

Communicating science: how do we teach undergraduates to become scientists?

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Scientific communication is considered a core competency in a number of undergraduate programs. However, traditional science curricula typically are developed to teach discipline content and not to develop scientific literacy skills in their students. Consequently, there is an increasing interest in the development of subjects or modules of subjects that are associated with the development of scientific literacy and communication skills. Based on my recent research, two examples are provided which demonstrate 1) an individual assessment task focused on critical understanding scientific literature and 2) a whole of subject scaffolded learning approach to enhance scientific written communication.

In the first example, we employed a content-based language instruction which has been investigated in a cohort with a large number of English as a second language (ESL) students. Previous studies have suggested that this form of teaching ensures a better learning and teaching outcomes in ESL students, however, prior to this study, it was not used as a means of developing critical analysis skills in these students. We used a 'Socratic' small-group discussion in addition to content based instruction, to enhance critical thinking skills in ESL Biomedical Science students. Students were provided a detailed protocol for the analysis of a research journal manuscript and participated in a Socratic discussion. Students wrote evaluative pieces to summarize the manuscript's topics, both before and after a small-group discussion focused on understanding the content of the manuscript. Students' level of understanding and analysis was assessed using Bloom's taxonomy. Overall, a third of all students displayed an improved critical thinking score based on Bloom's taxonomy. However, only 20% of ESL students improved their critical thinking score, while 42% of non-ESL students improved their critical analysis of the manuscript. Despite this, ESL students believed that the discussion made them feel positive about their ability to read and interpret scientific literature.

In the second example, a 2nd year undergraduate subject was developed to improve students' experimental design and written communication skills through the generation of a scientific manuscript based upon data generated in the teaching laboratory. This subject consisted of active-learning lectures (using PRS clickers), small-group discussions (focused on the scientific principles of experimental design) and formative feedback on students' drafts of sections of their manuscript generated from practical class data. Students were segregated into low-, middle- and high-achievers based on their prior level of achievement. Our data demonstrated that there was a significant positive Kendall's rank co-efficiency between the number of drafts submitted and the scientific manuscript assignment mark for low- and middle-achievers, but not the high-achievers. In addition, there was a positive Kendall's rank co-efficiency between students' prior level of achievement and their assignment mark across low- and middle-achievers only. Thus, using either a single assessment task, or whole of subject approach, we can develop scientific written communication and basic skills in scientific enquiry in our undergraduate cohorts.