Chemistry for the Masses

Philip C. Sharpe and Joanne T. Blanchfield

Corresponding author: p.sharpe@uq.edu.au
School of Chemistry and Molecular Biosciences, The University of Queensland, Brisbane QLD 4072, Australia

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Abstract

Students in a second year Chemical Biology course at a major Australian research university have participated in a "Chemistry for the Masses" assignment as part of their course assessment. The assignment requires students to communicate scientific concepts to a general audience, which is not common for assessment within a Science course. This article describes the assignment components and reflects on the challenges of preparing students for such an assignment. It will be useful to instructors considering similar assessment in their own science courses.

Introduction and Context

All stakeholders in the education process desire the acquisition of communication skills by science students. Some students perceive "important" communication skills as only those needed to convey scientific information to a scientific audience. More, however is definitely desired and often demanded in the workplace. The Australian Threshold Learning Outcomes for Science requires graduate science students to

> "*4. Be effective communicators of science by:*
> *4.1 Communicating scientific results, information or arguments, to a range of audiences, for a range of purposes and using a variety of modes*" (Jones, Yates et al., 2013).

The graduate attributes used by universities also often include statements along the lines of those used by The University of Queensland.

- *The ability to collect, analyse and organise information and ideas and to convey those ideas clearly and fluently, in both written and spoken forms.*
- *The ability to select and use the appropriate level, style and means of communication.*
- *The ability to engage effectively and appropriately with information and communication technologies* (The University of Queensland, 2011).

Outside the teaching and learning community, there is a strong demand for science graduates who are able to communicate well. A Royal Society of Chemistry survey of employers of UK Chemistry graduates found that employers regarded the main skills lacking in graduate students were those of spoken and written communication (Purcell, Atfield, Ball, & Elias, 2008). An illustration of why there is a requirement for general communication skills is provided by United States survey results showing that 43% of Science, Technology, Engineering and Mathematics (STEM) graduates work in non-STEM occupations immediately

after graduation. After 10 years in the workforce, 46% of workers with a degree in a STEM discipline had left the field (Trager, 2011) There is thus an imperative to consider how well we are equipping students for the working world. As Colthorpe, Rowland and Leach (2013) have noted in their Good Practice Guide on the Threshold Learning Outcome of communication for Science:

> "*design of curricula for undergraduate science programs must acknowledge that the courses within these programs serve a mixed cohort of students.[…] It is inappropriate to assume that all BSc students will become research scientists. Hence the other types of communication skills these students will need during their working life should be considered and included in curricula as learning and assessment activities*."

A recent survey of assessment in Australian University Science courses at five Australian universities has found that nearly all communication-based assignments in three particular scientific disciplines require communication to a professional audience while only 3 assessment items out of the total of 379 identified required students to communicate with a general audience (Stevens, 2013). These results are taken from courses within the majors of Genetics, Ecology and Marine Science, but similar results would appear likely for other disciplines. This article describes the communication assignment within a second year Chemistry course (CHEM2052: Chemical Biology, enrolment = ~70). In contrast to the majority of STEM assessment, assessment in this course requires students to address a general audience.

An assignment involving an aspect of communication has been part of the assessment in CHEM2052 for several years. The CHEM2052 cohort is a roughly equal mixture of Chemistry majors and Biology majors. Originally, the assignment required students to select an article from the popular press that reported on a topic relevant to Chemical Biology, then (i) critically assess whether the science was represented accurately and (ii) prepare an oral presentation, similar to the task described by Sivey and Lee (Sivey and Lee, 2008). Many students struggled to engage with this task and, instead, presented a summary of the original scientific article used as a basis for the press report. Students showed only limited engagement with the talks of their fellow students and a considerable amount of class time was devoted to the talks. Due to these issues as well as lecturer dissatisfaction with how students were approaching the assignment, the structure of the assignment was altered in 2012. Students were required to select an original scientific article which was relevant to Chemical Biology, and which had been published by a researcher within the School of Chemistry and Molecular Biosciences, The University of Queensland within the previous 12 months. It was hoped that by restricting the choice to a "local" researcher, students would have the opportunity to ask questions and potentially even interview the researcher involved. Students were then required to prepare a video presentation (presented as a television news item for a general audience) as well as a written news article. Surprisingly, this proved to be very unpopular. Comments in end of semester student surveys included "*Scrap the video assignment, this is Chemistry not journalism*", "*Video assignment is not helpful in course content*", "*Video assignment: quite irrelevant to anything and unnecessary*", "*Video assignment is a bit strange and hard to do – should be changed to something more familiar*", and "*Media-based assignment was out of left field*".

Such responses are not unique to this course. For example, Edmondston, Dawson and Schibeci (2010) found similar attitudes expressed by biotechnology students. Their survey and interviews

found that many science students were antagonistic to the idea of being required to communicate with the public. This article discusses the way in which those attitudes were ameliorated by (i) a redesign of the way the assignment was presented to students and (ii) redevelopment of the assignment components.

Involvement of students in setting assessment criteria

CHEM2052 is structured with three hours of lectures and one three-hour workshop each week. In the year where we re-developed the communication task we presented the assignment task to the students in the first workshop and explored the justifications for requiring students to communicate to a general audience. The structure and timing of the assignment components were outlined as follows: (i) a Story Pitch explaining why the research article chosen would be of interest to a general audience (two to three paragraphs), (ii) a 700-800 word news article suitable for a general audience, and (iii) a three minute video news broadcast. The students were asked to form small groups and discuss what they thought would be a fair weighting of the three assignment components. They were told that the weighting applied would be the average of the individual student suggestions. They were also given coaching in using scientific databases such as Scifinder Scholar and Scopus to identify suitable articles.

The student suggestions of relative weightings for the three assignment components are shown in Figure 1. The results indicate that most students are comfortable with the idea of being assessed on the basis of a video. Discussions around the room centred on the idea of the weighting needing to reflect the relative amount of time and effort required for each assessment item. Students who expressed reservations about the video task were most concerned about their personal lack of familiarity with video-editing software.

Figure 1: Individual student-suggested weightings for the three assignment components. (47% of students submitted weighting suggestions, from 70 enrolled).

After discussing the relative weightings that they wanted applied, students were provided with the assessment criteria for the story pitch (included as Appendix 1). The due date for this item

was deliberately set at the end of the third week of semester, to encourage students to commence early planning for the assignment. An additional component of the story pitch was that students could get "scooped" if their chosen research article had already been claimed by another student. Scooped students were required to choose another article, but they did not not need to write a new story pitch. Students were informed of what articles had already been chosen through a list placed on the electronic learning system site for the course. The possibility of being scooped was also included to ensure that a wide variety of research articles were considered, from different research groups. Rifkin, Longnecker, Leach, Davis and Orthia (2010) hypothesise that requiring students to adhere to tight deadlines can add authenticity to assessments, with authentic learning tasks being effective in developing student graduate attributes. Six students needed to choose a second article after being scooped. In most cases, they had not consulted the list provided before choosing their article.

The criteria for selection of the research article were that it be: (i) an original research article, (ii) published in the last 12 months, (iii) by a researcher within the specified school; and (iv) be relevant to the area of Chemical Biology (the topic of the course).

It was hoped that by limiting the choice of article to recent research carried out within the school, students would have opportunity to interview the researchers if they wished and would also be exposed to an area of potential future research.

The choice of articles was left to students, rather than them being assigned particular articles. The advantage of this is that it allowed students to select articles according to their own interests, within the broad field of chemical biology. Articles were chosen from over 40 different journals, ranging from more chemistry–focused journals, such as the *Journal of Physical Chemistry*, *Dalton Transactions,* and *Analytical Chemistry*, to journals with a medicinal chemistry emphasis, such as *Journal of Medicinal Chemistry* and *Bioorganic and Medicinal Chemistry*. This ability to choose also appealed to students with a biology-based major; they took the opportunity to explore the chemistry within a biological context by choosing articles with a chemistry connection from *PLoS One*, *European Journal of Nutrition*, and *Crop Protection*, amongst others. Allowing students to self-select their articles also provided us with the opportunity to extend their database-searching abilities, by introducing the idea of refining searches by researcher location and publication date.

Student submissions of the Story Pitch component revealed that just over 10% of students were unaware of what constituted an original research article and had chosen reviews, rather than original research articles. These were students in their fourth or later semester of study at university. Bogucka and Wood (2009) also found that although students may be confident in their abilities to tell the difference between different forms of scientific communication, such as communications, research articles, and reviews, this confidence often does not translate to correct practice. Students were also asked to provide a citation for their reference in American Chemical Society (ACS) format and were referred to a library referencing guide. Only 69% were able to do this correctly. A small number of students chose topics that were not related to chemical biology, such as solar cell production and kinetics of gas phase reactions. These students were required to choose another article that was appropriate.

In their Story Pitch, students were required to justify their choice of article to an editor (one of the lecturers in the course) and explain why it would be of interest to a general audience. As well as emotional appeals, factors relied upon by students included the incidence of a disease and the potential economic impact of a discovery. Environmental issues were also raised as being of interest to a general audience. Fewer than 5% of students bolstered their argument by using available statistics. Several students struggled with the idea of having to explain the importance of the research to a general audience and relied solely on appeals to the purely scientific value of the research. The value of the Story Pitch component lay in early focusing of student attention on what would make for an interesting story and what strategies they could potentially use in connecting with a general audience. It was hoped that by providing early feedback, to these students in particular, that they would think more deeply about the purpose of the two later components of the assignment. To some extent this occurred, but there were several students who were not able to make the shift from a style suited to that of a professional science audience to that of a general audience. International students were over-represented in this group, which may indicate unfamiliarity with the genre conventions of newspaper and magazine writing in English. Conrad and Goldstein (1999) noted that matters of style are among the most resistant to change after feedback to ESL students.

Student development of assessment criteria for video and written news article

As Baram-Tsabari and Lewenstein (2013) observe, "*Communicating to the lay public demands yet more learning – in this case, the ability to use nontechnical language and norms when discussing science beyond the science community*". Students who have already invested considerable time and effort in learning the norms of scientific technical writing can be reluctant to engage in readjusting their skills and approach to a general audience, as shown by the student survey comments reported above. Such a requirement can also threaten students' nascent idea of themselves as part of the community of scientists, based on their developing mastery of the usual forms of scientific communication (Lemke, 1990).

For these reasons, time in the first workshop was given over to students discussing, in small groups, the assessment standards that should be applied to the video and news article components. To aid them in this, they were given criteria sheets with the headings of "Content", "Professionalism" and "Production Values" to guide them in their discussions. These headings were chosen based on perusal of several of the marking rubrics that are available. (KQED Education Network, 2014; Schrock, 2014; Vandervelde, 2013). These headings can also be mapped broadly to the clusters that Baram-Tsabari and Lewenstein (2013) have identified of clarity, content, knowledge organization and style. Their categories of analogy and narrative were incorporated into criteria for style. The category of "dialogue" was judged not relevant to this level of student, but is more suited to the advanced science practitioners that Baram-Tsabari and Lewenstein were addressing in their instrument. Under the broad headings of "Content", "Professionalism" and "Production Values", students were provided with examples of what could come under each section. They were then challenged to write the standards for what would constitute an excellent, very good, satisfactory, or unsatisfactory performance, as well as their desired weighting for each component. Similarly, students developed assessment standards for their written article, based on "Content", "Style", and "Referencing".

Table 1: Areas of assessment and examples provided to students for video news item

Assignment Component	Area of assessment	Examples of areas covered
Video News Item	Content	Scientific accuracy, appropriate for audience
	Professionalism	Evidence of rehearsal, logical structure, pronunciation, eye contact, pitch and pacing of voice.
	Production values	Quality of images, audio quality, transitions between scenes, adherence to length requirement, adherence to copyright.
Written news article	Content	Scientific accuracy, appropriate for audience, journalistic details included
	Style	Structure, Grammar and spelling, adherence to length requirement
	Referencing	Format of article reference, attribution of quotes.

The weighting for the three components for the video news item suggested by students is shown in Figure 2. Students wanted a high weighting placed on the quality of the content that they produced, ranging from 30 to 70%, with an average of around 50%. The average suggested weighting for professionalism was 25%, with production values being given a slightly lower weighting, possibly reflecting a lack of familiarity or confidence in the process of making a video.

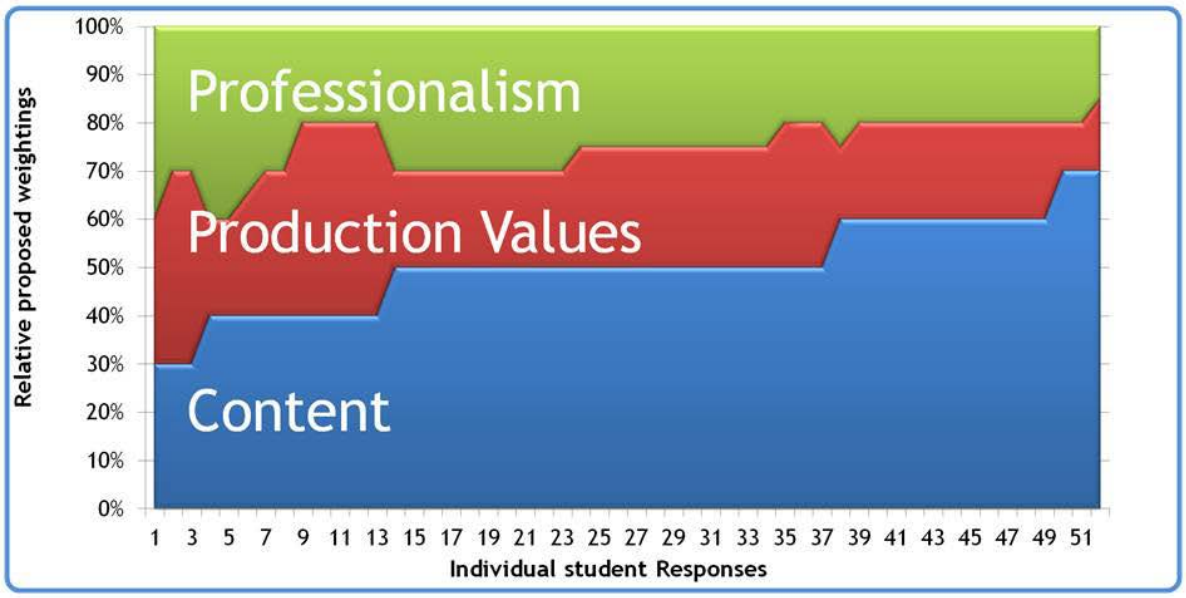

Figure 2: Individual student-suggested weightings for the three assessment areas for the video news report.

The suggestions by students of criteria were collected and used to create the rubrics included at the end of this article. Student suggestions were, in the main, thoughtful and considered. Students could readily identify what they considered excellent and very good criteria of different assessment standards, but struggled to describe satisfactory and unsatisfactory levels of

achievement with the same detail. Some students advocated for marks based on the technical quality of the video recording, in terms of frame rates. This was rejected on the grounds of student equity, with some students possibly lacking access to higher resolution recorders. HD-video cameras were lent to students who did not have access to recording equipment. Only one student took advantage of this in the last iteration.

Providing a rubric to students is not a value-neutral proposition and "*we need to examine what they* (rubrics) *do, why and in whose interests*" (Turley & Gallagher, 2008). The development of a rubric in consultation with students can help them to develop as self-assessors of their learning and to develop in their judgments. Hodges notes that rubrics can "*show all students how we in the academy think and the standards to which they should aspire*" (Hodges, 2014). Having clearly-presented standards was particularly important here, because of the unfamiliar nature of the task, compared to the more usual assignment tasks given to science students. A key aspect of the assessment design was also the involvement of students in writing the standards that they would be expected to achieve. The 2011 NUS/HSBC survey of UK tertiary students identified that 58% said they wanted to be involved in the shaping of 'content, curriculum and design' of their course (Bols & Freeman, 2011). McCulloch (2009) proposes that student involvement in their assessment, and in the learning process more generally, can overcome the problems of the 'student as consumer' mind-set, leading to a greater emphasis on the role that students have in their learning - helping them move from a passive role to deeper learning.

Access was also given to two students' video reports from the previous year, with permission from the students involved. These exemplars were accessed between 150 and 200 times each, or on average more than twice by each student enrolled in the course.

In their videos, the students adopted a variety of strategies to add interest to their presentation. Although the largest number of students (48%) appeared only as a reporter in their video, 32% took on dual roles as reporter and a researcher. Only one of these students included an interview with the original researcher. Fewer students took on roles as both an anchor and reporter (11%) and 9% appeared as an anchor, reporter and researcher. There was no statistically significant difference between the groups in their marks (Kruskal-Wallis non-parametric comparison, $p > 0.10$). The number of students taking on multiple roles increased compared to the previous year, most likely as a result of exposure to the exemplars. It was also likely that students found other examples still publicly available on the two video-sharing websites used by students to upload their videos.

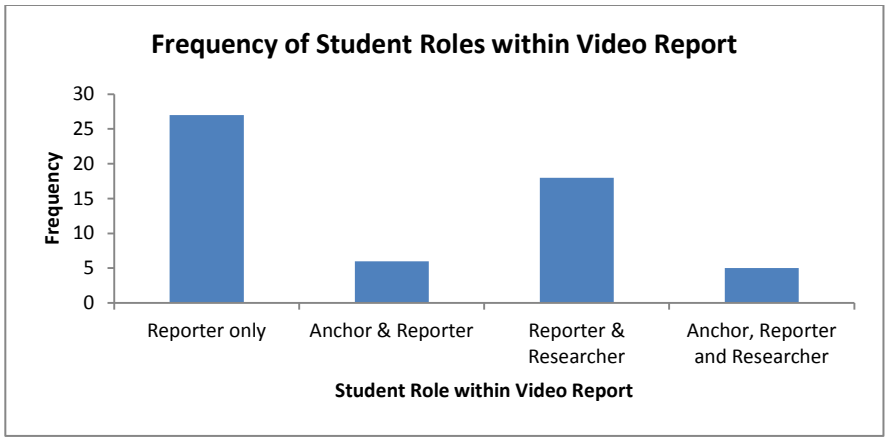

Figure 3: Frequency of roles taken by student within their video report. (Not all student videos were accessible at the time of analysis, n = 56, total course enrolment 70).

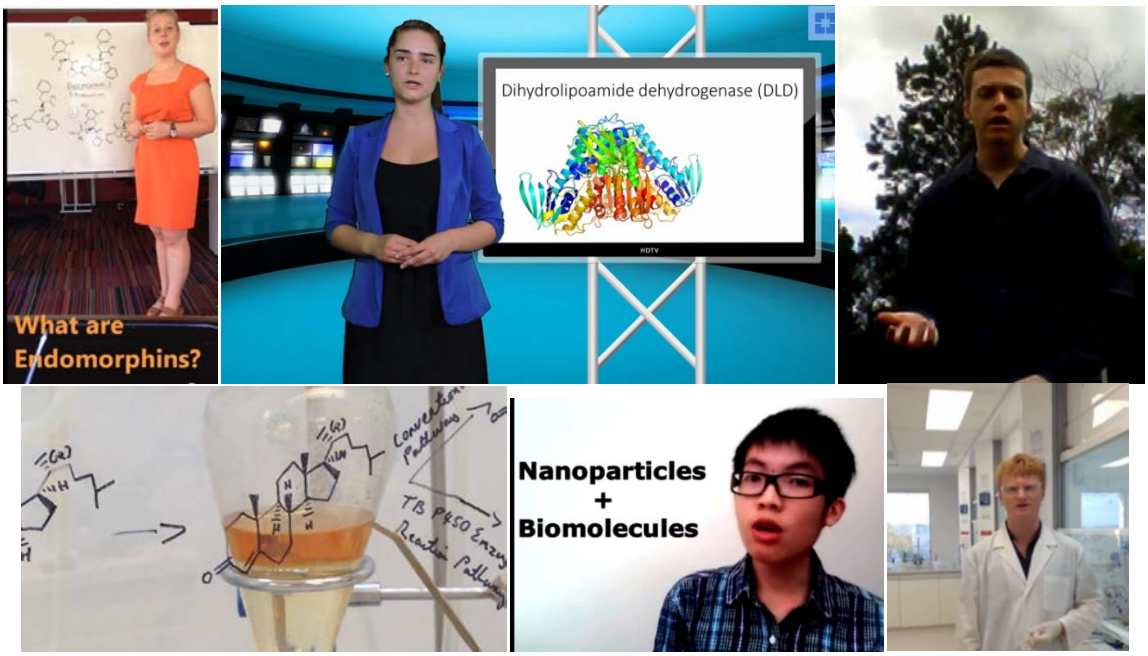

Figure 4: Still images taken from student videos (used with permission).

One other potential use of detailed rubrics is to inform subsequent rounds of teaching, so that troublesome areas for students can be addressed. This will be addressed in the last part of this article. An analysis of the written comments made by markers is shown in Figure 5. The comments from the four academic markers were tallied and coded (two lecturers and two post-doctoral assistants). The written comments highlight the areas that the markers thought were particularly worthy of commendation or that students needed to pay attention to. Roughly equal numbers of comments for the news article were directed to the areas of content and style, as defined on the assessment rubric, with around 1% of comments relating to referencing. Comments in relation to content were 65% negative in tone, compared to only 45% negative in the area of style.

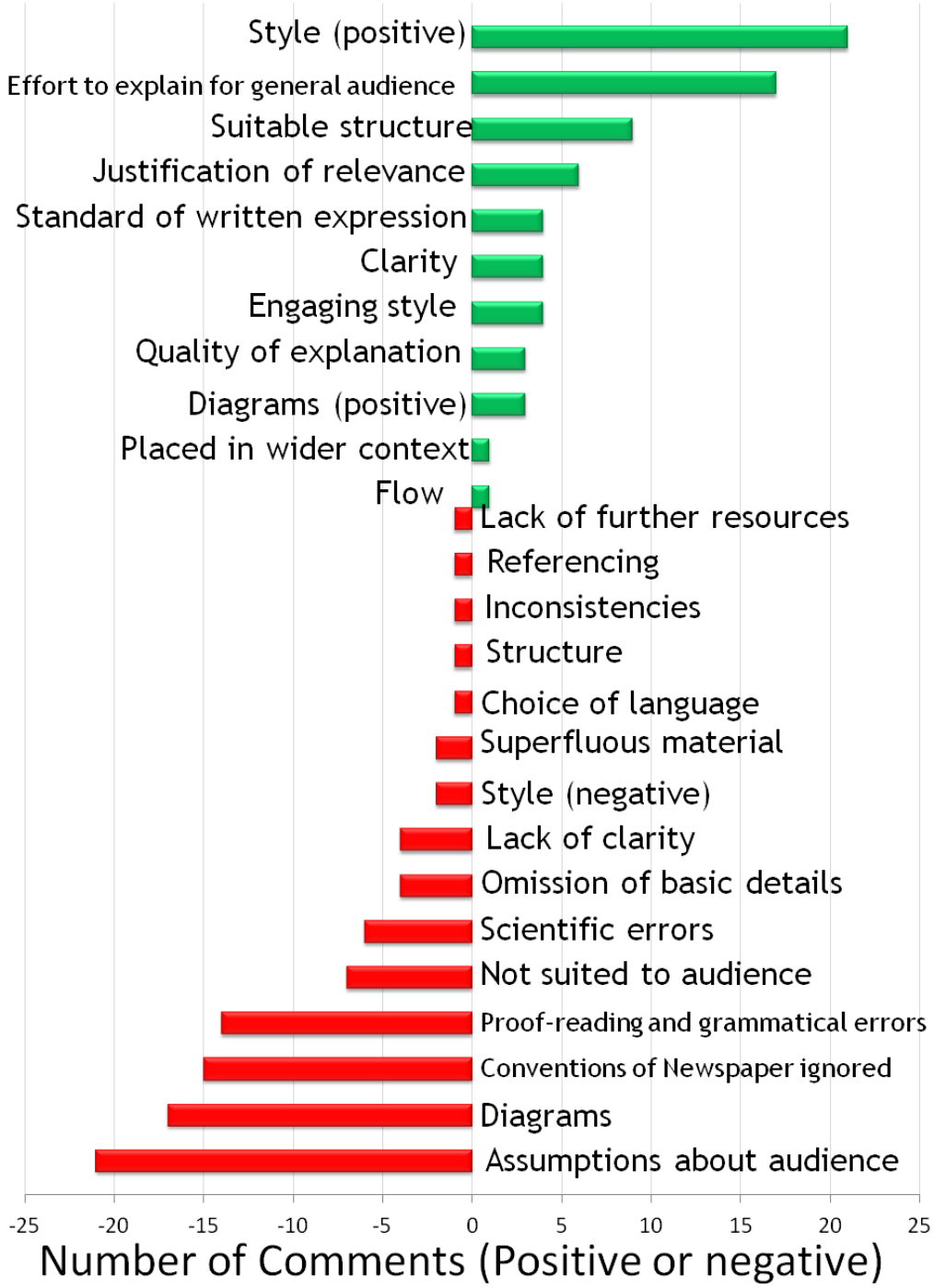

Figure 5: Classification of written marker comments on student written news article.

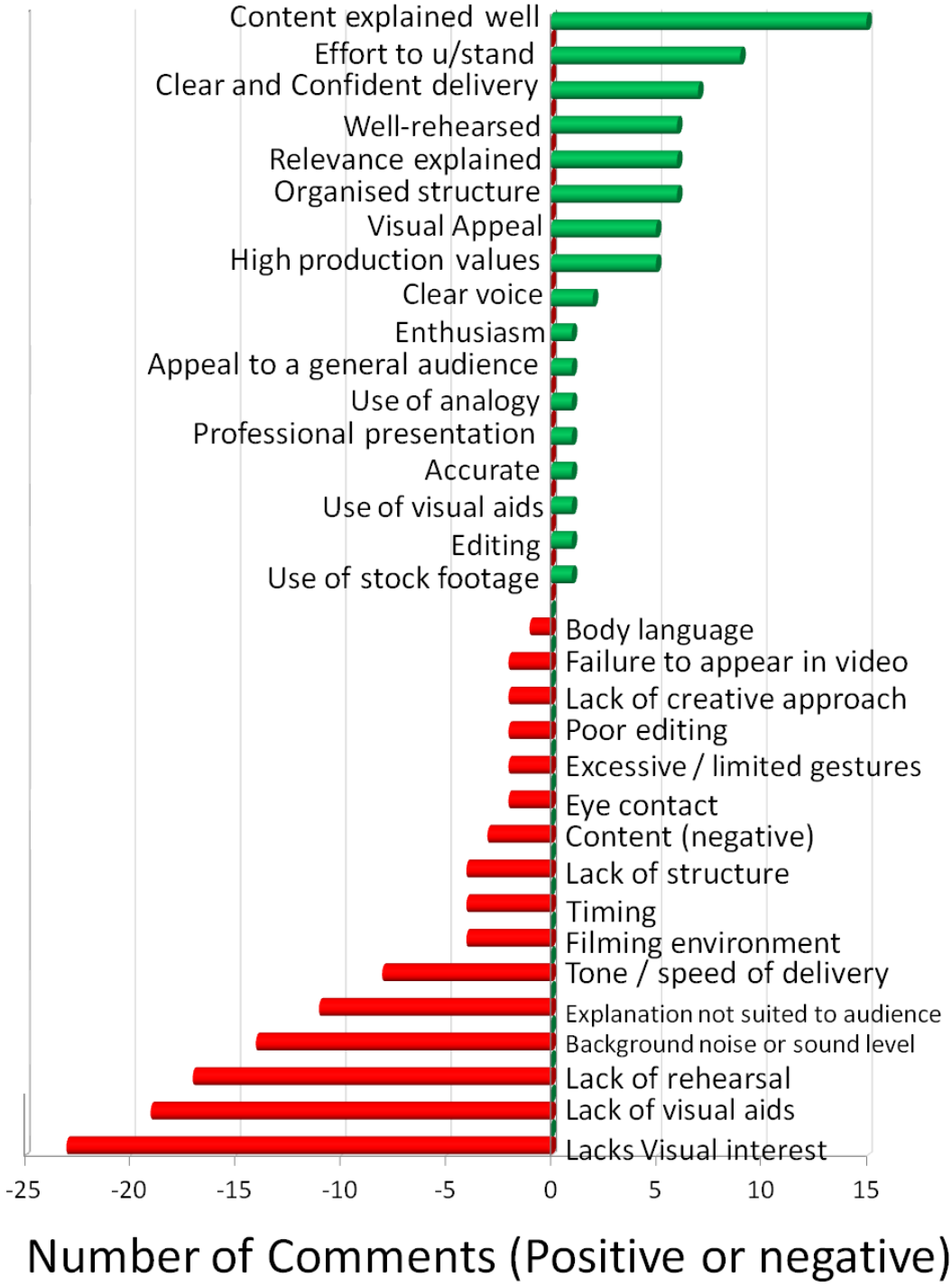

Figure 6: Classification of written marker comments on student video.

In regards to the video, the comments were divided into areas having to do with content (as defined on the assessment rubric) (31% of all comments, 65% positive), production values (42%, 63% of those comments negative) and professionalism (27%, 54% of those comments negative). It appears that the written articles were held to a higher standard in relation to content than video

assessments, on the basis of the number of written comments in each area for the two assignment components and the relative proportion of positive and negative comments. The rubrics for the assignment are included in the supplementary information, as well as the percentages of students achieving each standard.

Outcomes

Student comments following the redesign of the assignment were still somewhat mixed, but leaned much more towards the positive. Positive comments were that the video activity was fun to complete or enjoyable. One student wrote " *The news article assignment is a great assignment not only for us to have a good understanding of the journal article, but also a big challenge for us to convey scientific information to the public in a simply understandable form for the non-science audience*". Other students raised queries about how the lecture material and the assignment related to each other (e.g., "*I think the assignment could be more applicable to the course*", "*I enjoyed doing the assignment, however I didn't fully understand the relevance to the course material*"). There were still negative comments, but these were fewer in number than the previous year (e.g., "*Wouldn't you pay a reporter to do the video/article of your research? Not a fan!*", "*Video and article took a ridiculously long amount of time to do and I got nothing out of it*").

The consensus among markers was that there was a large improvement in the quality of the student work submitted, particularly the video. Three of the four markers found the detailed rubric made marking easier, by facilitating the process of providing feedback to students; it offered students a level of feedback detail that would not be available just by using written comments.

Improvements for the next iteration

The structure of the assignment is undergoing further refinement for its third iteration. The weighting of the assessment will be increased from 20 to 30% of the course grade (to better reflect the time and effort involved in submitting work of high quality) and the written news article will be submitted a few weeks prior to the video. Changes are also planned to the content of the introductory workshop. Workshop exercises are being developed in conjunction with an expert in Science Communication to orientate students to thinking more deeply about the purposes of their writing, characteristics of their audience, and strategies that can be used to explain science concepts to a general audience, such as the use of analogies. A greater emphasis will be given to explaining why students are being asked to undertake this style of assessment task. Given the number of students unsure about the difference between an original research article and review, an exercise will also be introduced along the lines of that described by Bogucka and Wood (2009).

Conclusions

The merits of assigning an assessment task involving communication to a general audience may not be readily apparent to certain students and care must be taken to share these reasons with students, or resentment or confusion will result. By including students in developing their own

criteria for an assessment rubric, students gain an appreciation of the value of general communication skills and become much more positive about their learning. Familiarity of students with the format of science writing cannot be assumed and students benefit from exposure to specific techniques that they can use when communicating to a general audience.

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Appendix 1: Assessment Criteria

Story Pitch Criteria: The percentage values in each box refer to the percentage of students achieving that standard.

Pitch: /15	**Excellent (100-80%)**	**Very Good (80-65%)**	**Satisfactory (65-50%)**	**Unsatisfactory (50-0%)**
Choice of Article: /2			i. Original research article chosen, ii. published in last 12 months, iii. relevant to theme of Chemical Biology, iv. with researcher from School as author (74.2%)	i. Non-original research article chosen e.g. review ii. not published in last 12 months, iii. not relevant to theme of Chemical Biology, iv. SCMB researcher not named as author (25.8%)
Citation format: /2			Follows a correct literature format (e.g. ACS) (74.2%)	Incorrect literature format or citation data missing. (25.8%)
Justification of article: /9	Concise, grammatical justification with clear reasoning. (33.3%)	Justification is clear, with one or two grammatical errors. May be overly long. (36.4%)	Justification has unclear elements, but overall meaning is clear, or several grammatical errors. (27.3%)	Justification absent or unclear. Many grammatical errors. (3.0%)

Video Criteria: The percentage values in each box are the percentage of students achieving that standard.

Content: /24	**Excellent (80-100%)**	**Very Good (65-80%)**	**Satisfactory (50-65%)**	**Unsatisfactory (0-50%)**
Scientific Accuracy _____ /12	Content of paper is represented accurately. No errors in scientific information presented. (80.4%)	A few minor errors in presentation of content or scientific information. (19.6%)	Several minor errors in presentation of content or scientific information. (0%)	Multiple scientific errors or errors in content of paper. (0%)
Appropriate-ness for a general audience _____ /6	Concepts are explained clearly in non-technical terms. Creative use of analogy to assist in understanding. (15.7%)	Content tailored to a general audience, with only one or two unexplained assumptions of prior knowledge. (49.0%)	Attempt to tailor explanations for a general audience, though several unwarranted assumptions about background knowledge made. (23.5%)	Presentation uses multiple scientific terms & concepts that are not explained & thus exclude understanding of a general audience. (11.8%)
Explanation of relevance to a general audience _____/3	Clear link made between scientific results & relevance for general audience, with compelling reasoning. (53.0%)	Clear link made between scientific results & relevance for general audience. (20.4%)	Explanation stated, but lacking in clarity or detail. (12.2%)	Explanation of relevance absent, not understandable or unconvincing. (14.3%)
Identification of key concepts _____ /3	Judicious choice of all key concepts from paper, with no extraneous material. (48.9%)	All key concepts from paper are included, with one or two other concepts also included. (25.5%)	Extraneous detail included, with majority, but not all of key concepts are included. (21.3%)	Presentation attempts to cover whole of paper with NO selection of key concepts OR majority of concepts chosen are not key concepts. (4.3%)
Production Values: /7	**Excellent (80-100%)**	**Very Good (65-80%)**	**Satisfactory (50-65%)**	**Unsatisfactory (0-50%)**
Image quality _____ /2	Presenter visible when on-screen, with appropriate lighting. Camera work is smooth & steady. Images or footage used are of high quality & clearly legible. (58.0%)	Presenter mostly visible for whole of video. Images & stock footage used are of good quality & mostly legible. (22.0%)	Most shots are in focus, but framing needed. Lighting poor. Camera work is often shaky or unsteady. Images sometimes difficult to discern. (10.0%)	Shaky or unsteady camera work is distracting. Image out of focus or difficult to see. Lighting makes presenter hard to see. (10.0%)
Sound Quality _____ /2	Presenter clearly audible throughout, with even volume. (53.3%)	Presenter clearly audible, with some minor but noticeable changes in sound level. (28.9%)	Presenter mostly audible. Background noise occasionally distracting. Some periods of extended silence. Variations in sound level distracting. (11.1%)	Presenter is inaudible through low volume or background noise. Excessive periods of extended silence. (6.7%)
Timing _____ /2	Video report adheres to 3 minute length (± 15 seconds), not counting closing credits. (76.0%)	Video is 3 minutes ± 30 seconds, not counting closing credits. (10.0%)	Video is 3 minutes ± 45 seconds, not counting closing credits. (4.0%)	Video is less than 2 minutes or more than 4 minutes in length, not counting closing credits. (10.0%)

Editing _____ /1	Smooth transitions throughout piece. No dead space. On screen titles or captions are legible, appropriately placed on the screen & contribute to understanding. (70.0%)	Transitions between scenes are generally handled well. Short periods of dead space or black screen. (10.0%)	Editing is of a basic nature, with some disjointed segments of video, which distracts from flow. (4.0%)	Multiple periods of dead space or no evidence of editing. (16.0%)
Profession-alism: /14	**Excellent (80-100%)**	**Very Good (65-80%)**	**Satisfactory (50-65%)**	**Unsatisfactory (0-50%)**
Appropriate style _____/4	Creative, interesting video, with wide appeal to a general audience. Creativity enhances the purpose of the piece in an innovative way. Use of visual aids & stock footage in a thoughtful & constructive fashion, integrated into presentation. (6.1%)	Interesting video, with several creative elements, which will appeal to most members of a general audience. Visual aids & stock footage used aid audience understanding & are integrated with remainder of presentation. (40.8%)	Video has interesting elements & will appeal to some members of a general audience. Visual aids used are appropriate but are not integrated well into the rest of the presentation. (42.9%)	Video lacks interest & lacking appeal to most members of a relevant audience. No visual aids used or those used distract from message or relevance is unclear. (10.2%)
Structure _____/4	Compelling introduction. Clear narrative structure which is easy to follow, with sign-posting to aid audience. Concise summary. Seamless flow from one section of video to the next. (23.4%)	Engaging introduction to piece. Narrative structure which is mostly easy to follow. Summary present. Flow between sections is good. (40.8%)	Logical structure present, but certain elements may be missing, such as introduction or summary or out of order. Some disjointed sections. (29.8%)	Video is hard to follow & makes little sense. Links between sections absent. (4.3%)
Vocal Delivery _____ /3	Variations in pitch, pace & tone used to create & maintain interest with a confident delivery of material. Rehearsal clearly evident. Narrator sounds comfortable & has practiced the piece for an excellent delivery. Words are clear & pacing is appropriate. Correct grammar & pronunciations are consistently used. (36.0%)	Narrator has practiced the piece for smooth delivery. Words are clear & pacing is appropriate. Correct grammar & pronunciation are used in the piece (only one or two errors). (16.0%)	Limited variation in pitch, pace or tone of voice. A script is sometimes referred to. It doesn't sound like the narrator has practiced the piece. Delivery is better in some places than others. Words aren't always clear &/or pacing is uneven. Some instances of incorrect grammar or pronunciation are noted (more than two). (24.0%)	The speaking pace is too fast to follow, inappropriately slow or delivery is a monotone. Lack of rehearsal evident, with halting delivery or multiple mistakes in pronunciation or grammar. Presentation read from script with very limited eye contact with camera. (24.0%)
Visual presence _____ /3	Presenter on-screen for majority of video. Use of appropriate variety of gestures & body language & posture, which contribute to enhancing audience interest & clarity of message. Appropriate attire worn to convey professional message including all personal protective equipment required by location. (30.6%)	Presenter on-screen for majority of video. Gestures & body language mostly contribute to message, with only one or two distracting mannerisms. Attire worn is not distracting. Some Personal protective equipment worn if required by location. (34.7%)	Person other than presenter talking for more than 30 seconds in video. Body language & posture are stilted or distracting or little variety present. Attire distracts from video or safety violations shown. (30.6%)	Presenter does not appear in video or video has the presenter appearing continuously for the whole time. (4.1%)

News Article Criteria: The percentage values in each box are the percentage of students achieving that standard.

Content: /25	**Excellent (100-80%)**	**Very Good (80-65%)**	**Satisfactory (65-50%)**	**Unsatisfactory (50-0%)**
Scientific Accuracy _____/8	Content of paper is represented accurately. No errors in scientific information presented. (84.6%)	A few minor errors in presentation of content or scientific information. (15.4%)	Several minor errors in presentation of content or scientific information. (0%)	Multiple scientific errors or errors in content of paper. (0%)
Appropriate for audience ____/8	Concepts are explained clearly in non-technical terms. Creative use of analogy to assist in understanding. (50%)	Content tailored to a general audience, with only one or two unexplained assumptions of prior knowledge. (23.4%)	Attempt to tailor explanations for a general audience, though several unwarranted assumptions about background knowledge made. (15.6%)	Article uses multiple scientific terms & concepts that are not explained & thus exclude understanding of a general audience. (10.9%)
Relevance _____/6	Clear link made between scientific results & relevance for general audience, with compelling reasoning. (50.8%)	Clear link made between scientific results & relevance for general audience. (41.7%)	Explanation stated, but lacking in clarity or detail. (4.5%)	Explanation of relevance absent, not understandable or unconvincing. (3.0%)
Journalistic details (who, what, where, when, why & what next) **_ /2**	Basic details provided early in piece & integrated into flow of story. (73.5%)	Basic details provided early in piece, but not well integrated into flow of article. (1.5%)	Most journalistic details provided somewhere in story. (17.6%)	Majority of journalistic details are absent. (7.4%)
Illustrations ___ /1	Illustrations great aid to readers' understanding & are explained in a way accessible to general reader. (19.7%)	Illustrations are useful in understanding content. General reader may have trouble following some components. (40.9%)	Illustration/s not explained. May be difficult for casual reader to follow. (33.3%)	No illustrations provided or more than 2 provided. (6.1%)
Style: /10	**Excellent (80-100%)**	**Very Good (65-80%)**	**Satisfactory (50-65%)**	**Unsatisfactory (0-50%)**
News article style ___/4	Meets conventions of genre (headline, lead paragraph, use of captions for figures) & story is compelling & creatively presented. (50.7%)	Meets nearly all conventions of genre (headline, lead paragraph, use of captions for figures) & written in an interesting style. (19.4%)	Some conventions of genre have been ignored. Story is written in a straight-forward manner. (22.3%)	Article ignores requirements of a news article. Language used is confusing or hard to follow. (7.5%)
Structure ____/4	Compelling introduction. Clear narrative structure which is easy to follow, with sign-posting to aid audience. Concise summary. (48.5%)	Engaging introduction to piece. Narrative structure which is mostly easy to follow. Summary present. Flow between sections is good. (39.7%)	Logical structure present, but certain elements missing or out of order (such as introduction or summary). Paragraphs contain more than one main idea. (11.8%)	Article is hard to follow & makes little sense. Links between sections absent. (0%)
Grammar & spelling _____/1	Item is free of grammatical or spelling errors. (30.9%)	1 or 2 grammatical or spelling errors only. (32.4%)	Some grammatical & spelling errors. (26.4%)	Multiple grammatical & spelling errors. (10.3%)
Length (Word count required) _____/1	Between 700 & 800 words (31.8%)	±25 words of word limit (0%)	± 50 words of word limit (0%)	Accurate word count not provided OR more than 50 words under or over word limit. (68.2%, most students didn't provide word count)
Referencing: /5	**Excellent (80-100%)**	**Very Good (65-80%)**	**Satisfactory (50-65%)**	**Unsatisfactory (0-50%)**
Source of article __/2	Reference to scientific article provided early in news article, with correct reference. (75.0%)	Reference to scientific article provided in news article, with correct reference. (13.2%)	Sufficient article details provided to allow article to be found. (1.5%)	Source of scientific article not provided. (10.3%)
Attribution of quotes & images used. __/2	Clear distinction drawn between body of article & all quotes from others. Non-original images are correctly attributed. (87.7%)	Distinction usually drawn between body of article & quotes from others. Non-original images are attributed. (3.1%)	Author of quotes identifiable from context, even if not directly acknowledged. (0%)	Unclear from story which passages are direct quotes from scientific article or direct quotes provided by others. (9.2%)
Further resources __/1	3 or more appropriate further resources provided, accessible by general public. (35.3%)	2 appropriate further resources provided, accessible by general public. (4.4%)	1 appropriate further resource provided, accessible by general public or additional resources not accessible by general public. (10.3%)	No further resources provided or resources are not relevant. (50.0%)