TEAMWORK IN AN HONOURS GROUP WRITING ASSIGNMENT

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ABSTRACT

Scientific practice is essentially collaborative. Most research publications list multiple authors making collaborative writing a key skill for scientists. This paper reports the student experience of a collaborative writing task for honours students in experimental science. Students were asked to work in groups of five to research and construct a scientific review suitable for publication in a peer-reviewed journal. Students submitted a piece of individual writing as well as the final group review and where also asked to assess the contribution of group members. Students found group work demanding and this appeared to overshadow the experience of collaborative writing. However, at the same time, students strongly agreed that teamwork skills and collaboration were essential for successful research. This dichotomy between the need for collaborative skills and the difficulty of putting this into practice argues for greater development of teamwork skills in the undergraduate curriculum in preparation for research training.

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INTRODUCTION

Writing for publication is a key skill for scientific researchers. Although conventions and styles vary between scientific disciplines, the dominant forms for publication in scientific journals are primary research articles reporting new experimental data or analysis and reviews, which collate and evaluate key information in a field. Most publications in science, including reviews, have multiple authors acknowledging a range of contributors to the preparation of a publication (Sonnewald, 2007). This reflects the predominant working environment for science. Scientists work in research groups which may operate in a single laboratory but often include collaborators from other institutions and even between countries. Collaboration and teamwork skills are therefore essential skills for a successful research career for both the practice of science and the communication of its results.

In Australia, research training usually begins with an honours undergraduate year. The honours year for most disciplines is a mix of coursework and an authentic research project undertaken in an operational research laboratory. The honours student moves from a role as a student in a large class to an apprentice researcher working alongside experienced researchers and usually with one to one supervision. During this year students practise the conventions of performing and reporting research.

The honours year emphasizes personal development and achievement. Entrance into an honours year can be very competitive as places are usually limited by the availability of research supervisors. Individual academic achievement in the preceding undergraduate program is usually a key selection criteria. At the completion of the honours year, students who wish to continue with research training compete for scholarships to study higher degrees. Again, scholarships are usually awarded on the basis of individual academic achievement. However, since the normal working unit for science consists of a team of researchers, students must also learn about the collaborative nature of research. In this study, we trialled an authentic group writing task for honours students in biochemistry. Although the task was designed to focus on collaborative writing skills, evaluation of the student experience uncovered some interesting responses from students regarding teamwork.

METHODS

The honours year in biochemistry at La Trobe University includes a significant coursework component (40% of assessment weighting) with the remainder of assessment arising from an individual research project (La Trobe University, 2010). The style and content coursework component varies each year as different researchers take responsibility for the design of associated assessment tasks. Tasks are reviewed by the honours management group to ensure intended learning outcomes and standards are consistent. The learning objectives as presented to students are listed below. The writing task reported here addresses the final objective of communication.

Throughout the year we will help you to acquire the skills that you need to become a competent researcher. You will learn to:

- *Perform a range of practical biochemical and molecular biological techniques required to perform research.*
- *Plan and set up experiments correctly.*
- *Develop effective time management skills.*
- *Read and understand the technical literature, interpret results, and critically evaluate published data.*
- *Develop the communication skills required to present to a scientific audience.*

In 2010, the authors designed a novel writing task for the honours cohort. The task was to construct a review of sufficient quality for publication in a peer-reviewed journal. The broad area for the review was selectable markers, which are experimental tools for selecting organisms with desired phenotypic characteristics. Three review topics were proposed to students with suggestions for focus within the broad topic although students were encouraged to refine these or consider alternatives. The broad topic was relevant to most student's individual research projects to some degree but not a key focus for any of the research projects. Authentic scientific writing at this early stage of research training is limited by access to novel experimental data. However, students have ready access to primary research publications and can reasonably be expected to review the literature in a defined area.

WRITING GROUPS

The fifteen students in this cohort were asked to self-select into groups of 5-6 to write a joint review. The task was split into two phases: a scoping phase where each student worked independently on a topic allocated by the group to produce a short research report and a subsequent writing phase for construction of the final review by the whole group. Each phase included a planning workshop with staff and then subsequent independent work. During the scoping phase the group decided on a topic for investigation and developed a research plan with each member of the group researching an aspect of the topic. Students submitted a short report of their own research for individual assessment. In the second phase of the task, students were asked to write as a group using the individual research from phase one as a basis for the review. One class was held to discuss the roles that individuals could play in constructing the review: planner, writer, illustrator, editor, proof-reader. Groups were asked to develop a strong theme or argument that would be attractive to a journal editor and to ensure the final review had a single consistent voice. Although the idea of a team was discussed, each group was free to allocate roles as they chose and since this was not monitored, the task is described as group writing in this report. Students used the terms 'group' and 'team' interchangeably.

FEEDBACK

Each group submitted a draft of their joint review for detailed feedback at least two weeks before submission of the final review. The academic staff met with each group, provided written feedback and a half-hour discussion with the group focussing on strategies for improvement. The discussion reviewed the quality of the writing, content covered and considered what would make an article attractive to a journal editor.

ASSESSMENT

The distribution of marks for components of the task is given in Table 1. Both the individual reports and the final review were double-marked by the authors using common criteria. Marks for the individual report were divergent between the markers suggesting the marking rubric needed refinement. Marks for the final review were more consistent between markers. Final marks were determined by moderation. Marks by staff were allocated for the quality of both the individual and group reports and not for the process.

Students were asked to assess the contribution of each member of the group. They were provided with a simple marking scheme, which asked them to consider contribution to background research, discussion and writing to arrive at a final mark out of ten. No formative work was undertaken to prepare for this assessment apart from the workshop considering roles and effectiveness within the group. All students had previously had an experience of assessing peer presentations in preceding undergraduate subjects in Biochemistry but had not all been asked to evaluate less defined work. Students were offered support after assessment to further develop their review for publication in an international undergraduate research journal. One of the three groups expressed an interest but did not proceed as they felt they did not have sufficient time to work further on the project.

Table 1: Assessment weighting of task components

Component	Assessor	% of final mark
Individual report	Staff using marking criteria with internal moderation	40
Group review	Staff using marking criteria with internal moderation	40
Group	Peers using simple marking scheme	20

EVALUATION

The student perceptions of this new task were collected using a paper survey followed immediately by a focus group discussion with an independent facilitator. The survey included 18 statements with a request for students to register their level of agreement with each statement using a Likert scale. The statements explored student perceptions of the task and the role of teamwork in research science. Students were also able to respond with written comments to two open-ended questions.
In the focus group students were encouraged to discuss the task and the communication and teamwork skills needed by scientists. The session was recorded and transcribed. Comments from the transcription and the written comments from the survey were collated by the categories that emerged in the data. Key themes were identified and reviewed with the session facilitator to ensure the intent of the session was captured.

RESULTS

STUDENT DID NOT ENJOY WORKING IN A GROUP

This task was not popular with students. Responses were neutral (neither agree nor disagree, mean response between 3 and 3.8/5) for statements exploring the quality of feedback, group effectiveness and content of the task. Table 2 presents those statements with which students either disagreed (mean response <3/5) or agreed (response >3.8/5). Interestingly, students recognized the importance of teamwork skills in research at the same time that they reported a preference for individual work. This dichotomy is likely to be related to the effectiveness of the group process and previous experience, although the students reported neutral responses when asked about group function.

Table 2: Student survey responses showing agreement and disagreement: responses were recorded on a scale of 1 (strongly disagree) to 5 (strongly agree) with 3 representing "neutral, neither agree nor disagree". The mean score and standard deviation for all responses is reported (N= 15)

Survey statement	MEAN	ST DEV
Students disagreed with statement		
I like working in a group	2.8	0.8
I enjoyed working on this task	2.8	0.9
Students agreed with statement		
Discussion with colleagues helps to clarify my ideas	3.9	0.8
My group regularly met to discuss our work	3.9	0.5
Experience with writing in a group will help in the future	3.9	0.6
Research scientists need to work effectively in groups	4.5	0.7

NEUTRAL RESPONSES ON GROUP FUNCTION

Students were asked to respond to statements regarding the function of their group (Table 3). All statements on this topic elicited a lukewarm response although the data is limited by class size to the experience of three groups. The students felt underprepared to work in a group and also felt that the task did not strongly develop teamwork skills. It is interesting to note that all students had worked in pairs or groups in laboratory classes throughout the preceding three years of their undergraduate degree.

This interesting data on student perceptions of group work was further explored in focus group discussions and in written responses to open-ended questions on the student survey. Two themes emerged regarding teamwork skills and the student experience of group function for this task.

Table 3: Student survey responses regarding group function: responses were recorded on a scale of 1 (strongly disagree) to 5 (strongly agree) with 3 representing "neutral, neither agree nor disagree". The mean score and standard deviation from all responses is reported (N= 15)

	MEAN	ST DEV
Statements on group dynamics		
Everyone in my group contributed equally to the final article	3.1	1.0
I have had lots of opportunities to practise working in groups in my degree	3.3	0.9
Sufficient guidance was provided in how to work in a group for this task	3.4	1.0
I received adequate feedback from the group on my contribution	3.5	1.0
My group succeeded in working as a team	3.5	0.7
Work was fairly allocated between group members	3.5	0.8
This task improved my ability to work in a group	3.6	0.7
My group was able to organize itself effectively	3.7	0.9

WORKING IN A GROUP

The students found working in a group challenging. Students listed a number of factors outside their control that were both positive (formative feedback provided during the task) and negative (competing demands from research projects, boring topic for the task) which affected their experience. The organization and function of the group was primarily determined by its members with staff providing guidelines for group activity during the introductory and feedback class sessions. During evaluation, most of the discussion in the focus group and written comments from the survey concerned group function.

Students recognised that group work requires an investment of time and considerable negotiation. They felt that, for this task, a smaller group size would be more effective.

> *Student 1: 'That's where I think the five people made it difficult, because, like in the last stages of editing, we all would go away and, you know, read the final thing and write down our own comments on what we thought needed to be changed. Then we all had to get together and go through it all. It was just like a lot of input from a lot of people all at once. It was just sort of a lot to kind of handle I thought'.*

> *Student 2: 'In that way though, yeah. 'Cause the idea, I remember (author) saying to us, try and get, give yourselves tasks, so if you're an editor, you're an editor, you're not a proof reader. But there's that ... it's very hard to detach yourself from it… 'cause you want… it's easier if everyone comments, but then it also gets confusing 'cause then you have to agree about that…'.*

Students were reluctant to assess their peers but did recognize differential input from group members. The weighting for peer assessment, which assessed contribution to process, was significant but considerably less than the weighting for the written work (product) (see Table 1). The intention of the authors to empower the students by engaging them in the evaluation process was not initially recognized by the students. Students found it difficult to make an objective judgement of colleagues in a complex situation.

> *'But each person had different circumstances, different commitments. We all have different methodologies. Some of our methodologies are extremely time consuming, other people find they're time consuming. I think you should learn to trust people if you're in a group, just got to have some level of trust that someone is trying their best and can't do anymore, but nor are they doing any less. I think you just need to draw that line'*

The task incorporated both individual work in the initial research of aspects of the topic and group work in the construction of the final product. Students had mixed responses to this approach. Some

found it difficult to convert individual work into group task, but in other cases comparison of individual work uncovered new research questions through discussion at the group level.

> *'…One of the main issues I had with the whole structuring of the assignment was the fact that we were given these broad topics and then given examples of individual things to write about, but we were then supposed to join into a, a review article... the individual pieces on individual things that we had to bring together that didn't necessarily work so well…'*
> *'…See I liked that though. I thought (in) our group, we were discussing that easily. And we ended up finding it quite …, like as a group, I thought it was quite good because that really got our communication going, really got us thinking about it …'*

GROUP WORK IN SCIENCE

Students reported that group work was crucial for scientific research in their experience. They recognized that research was a combination of individual work and collective review.

> *'Workplaces hold multidisciplinary teams these days because each area of research, each area of knowledge is incremental, you know, knowledge gets pooled, it doesn't just happen, so it increases slowly. And even then (in) most workplaces that I've been aware of, you end up working in a multi-disciplinary team and then you've got pools of knowledge actually coming together to find solutions.'*
> *'Yeah, well when you write up results there's probably ten (team members); you're using other people's results as well but when you're actually doing the work it's more individually focused.'*

COMMUNICATION SKILLS

Comments regarding group work skills and group function dominated both written comments and the focus group discussion with little mention of writing skills. When asked specifically about skills required for communication, students listed process skills such as "patience" and "listening" rather than skills related to writing in particular. Students did not feel the task had changed their writing skills. One out of twenty-four of the unstructured comments from the student survey addressed communication skills.

DISCUSSION

Collaborative publication is the norm for many scientific research fields. Bibliometric analysis of the authorship of scientific publications demonstrates the number of authors and acknowledgements in papers has increased for some decades (Sonnewald,2007). Conventional research training introduces students to collaboration during their research apprenticeship where they work alongside and are mentored by senior scientists (Florence, & Yore, 2004; Hunter, Laursen, & Seymour, 2007). Undergraduate courses tend to create competitive and individualistic learning environments (Tanner, Chatman, & Allen, 2003) rather than collaborative learning. This can be seen in a emphasis on individual assessment tasks in undergraduate science courses (Johnson, Maddox, Quinton, & Burke da Silva, 2010). In particular, students compete for access to research training places as they progress towards the completion of their first degree.

Many universities emphasize the value of both writing and teamwork skills in information about their undergraduate science courses. Both of these attributes are explicitly included in the draft science standards developed by the Australian Teaching and Learning Council with comprehensive consultation with scientists and science academics (Jones, Yates, & Kelder, 2011). Undergraduate science students are routinely asked to write scientific (laboratory) reports and essays although this style of writing may not reflect authentic scientific practice (Braine, 1989; Moskotvitz, & Kellogg, 2011).

Some higher education institutions do support undergraduate students to publish authentic research writing through undergraduate research journals (Tatlovic, 2008). These journals are more popular in the United States and the United Kingdom. The University of Tasmania in Australia has hosted an undergraduate science, technology and engineering journal, Nexus, but it is not currently in regular publication (S Jones, *pers. comm.*). The task reported here was designed to develop collaborative writing skills using a research writing task. It is interesting to note that during evaluation of the task, the students discussed teamwork issues much more than writing skills implying that teamwork function was more demanding. It appears that difficulties with group processes can overwhelm consideration of other aspects of the task.

The students recognized that scientific research is a team environment and that collaborative writing is a key skill for scientists. However, in this task the most negative statements were that they didn't like the task and that they prefer not to work in groups. Although negative perceptions of this task will have influenced student perceptions, it is still surprising that students who see themselves working in a team environment in the future report that they are uncomfortable working in a group situation.

Effective teamwork requires a sophisticated set of skills: negotiation, organization, leadership and management (Tanner, Chapman, & Allan, 2003). Discussion with the students in the focus group shows they have a developed idea of the skills needed for successful teamwork and are able to identify key issues. However, students reported limited past experience with group tasks. If these skills are not developed during undergraduate study, it is not surprising that students find group work challenging at honours level. Inquiry-based curriculum and undergraduate research experiences are becoming more visible in undergraduate curricula in the UK, US and Australasia (Healey & Jenkins, 2009). This study suggests that future research students would benefit from teaching and learning tasks that explicitly develop teamwork skills alongside authentic research experience.

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