

The development over two years of an online formative and summative writing tool used by first year biology students

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Abstract

The Online Report Writing Evaluation Tool (ORWET) incorporates summative assessment in a tool designed for a large human biology course. ORWET aims to improve students' understanding of report writing. It was developed in 2007 and launched in semester 1 2008. A staff version of the tool was also developed to help a large pool of markers understand the criteria by which to mark the written scientific report. The feedback from staff and students was very different. Staff considered their tool to be a useful resource. Students thought their tool was useful to their understanding of what constituted a good scientific report, but they did not like using it. This latter response indicated improvements were needed in the way ORWET was presented to students. Whilst ORWET was originally designed to be used in a second semester course, curriculum changes moved it to first semester. Many of the recurring comments of the students were probably due to their transition from school to university and these were addressed in the second version of the tool which was used in semester 1 2009.

Introduction

Science teaching is being encouraged to change at an accelerated pace to provide different learning experiences for today's time-poor students. The traditional mode of face-to-face teaching has undergone a transformation with the adoption of online learning resources. These changes have varied according to: the needs and expectations of the students, staff and institutions; the support, both monetary and skills-based, to develop the material; the confidence insight and courage of the staff member/s to embark and invest time in the creation and adoption of online resources; and, the infrastructure to support such resources. The ubiquitous nature of the Internet has fuelled society's expectations of the range and quality of online educational resources (Nigam & Joshi, 2007) whilst the increasing diversity of the student body is requiring institutions to be more flexibly creative to enhance the student learning experience, especially in a competitive market.

Traditionally first year biology courses at the University of Sydney were delivered each week by three face-to-face lectures and a three hour laboratory class. Since 1996 there has been a gradual change from teacher-centred teaching to more student-centred learning with the introduction of independent learning resources that, early on, were paper-based but are now all online. Replacing face-to-face learning experiences with online resources provided our students with an increased flexibility, for which they had been lobbying, and these resources became better organised with the advent of a mature and stable learning management system (in this case *WebCT*). The integration of more online resources in first year also seemed to address issues relating to increasing class size and decreasing availability of traditional teaching support. One of these resources was provided to help students

develop better scientific writing skills, an acknowledged important generic attribute. This resource, the Online Report Writing Evaluation Tool (*ORWET*), was introduced in 2008 as an online formative and summative assessment tool in the human biology unit of study. For more details of the tool see Lilje, Breen, Lewis & Yalcin (2008).

The purpose of *ORWET* was to enhance students' understanding of scientific report writing by giving them opportunities to see and comment on a variety of reports. The first study aimed at finding out how students perceived this new online tool and asked for feedback on aspects of the tool for improving it. When asked separately how useful they found *ORWET* to learning and understanding the structure of a biological report, 50% of respondents reported finding the tool useful or extremely useful, although when asked to indicate the usefulness of a number of assessment tasks (including *ORWET*), students preferred other tasks to *ORWET*. From a series of 22 questions using a 5 point Likert-scale, it became apparent that students did not like the tool, even though they thought it was useful to learning and understanding the structure of a biology report. When asked to highlight aspects of the tool that needed improvement we were inundated with comments. *ORWET* was introduced the same year the curriculum changes were introduced and the human biology course was moved from second semester to first semester. As a consequence of this move the knowledge base of the students had also shifted. Most of the students in Human Biology were enrolled for the first time in their first semester of their university degree. Many of the comments raised by students indicated no prior experience in scientific report writing and needed additional support on top of *ORWET*. Many of the students were school leavers and this may reflect on their readiness to work independently.

There were clear indications from the evaluation of its implementation in 2008 that further consideration was required regarding how *ORWET* was presented. This reflective process is important in order to make appropriate changes so as to maximise the effectiveness as a learning resource (Cotton & Gresty, 2007; Underwood, 2004). With the course still in semester 1, in 2009, *ORWET* was introduced to students at the beginning of semester by blending it with a face-to-face workshop session. As part of the workshop students were required to mark a paper copy of a sample scientific report according to a set of marking criteria. During the workshop students discussed the marking of the sample scientific report and were then given a PowerPoint presentation on the purpose and use of *ORWET*. To help reinforce their understanding of the marking process students were then encouraged to mark two further sample scientific reports through *ORWET*. Students were randomly allocated up to two of the four sample scientific reports available for marking. The samples provided were of varying quality. Whilst students received formative feedback on their sample report marking there was also a summative mark for using *ORWET*. The summative mark for *ORWET* was calculated differently from 2008. In 2008, the summative mark was calculated as a percentage based on the mark received by the student for how accurately the samples were marked. In 2009, students were given a fixed percentage if their marking was at least 50% accurate. In addition an entire sample scientific report was presented to students for marking rather than fragments of different reports (as was the case in 2008). These changes acknowledged the many comments from students about how we could improve our presentation of the *ORWET* exercises for their use.

This paper will report on a re-evaluation of the impact of the tool by investigating if using the tool enhances students' understanding of what is required of them, and whether it enhances scientific writing skills. It discusses the student learning experience in terms of their responses to an *ORWET* questionnaire and addresses the question of whether prior

exposure to sample reports, criterion-based marking and detailed feedback impacts on the standard of scientific report writing skills.

Materials and Method

The *ORWET* tool is modular in structure and has been described in Lilje et al. (2008). In brief, it is made up of three exercises (modules) which are based on one of three experiments done in class time, 'Energy intake and expenditure', 'Push-up exercise' and 'Caffeine consumption' (School of Biological Sciences, 2006, 2007 & 2008). These three experiments are rotated from year to year, so that in any one year one of the experiments is presented in *ORWET*, another is done as a class exercise and written up for summative assessment and the third is "rested". In 2009, students were presented with the 'Energy intake and expenditure' experiment in *ORWET* and did the 'Push-up exercise' experiment as part of the summative scientific report activity. Students fill in a marking template as they "mark" a report. The template utilizes the quiz function of *WebCT*, so students get feedback on their marking as well as being scored on their attempts.

A questionnaire was administered to the students at the end of the semester in 2009. In addition to demographic information and general questions about the usefulness of the tool in comparison to other assessment items in the course, quantitative questions asked students to comment on a range of issues associated specifically with the tool. These questions used a Likert scale for measuring responses (Likert, 1932) and were thematically categorised (Denzin & Lincoln, 1994). The Likert rating scale was numerically coded from 1 to 5 where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree (Moni, Moni, Poronnick & Lluka, 2007). The *ORWET* scores for students in 2008 and 2009, and the written scientific report marks for 2005 to 2009 were collected. The percentage of students who passed the *ORWET* summative assessment activities in 2008 were compared to students who passed in 2009. The overall report mark distribution from 2009 human biology students was compared with those from 2005 to 2008 to see whether the introduction of *ORWET* had any impact on the improvement of scientific report writing skills as reflected in the report mark.

Approval for this study was obtained from The University of Sydney, Human Research Ethics Committee (Ref.No.04-2008/10636).

Results

Twice as many females as males (66% females; 34% males) responded (n=330) to the questionnaire in 2009 which is consistent with the 2008 data (60% female). The rest of the demographics (83% school leavers; 97% full-time enrolled) are also comparable to those found in the 2008 survey (Lilje et al., 2008) and to previous HB cohorts (Peat, Franklin, Devlin & Charles, 2005). As in the 2008 survey we found that 96% of all students had not studied any biology at tertiary level before taking the Human Biology course. Access to the online resources was mainly done from home (93% compared with 72% in 2008), via Broadband (96% for both the 2009 and 2008 cohorts), and with very few technical difficulties. Students reported that they mostly completed the *ORWET* exercises in one sitting (66% for the first exercise and 74% for the second one, compared with 48% in 2008 for the first exercise). Table 1 summarises the 2009 demographics.

Male/Female	Full-time/Part-time	Age 17-20/21-24/>24	No HSC/HSC 2008/ HSC pre-2008	Previous junior biology No/Yes
34/66	97/3	83/13/4	16/57/27	96/4

Table 1 2009 student demographics (%)

Asked to comment on the usefulness of *ORWET* to learning and understanding the structure of a biological report, 55% of the students rated it useful or extremely useful (compared with 50% in 2008). When asked to indicate the usefulness of various assessment tasks to learning and understanding of the course content, students reported *ORWET* to be less useful than other tasks with 36% of them finding it useful or extremely useful (compared with only 26% in 2008). One of the main aims of this pilot study was to find out how the 2008 (n=576) and 2009 (n=330) Human Biology students perceived this new online tool. A series of questions was asked, using a 5 point Likert scale. The questions related to various aspects of students' perceptions of the *ORWET* tool. This included students' understanding of the purpose of the tool; the type of content; the user-friendliness of the tool; the layout or legibility of the tool; the level of feedback provided; and, the effect of the tool on their confidence. The results are shown in Table 2.

Qu.		2008		2009		
		Mean	S.D.	Mean	S.D.	
1	The purpose of the <i>ORWET</i> site is clearly understandable	2.8	1.2	3.1	1.1	Purpose
2	The purpose of <i>ORWET</i> is relevant to me	2.8	1.2	2.6	1.2	
3	The content of <i>ORWET</i> is appropriate	2.8	1.1	3	1.1	Content
4	The content of <i>ORWET</i> is pitched to my level	2.9	1.1	3.1	1.1	
5	Site maintains my interest	2.5	1.1	2.9	1.2	User-friendliness
6	Comprehensive instructions are available at all times	2.8	1.1	3	1.1	
7	Information is organised into sections.	3.2	1.1	3.4	1	
8	Method of operation is consistent throughout	3.4	1	3.5	1	
9	Layout is well designed	3.1	1.1	3.2	1	Legibility
10	Screen layout is consistent throughout	3.1	1.1	3.2	1.3	
11	Screen is easy to read	3.3	1.2	3	1.1	
12	Colours are used effectively	3.3	1	2.9	1.1	
13	Program is visually attractive	2.6	1	2.9	1	Feedback
14	Site effectively evaluates my understanding of the marking criteria	2.5	1.2	2.8	1	
15	Provides appropriate and useful feedback	2.5	1.2	2.7	1.2	
16	Overall the feedback/reinforcements are helpful	2.6	1.2	3	1.3	
17	Time taken to use the site is worthwhile	2.7	1.1	2.7	1	Confidence
18	Using <i>ORWET</i> made it easier to write my report	2.7	1.3	2.9	1.1	
19	<i>ORWET</i> improved understanding of how to write a scientific report	2.8	1.3	3	1.1	
20	Before using <i>ORWET</i> I was confident of my ability to write a scientific report	2.8	1.2	2.6	1.2	
21	Using <i>ORWET</i> has increased my confidence in report writing.	2.6	1.2	2.9	1	

22	Having reviewed my marked report, I can see the benefits of using <i>ORWET</i>	2.5	1.2	2.9	1
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Table 2 2008 and 2009 student responses (mean±SD) to Likert scaled questions

Even though students did not appear to be very positive about using *ORWET*, comparison of *ORWET* scores for 2008 and 2009 show that in both years the students were able to perform well on the *ORWET* exercises with 85% of students in 2008 and 73% of students in 2009 passing the *ORWET* exercises. There was no significant difference between the number of students that passed the *ORWET* exercise in 2008 and 2009.

The mean mark for the summative scientific report for the five years 2005 to 2009 is shown in Figure 1. It would appear that the introduction of the tool has not adversely affected the standard of scientific report writing.

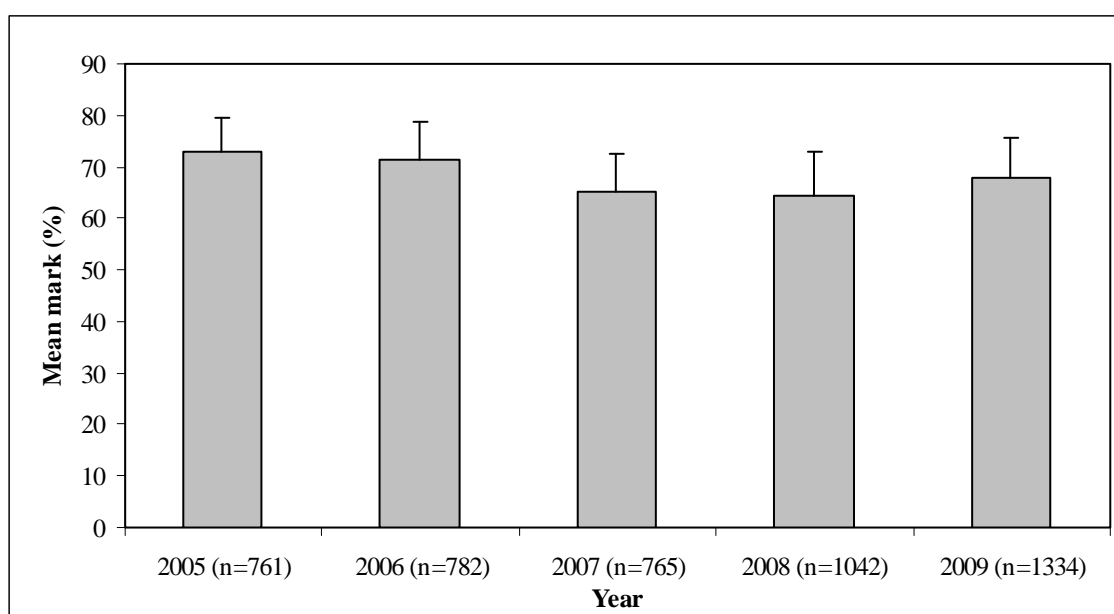


Figure 1 Distribution of scientific report marks (2005-2009)

Discussion

The emphasis on this study was to see if we have overcome some of the problems we believe were introduced, to both the format of the course and in particular the use of the online tool *ORWET*, when the course was moved from second semester to first semester. In 2008 we believed that this shift may have impacted on the readiness of students to work at a more independent level. The changes implemented in 2009 included introducing a workshop at the beginning of the semester to alert the students to the online tool and guide them on how to use it. A re-evaluation of the impact of *ORWET* looked to see if using the tool enhanced students' perceptions of their understanding of what is required of them (in marking reports) and whether it enhanced their own scientific writing skills.

The demographics of the 2009 students are consistent with those of the 2008 cohort, and as such we can make comparisons of their questionnaire data. Other responses to the questionnaire indicated that the majority of 2008 and 2009 students entering their first

semester of tertiary education had already developed IT skills such as word processing, email and general computer skills. The students were encouraged to continue to enhance these skills as well as adding skills of communicating through a discussion board, using databases and *WebCT*. Students' rating of *ORWET* as useful or extremely useful for learning and understanding the structure of a biological report had increased from 50% in 2008 to 55% in 2009. The changes made in 2009 to the way *ORWET* was introduced and presented to students through a blended format appears to have impacted positively on students' perceptions of the tool.

The five point Likert scaled responses were categorised according to whether they related to the purpose, content, user-friendliness and legibility of *ORWET*. There were two additional categories that related to the feedback provided in *ORWET* and the impact of completing *ORWET* on students' confidence in report writing. It was interesting to find that overall student confidence in their ability to write reports (Q20), before using *ORWET*, was lower in 2009 compared to 2008 and yet their confidence in report writing after using *ORWET* (Q21) was higher in 2009. This suggests students' perception of writing skills development was positively influenced. Based on the Likert scaled responses, the changes implemented in 2009 did result in improving students' perceptions of *ORWET* with 77% of Likert scaled questions being more positive, but within the neutral range, compared to 2008. Further, students' performance in *ORWET* was markedly improved with 76% of 2009 students passing the online summative tool compared to 19% in 2008. It is clear from these results that despite students' neutral perceptions of *ORWET*, the blending of the online tool with more traditional teaching improved students' understanding of scientific writing and improved students' performance in *ORWET*.

The mean mark of the summative scientific report activity for 2009 Human Biology students was consistent with previous years. Student performance in the summative activity was not detrimentally affected by the changes made over the years from completely traditional, face-to-face feedback (2005-2007); to completely online feedback (2008); to blending of traditional and online feedback (2009). There is no evidence to suggest the blending and use of *ORWET* has had a detrimental impact on student performance in the summative scientific report writing activity and this encourages us as we have been trying to offer equitable support for all students in a climate of diminishing resources (in this case face-to-face consultations).

It was clear that even though the majority of students in both years had the basic IT skills needed to use online learning resources students still needed support and guidance on how to use online learning resources during their transition from more traditional learning (paper-based) to the online environment (*ORWET*). The learning expectations of students are determined by their experiences (Kirkwood & Price, 2005; Becker, Kehoe & Tennent, 2007). In the case of students in human biology this has been largely dependent on traditional modes of learning. It is therefore important to reassure and develop students' learning expectations, especially during the transition period between secondary to tertiary education, by supplementing rather than substituting traditional modes of learning with new technologies (Kirkwood & Price, 2005; Becker et al., 2007). The results indicate that despite the positive impact of the tool on students learning, the perceptions of the students need to be addressed by further integrating traditional modes of learning. It was observed in a survey conducted by Becker et al. (2007) of undergraduate 'Generation Y' students that despite their familiarity with technologies, students still favoured a blending of traditional and online course delivery.

ORWET in its current incarnation is used to assist students' understanding of report writing by its provision of sample writing in an interactive format. The students have an opportunity to do these samples independently and be provided with feedback on their assessment of the writing according to a set of criteria. However it is envisaged that the online tool and the way in which it is used can be transferred to other activities in other disciplines where there are a clear set of criteria.

In conclusion, the results of this study indicate that the changes implemented in 2009 including, the blending of the online summative assessment tool with traditional modes; and, the presentation of the tool and samples have resulted in positive learning outcomes. Further work needs to be done to determine whether the skills students develop through *ORWET* can be directly linked to those needed to complete the summative scientific report.

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