



A pilot study on the impact of an online writing tool used by first year science students

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Abstract: A recently developed Online Report Writing Evaluation Tool (ORWET) is a summative assessment tool that was introduced in 2008 into the first year Human Biology (HB) course in the School of Biological Sciences, The University of Sydney. ORWET aims to improve students' understanding of scientific report writing. The tool presents sample scientific reports to students for marking, using the same criterion-based marking scheme provided to staff members when marking reports. The interactive environment of ORWET allows students to test their understanding of what makes a good scientific report. It also ensures students are made aware of the marking criteria and how reports are marked before producing their own scientific report. The reflective process is encouraged by the timely feedback provided by ORWET in response to students' multiple marking attempts. ORWET has been integrated into the course structure as a summative assessment activity in an attempt to maximise students' perception of usefulness of the online component (Lilje, Krishnan and Peat 2007). The eLearning tool complements the traditional experimental and reporting assessment activity thereby reinforcing the blended learning environment of the Human Biology course (Lilje and Peat 2006). This paper discusses students' responses to ORWET and how it has impacted on the overall standard of scientific writing submitted by the student cohort.

Introduction

ORWET was introduced in 2008 as an online summative assessment tool in the Human Biology (HB) course. It aims to improve students' understanding of scientific report writing. ORWET was created in 2007 to help increase the online support for students for report writing. External factors changed the timing of the HB course from Semester 2 to Semester 1. Prior to 2008 the majority of students in HB had completed another first year biology course before enrolling in HB and thus had been assumed that students would have had prior exposure to scientific writing before starting HB. The transfer of HB to Semester 1 meant that issues such as: flexibility of the learning environment; availability and effectiveness of the learning resource; timetable restrictions; and, integration and continuity with the structure of HB had to be addressed. The phenomenon of increasing student numbers with decreasing resources in higher education (Cotton and Gresty 2007; Kirkwood and Price 2005; Peat and Franklin 2002; Maye 1998) was also a point of consideration.

Rarely do students have the opportunity to read the reports of other students and so have no standards with which to compare their own work. ORWET provides reports of different standards and allows students to mark online samples of the introduction, materials and method, results and discussion sections of scientific reports using the same criteria and information provided to staff members when marking reports. By completing ORWET it is envisaged that students will achieve the intended learning objectives of the HB course relating to literature comprehension and scientific report writing. It also makes the marking process of the written assessment task transparent as students are made aware through the use of ORWET of the standard marking criteria, how reports are marked and how to construct a scientific report. The module encourages a student-centred approach by allowing students to assess and allocate marks on sample reports. Students are provided with timely feedback on how marks are distributed and where to go for further assistance. They have an opportunity to reflect and improve on their performance by having two consecutive assessment opportunities with ORWET.

The ORWET site comprises three modules covering different experimental topics that can be rotated from year to year. The online tool complements the existing paper-based summative report

writing assessment activity. The linkage of eLearning and traditional summative activities is consistent with the blended learning environment of HB (Lilje and Peat 2006). The integration of *ORWET* into the course structure and clear linkage with another assessment activity is important as it has been demonstrated (Lilje, Krishnan and Peat 2007) in this course that how the eLearning resources are presented to students has a marked effect on students' perception of their usefulness. By linking *ORWET* to the summative report writing assessment activity it is envisaged that students will achieve higher cognitive levels of understanding, through analysis of report writing, synthesis of information for the report and evaluation of good writing practices based on a set of given criteria (Bloom, Englehart, Frost, Hill and Krathwohl 1956). Whether *ORWET* has this affect is the subject of another paper.

This paper reports on the introduction of *ORWET* to a large group of first year biology students. Whilst it seeks to discuss the student learning experience in terms of their responses to an *ORWET* questionnaire, it also looks at the standard of scientific report writing skills being submitted by students in 2008 compared to students in previous years (before the introduction of the tool).

Materials and method

The *ORWET* structure utilises the quiz function of *WebCT*. It is made up of three modules or exercises which are based on one of three experiments, 'Energy Intake and Expenditure', 'Push-up Exercise' and 'Caffeine Consumption' (School of Biological Sciences 2006, 2007 and 2008) which are rotated from year to year as part of the summative scientific report writing assessment in HB. Within each module there are four components, the Introduction, Materials and Method, Results and Discussion. The Introduction component has five samples of report introductions of varying quality. Similarly the other components have five samples each. Detailed feedback is provided for each sample. The *ORWET* quiz given to students is made up of one randomly selected sample from each component. Students are required to mark the content of each component according to a set of marking criteria used for all experiments with slight variations according to the topic. In 2008, students were required to do two summative quizzes from each of two modules, 'Push-up Exercise' and 'Caffeine Consumption', consecutively presented to students in the timetable, each with fixed submission dates. The summative scientific report writing completed by students in the same year was based on the remaining experiment 'Energy Intake and Expenditure'. Prior to the release of *ORWET* to students a promotional pamphlet highlighting the resources available to improve their scientific report writing skills, including *ORWET*, was circulated.

ORWET quiz marks, written report mark and questionnaire responses were collected from consenting respondents. The questionnaire was released to all 2008 HB students at the end of the course in Semester 1. In addition to demographic information, the survey included quantitative questions that used a Likert-scale for measuring responses (Likert 1932) and qualitative open-ended questions that could be thematically analysed and categorised (Denzin and Lincoln 1994). In depth analysis of the open-ended questions will be presented in another paper. 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 and Lluca 2007). A one-sample two-tailed student's t-test was used to determine whether the means of the Likert-scaled questions were different from the midpoint (hypothetical mean = 3). The overall report mark distribution from 2008 HB students (post-*ORWET*) was compared with those from 2005 to 2007 (pre-*ORWET*) to see whether the introduction of *ORWET* had any impact either positive or negative on the 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

The questionnaire was handed out to 1042 HB students in class time in Semester 1. The response rate was 55%; with 60% of the respondents being female; 50% undertaking science-based degrees; 69% school leavers; and, 98% full-time enrolled. These demographics are comparable to those in previous HB cohorts (Peat, Franklin, Devlin and Charles 2005). Nearly all of these students (96%) had not studied any biology at tertiary level before taking the Human Biology course. This reflects moving the course into Semester 1. Interestingly access to the online tool was mainly done from home (72% of the respondents), via Broadband (96%), and with no technical difficulties reported (92%). Students are obviously very switched on and very competent with the technology. Students indicated that about half of them (48%) completed the *ORWET* exercises at one sitting with a further third (36% of the total) completing the exercises at two sittings.

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. However, when asked to indicate the usefulness of a number of assessment tasks to learning and understanding of the course content, students reported *ORWET* to be less useful than other tasks, with only 26% of them finding it useful or extremely useful.

One of the main aims of this pilot study was to find out how the students perceived this new online tool. A series of questions was asked, using a 5 point Likert-scale. The results are shown in Table 1.

Table 1. Student responses (mean±SD) to questions in the *ORWET* questionnaire

One-sample two-tailed student's t-test, indicated that all the means ± SD are significantly different from the scale midpoint of 3

Question		Mean	S.D.
1	The purpose of the <i>ORWET</i> site is clearly understandable	2.8	1.2
2	The purpose of <i>ORWET</i> is relevant to me	2.8	1.2
3	The content of <i>ORWET</i> is appropriate	2.8	1.1
4	The content of <i>ORWET</i> is pitched to my level	2.9	1.1
5	Site maintains my interest	2.5	1.1
6	Comprehensive instructions are available at all times	2.8	1.1
7	Information is organised into sections.	3.2	1.1
8	Method of operation is consistent throughout	3.4	1.0
9	Layout is well designed	3.1	1.1
10	Screen layout is consistent throughout	3.1	1.1
11	Screen is easy to read	3.3	1.2
12	Colours are used effectively	3.3	1.0
13	Program is visually attractive	2.6	1.0
14	Site effectively evaluates my understanding of the marking criteria	2.5	1.2
15	Provides appropriate and useful feedback	2.5	1.2
16	Overall the feedback/reinforcements are helpful	2.6	1.2
17	Time taken to use the site is worthwhile	2.7	1.1
18	Using <i>ORWET</i> made it easier to write my report	2.7	1.3
19	<i>ORWET</i> improved understanding of how to write a scientific report	2.8	1.3
20	Before using <i>ORWET</i> I was confident of my ability to write a scientific report	2.8	1.2
21	Using <i>ORWET</i> has increased my confidence in report writing.	2.6	1.2
22	Having reviewed my marked report, I can see the benefits of using <i>ORWET</i>	2.5	1.2

Students clearly did not like the online tool, even if they thought it was useful to learning and understanding the structure of a biology report. What is going on here?

Students were asked to highlight aspects of the tool that needed improvement and aspects of the tool they thought were its strengths. There were over a thousand responses to these two open-ended questions. Whilst an analysis has yet to be completed, it is clear that there were more detailed

comments about what needs to be improved (totalling 16,600 words across 580 responses) compared with what students thought were the strengths of the tool (totalling 6,500 words across 578 responses). The 'improvement' suggestions did not include much comment about technical difficulties. In answer to a separate question asking about accessing the site, 92% of students indicated they had no technical difficulties. Instead the 'improvement' suggestions were more to do with the design of the content and the perceived lack of instructions as to how to use the tool. A detailed analysis of these responses will help to identify areas for future changes. The responses about the strengths of the tool range from positive comments about providing good guidance on what is expected by the markers of a report to comments that indicated that there were no aspects of the tool that could be considered its strengths (thus reinforcing the outcome of the Likert survey questions). Students in previous years had received written feedback on a draft prior to submitting their final report. It was of interest to the course coordinator to see if the introduction of *ORWET* (with the removal of this written draft report feedback) had any serious affect on the performance of the students. The distribution of marks for the summative report for four years was plotted as shown in Figure 1.

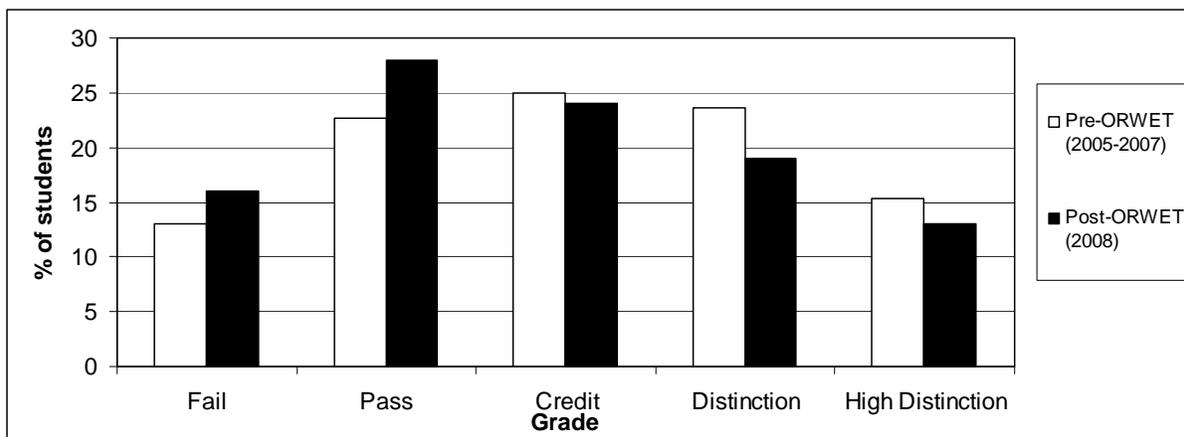


Figure 1. Distribution of report marks (2005-2008). Between 2005 and 2007 the HB course was in Semester 2. The student numbers in 2005, 2006 and 2007 were 745, 812 and 778 respectively. In 2008 (n=1042) the course was moved to Semester 1. Pre-ORWET (2005-2007) percentages were calculated by combining the summative report marks of those years.

It would appear that switching from written feedback for students reports to helping them develop better scientific writing skills (via *ORWET*) has not disadvantaged students.

Discussion

ORWET was first introduced into the junior Human Biology course in 2008. It was originally intended for use in second semester but external curriculum changes moved the course into first semester. This semester shift may have impacted on the readiness of students to work at a more independent level. Evaluation of the implementation of *ORWET* indicates that further consideration is required regarding how *ORWET* is presented and in what context. This reflective process is important in order to make appropriate changes so as to maximise the effectiveness as a learning resource (Cotton and Gresty 2007; Underwood 2004).

Student demographics indicate that the majority of students enrolled in HB are directly out of high school (70%) and have not taken any other tertiary course in biology (96%). The questionnaire responses indicate that the tool needs some modifications and that students require more guidance and support in developing their scientific report writing skills. Responses from



higher achieving students were more positive. This may reflect on students' ability to work more independently. Further refinement of the feedback is required to avoid inconsistencies that can lead to lack of confidence in the tool. This is particularly poignant as *ORWET* is currently used as a summative activity. Comparison of the 2008 cohort with pre-*ORWET* cohorts (2005-2007) show that report marks are normally distributed and in keeping with previous years. This is despite the removal of the draft report feedback (2005-2007) because of timetable restrictions. This may indicate that *ORWET* increases students' awareness of the report requirements. Anecdotal comments from report markers lend support to this idea because of the decline in the number of minor errors detected in 2008 submitted reports.

The incorporation of traditional modes, such as practice report writing activities, in addition to *ORWET* needs to be considered. E-learning tools are not always the total answer or appropriate way to address learning objectives (Cotton and Gresty 2007; Moni et al. 2007; Evans, Gibbons, Shah and Griffin 2004). Although *ORWET* has been linked to the summative scientific report activity, further blending of traditional, paper-based activities with eLearning resources may need to be made to enhance student engagement and relevance. For eLearning to be effective it needs to be based on sound assessment practices which have been integrated into appropriate learning and teaching activities (Moni et al. 2007).

For 2009 there will be a greater emphasis during the first two practical classes on how to write a report and how to use the online tool. This will be provided in the form of a short case study that requires the students to find out some information; check some data; and, provide a short report to include a written introduction and discussion. A face-to-face, non-assessable discussion activity on a paper-based sample report from *ORWET* will also be introduced into the practical class timetable. This will be followed by students using *ORWET* as a summative assessment activity.

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