techniques in social work education. *Social*
4
5
6 *Work Education*, 19, 471-483.

7
8
9 Orsmond, P., & Merry, S. (1996). The importance of marking criteria in the use of peer
10
11
12 assessment. *Assessment and Evaluation in Higher Education*, 21, 239-250.

13
14
15 Ødegaard, M. (2003). Dramatic science. A critical review of drama in science education.
16
17
18 *Studies in Science Education*, 39, 75-102.

19
20
21 Papinczak, T., Young, L., & Groves, M. (2007). Peer assessment in problem-based learning:
22
23
24 A qualitative study. *Advances in Health Sciences Education*, 12, 169-185.

25
26
27 Pope, N.K.LI. (2005). The impact of stress in self- and peer assessment. *Assessment and*
28
29
30 *Evaluation in Higher Education*, 30, 51-63.

31
32
33 Prins, F.J., Sluijsmans, D.M.A., Kirschner, P.A., & Strijbos, J.-W. (2005). Formative peer
34
35
36 assessment in a CSCL environment: a case study. *Assessment & Evaluation in Higher*
37
38 *Education*, 30, 417-444.

39
40
41 Metcalfe, R.J.A., Abbott, S., Bray, P., Exley, J., & Wisnia, D. (1984). Teaching science
42
43
44 through drama: an empirical investigation. *Research in Science and Technological Education*,
45
46
47 2, 77-81.

48
49
50 Searby, M., & Ewers, T. (1997). An evaluation of the use of peer assessment in higher
51
52
53 education: A case study in the school of music, Kingston University. *Assessment and*
54
55
56 *Evaluation in Higher Education*, 22, 371-383.

57
58 Sparks Linfield, R. (1996). Can scientific understanding be assessed through drama? *Primary*
59
60 *Science Review*, 45, 4-5.

1
2
3 Sivan, A. (2000). The implementation of peer assessment: an action research approach.
4
5
6 *Assessment in Education*, 7, 193-213.
7

8
9 Topping, K. (1998). Peer assessment between students in colleges and universities. *Review of*
10
11 *Educational Research*, 68, 249-276.
12
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14 15 16 17 18 19 Figure Legends 20

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26 Figure 1: Responses to the statement: 'I have benefited from the opportunity to interact
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28 with students from a) year classes above me (answers from 1st and 2nd years ONLY); b)
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30 year classes below me (answers from 2nd and 3rd years ONLY)'. 1 = Disagree Strongly,
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32 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree and 5 = Agree Strongly.
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36 Figure 2: Responses to the statement: 'I felt uncomfortable by a) having my work
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38 evaluated by other students (question for 2nd years ONLY); b) evaluating the work of
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40 other students (question for 3rd years ONLY)'. 1 = Disagree Strongly, 2 = Disagree, 3 =
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42 Neither agree nor disagree, 4 = Agree and 5 = Agree Strongly.
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47 Figure 3: Responses to the statement: 'This exercise should be repeated in subsequent
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49 years'. 1 = Disagree Strongly, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree
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51 and 5 = Agree Strongly.
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Figure 1

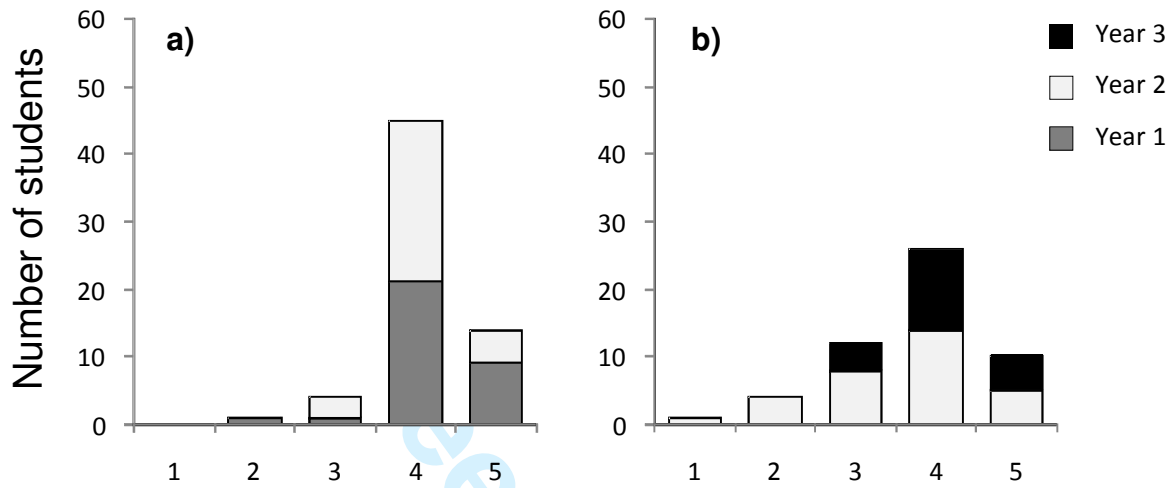
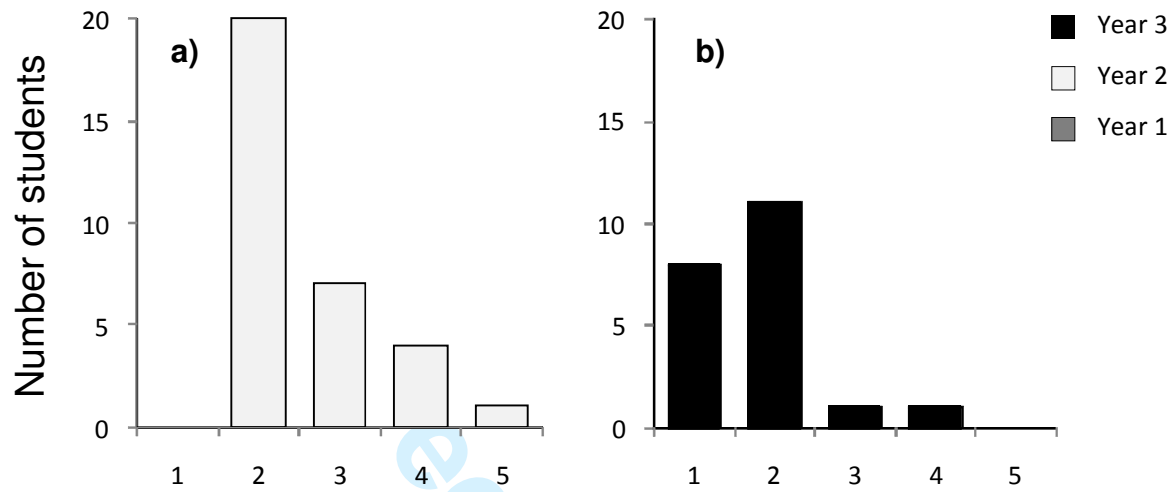
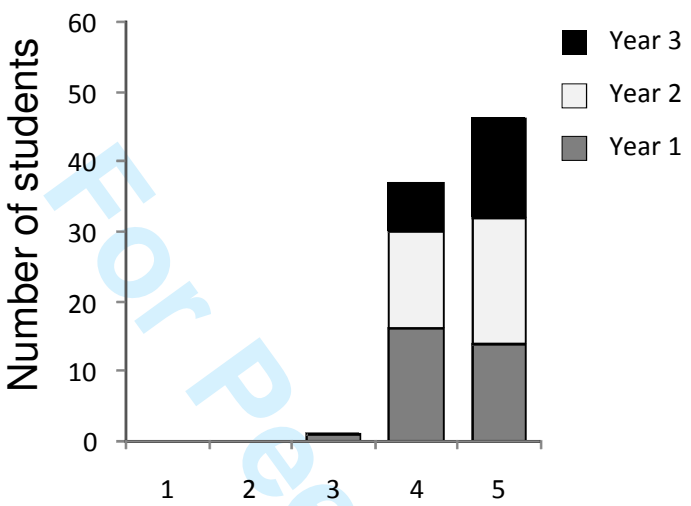


Figure 2



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Figure 3



Appendix 1

Questionnaire – Marine Biology Science and Society Workshop

NB 1) There are no right or wrong answers. 2) This questionnaire will not influence any of your marks. 3) Please circle the responses that most accurately reflect your opinion on the following statements. 4) Please also add further explanations to your answers.

1) I have benefited from the opportunity to interact with students from
 a) year classes above me (answers from 1st and 2nd years ONLY)

Disagree Strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly
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Please explain

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b) year classes below me (answers from 2nd and 3rd years ONLY)

Disagree Strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly
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Please explain

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2) My abilities in the following skills have improved as a result of this workshop (please circle yes OR no)

teamwork	yes	no
Debating opinions	yes	no
Decision making	yes	no
Evaluating scientific research	yes	no
Communicating my work to a scientific audience	yes	no
Communicating my work to the general public	yes	no

3) The presence of a representative from the Natural Environment Research Council added realism to today's exercise please answer yes or no and if possible explain your answer

Yes / no

.....

4) I believe this workshop has broadened my understanding of the role of scientists in society.

Disagree Strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly
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Please explain

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5) I believe this workshop has broadened my understanding of how society could influence UK science priorities.

Disagree Strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly
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Please explain

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6) I felt uncomfortable by
a) having my work evaluated by other students (question for 2nd years only)

Disagree Strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly
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Please explain

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b) evaluating the work of other students (question for 3rd years only)

Disagree Strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly
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Please explain

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7) This exercise should be repeated in subsequent years

Disagree Strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly
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Please explain

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8) What was the most valuable element of the day in relation to

a) Your undergraduate studies

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b) Your future career

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9) Any additional comments

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10) Which year of study are you in? 1st yr 2nd yr 3rd yr (please circle)

Optional additional questions that would be valuable to the research

11) What is your gender ? Male Female (please circle)

12) What is your age?

If you would be prepared to be involved in a related follow-up study please provide your contact details (optional)

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