Study on the Art of Scientific Report Writing: Emulation of Style

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Abstract

This paper presents a study on the art of scientific report writing and covers not only the format for reports but also some common grammatical mistakes that can be found in students' written reports. We find that a good style of writing can be achieved by a simple method of emulation. Specifically, we report that regular reading of scientific papers from the peer reviewed literature can increase the average student report mark by 10 ±2 %. Our study reveals that this figure can be even exceeded provided the subject matter is of interest to the student. For the first time, to the authors' knowledge, we report that papers on report writing itself are among the most effective in bringing about these advances.

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1. Introduction

From the perspective of the assessor, the marking of student scientific reports often comprises one of the most frustrating aspects of the work experience. As an expert researcher, the assessor has undertaken the task of scientific report and paper writing many times[1], has acted also as referee to others' paper submissions and as a result has become accustomed to excellence in these endeavours. Despite these frustrations, educationalists and those whose views are based more on knowledge of the school/university transition argue that assessors should not expect students to possess natural inherited skills in this area. McComb, notably, has shown that students need guidance[2] and other studies suggest that students can not only fail to improve their skills but actually can regress in their effectiveness if too much is expected too early[3]. In the seminal work of Carruthers *et al*[4] students' literary capabilities were observed to regress to those expected of their non-university peer group.

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There is therefore a need to understand what motivates students towards excellence in report writing. In this study, we carry out an exercise in effective report writing and show that with simple attention to the style adopted by others, students can readily solve the problem of the school/university transition and develop a professional style of writing.

Our study involves the preparation of a mock scientific report that is made available to students following a lecture held at the beginning of the term. It is designed to present the basic problems encountered by assessors when marking student reports and give an example of the style of writing and layout that are acceptable to the scientific community. We then draw some comparisons of marks achieved after using these methods with those obtained previously and compare them with the hypothetical Hase theoretical model[5]. We finally draw conclusions regarding the effectiveness of our new approach.

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1. Methodology (or "Experimental Details")

A class of students studying physics were made to sit within a large lecture theatre and exposed to a lecture on report writing for a period of 55 minutes. Following this the students were allowed to leave but were asked to read a mock paper on report writing that they had been given. The lecture comprised examples on style and requirements for the summatively assessed Extended Reports in the Discovery Skills in Physics module and was delivered using a blackboard, overhead projections (OHPs) and other audio visual aids as required (Figure 1). OHPs were delivered at a rate below that at which students lose track of the content.

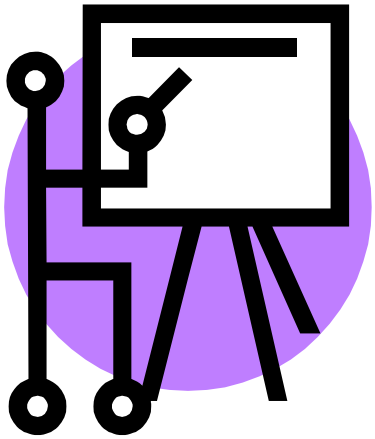

Figure 1: *Schematic diagram of the lecturer and equipment used to deliver the lecture on report writing skills. Open circles denote the head, right hand and feet of the lecturer. The blackboard is shown as a square outline although for practical reasons a wall mounted device was used in the study.*

The lecture theatre was fully equipped and serviced by the Audio Visual Section of the Department of Physics. Following the lecture the room was allowed to cool before being recharged with students studying another subject. All lectures were carried out using standard good practice as warranted by the Department's 24/24 in the Teaching Quality Assessment Exercise. Marks later collected were compared with those of previous years in order to measure the effects of these treatments.

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2. Results

The average mark obtained by students in extended reports over previous years is shown in Table 1. Marks exhibit a general decline for the period shown and the exceptionally high mark (102 %) recorded for 1998 was traced to an administrative error in Student Planning and Assessment[6].

Year	1995	1996	1997	1998	1999	2000	2001
Mark (%)	75 ±2	70 ±2	65 ±2	102 ±2	62 ±2	59 ±2	57 ±2

Table 1: *Average marks for Extended Reports achieved for students in the assessment period. The error shown relates to inherent uncertainties in the marking of experimental reports.*

This data is shown plotted (see Figure 2) with the theoretical expectation described by Hase[5]. Contrary to the theory, the observed marks do not decrease to a plateau but deviate significantly in later years where the theoretical curve lies outside of the error bar limits of the data.

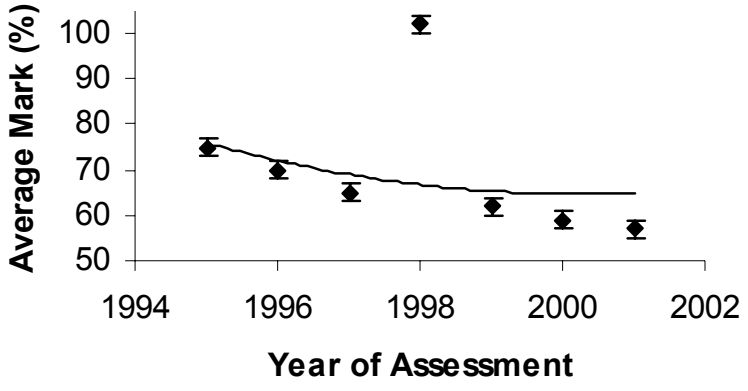

Figure 2: *Annual average report mark for Level 1 students (solid diamonds). The solid line follows the predictions of Hase (reference 5). Error bars are set at 2 % and represent systematic error.*

Using our new scheme for motivating and informing students on report writing, our sample of 256 students provided an average mark of 75 ±2 %. If the Hase model is assumed to be valid in these circumstances it would predict a mean value of 65 %, being the asymptotic limit of the model for long time scales. Clearly there is a substantial increase over this predicted value.

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3. Discussion

The general trend towards reduced marks and disagreement with the Hase theoretical model gives strong evidence that teaching and learning (T&L) standards in report writing were in decline in the later years of the last century. The Hase model is a predictive tool that suggests that incremental improvements to the T&L standards should lead to a steady state situation. However it makes some important assumptions. Most importantly, the model ignores the effect on moral of students which we consider to be an important consideration. Furthermore, the effect of continuing decline in standards of grammar is not fully accounted for. The Hase model therefore underestimates the decline. In our study, by contrast, we take these effects into account. For example, we indicate in the lecture the importance in the correct use of the apostrophe; suggesting that "carrot's", "carrots'" and "carrots" have quite different meanings. The first form indicating that which associates with the single carrot, the second, that which associates with carrots as a group and finally the simple plurality of carrots. We also emphasise that the use of the first person singular (for example,"I constructed the circuit according to…") is now not in general use as it was in the days of, say, Newton. Our approach also rules against the use of lists as might appear in lists of experimental equipment and we do make sure that full, explanatory figure and table captions are provided so that these devices are self-contained. Our main departure however from the previous models is to assume that simple emulation of good written style, through the regular reading of scientific literature, may contribute significantly to improved performance.

Our main finding, that the average report mark shows an exceptional improvement over those of previous years, therefore would not be expected to follow the Hase model which clearly underestimates what we have achieved.

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4. Conclusions

We have shown that with some relatively minor changes to instructional style and the development of interest in the skills of scientific writing in the student, significant improvements in average mark can be achieved. We attribute this improvement largely to the encouragement of emulation (simple copying) of the styles adopted by the general modern scientific community. Future work aims to make further improvements and to test the validity of our model on data sets over the next ten years. We can hope that these methods will be applied more widely for the general benefit of student and assessor alike.

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References

[1] For examples see: G.H. Cross, *Nature* (1995) 374, 307-308; M. Key, I.G. Hughes, W. Rooijakkers, B.E. Sauer, E.A. Hinds, D.J. Richardson and P.G. Kazansky, *Phys. Rev. Lett*. (2000), 84 (7), 1371-1373; T.P.A. Hase, E.M. Ho, J.J. Freijo, S.M. Thompson, A.K. Petford-Long and B.K. Tanner, *J. Phys. D: Appl. Phys*. (2003), 36 (10A): A231-A235

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[6] Note that this data as well as references other than those in reference 1, are a complete fabrication and no significance should be attached to these comments