The Social Role of the ALESS Program: The Place of a Science Writing Class in Undergraduate Education

Guy D. MIDDLETON

Introduction

The role, status, and value of higher education in society are increasingly called into question (Anderson et al. 2011). It is appropriate for those throughout higher education institutions to reflect on both the immediate aims of any particular course on offer, and its wider social aims, and to evaluate what is being offered to students, and to the rest of the society that sustains institutional higher education (Hodson 2003). Indeed, such sentiments are stated in the University of Tokyo's FOREST 2015 Action Scenario (Hamada 2011). Here I consider one potential way in which to broaden the social context and value of the Active Learning of English for Science Students (ALESS) Program at the University of Tokyo.

I begin by describing briefly the goals and outline of the ALESS Program, and then look at the issue of content in broadly English for Specific Purposes classrooms. I consider how questions of content and knowledge influence the structure and aims of such writing classes generally. Approaching the position of ALESS in the education of undergraduates at Tokyo University from this angle, I then suggest how the Program could be subtly recast to fulfil three broad aims—1) responding to the specific language and genre awareness needs of Japanese science students; 2) providing an apprenticeship to the international discourse community of scientists; and 3) acting as a vehicle through which students can become more aware of pressing local and global issues and their relation with the social roles and responsibilities of science and scientists. I end by noting some ways of achieving such a shift in focus, and noting some

useful resources, before ending with some brief final comments.

Goals and Philosophy of ALESS: Beyond Hedging

The ALESS Program is a compulsory writing class, which introduces first year undergraduate science students at Tokyo University to the genre and rhetoric of formal science research papers in English. There is a clear rationale for this focus, given the need for scientists around the world to publish, present, and communicate in English (Cho 2009; Freeman 2003; Langdon-Neuner 2008). The class involves guided exploration of authentic science papers, especially those in the well-known IMRaD format (see Myskow and Gordon 2010; Sollaci et al. 2004), and focuses on features of scientific English such as register, vocabulary choice, tense, and certainty (see Fang 2005), as well as the students' individual (but peer-reviewed) IMRaD composition.

But in its wider philosophy, the program is more ambitious in scope, seeking to encourage the normal and regular use of English among future scientists in Japan, and to promote in students a creative, critical, and scientific outlook. In addition, the program seeks to position science as global social action undertaken co-operatively in an international community. These goals are vested explicitly in the scaffolding of specific tasks and authentic communicative acts, interactions, and discoveries, during ALESS classes. They reflect recognition of a broader conception of scientific literacy as literacies that go beyond the acquisition of particular language features (Hodson 2003; Laugksch 2000; Lemke 1990; Parkinson 2000).

So, in addition to crafting a tangible product and gaining in language and genre awareness, ALESS students experience a journey of discovery as they settle on a project area, plan, propose and carry out an experimental research project, and write and revise a short paper, all in a communicative and co-operative English language oriented setting. In keeping with the philosophy of the program from its inception, it seems to be hoped the ALESS experience itself has a positive effect on the intellectual and social development of students, and promotes critical thinking and autonomy, quite apart from simply writing a paper in English. As such, ALESS already has a deeply social role.

The Role of Content

Content in a writing class can be regarded as either subject specific knowledge which appears in the writing product, or the knowledge and skills to be practiced or gained through taking the class. Here content is used to indicate the former.

Many scientific writing or writing for publication courses are aimed specifically at meeting the needs of postgraduate research students, professional researchers, or academics working overseas, who have a specialist field and are already members of a research community. Such people already possess content that they need to communicate in specific ways—in publishing papers in journals, presenting at conferences, and so on. Some course designers cope with this by incorporating field-specific tasks, or by using different kinds of content that can be addressed equally by participants, but that will allow the specific language aims to be addressed (Levis and Levis 2003).

ALESS is unusual in that it is a required class that aims at providing a foundation in scientific writing and communication for undergraduate students. These students are academically inexperienced, have not yet joined a research community, and are not writing for publication, which means that they lack the natural content, context, and motivations that participants in science writing courses often have. ALESS students, as future productive researchers, are positioned as initiates being socialised into both the academic community in general, and into the scientific discourse community specifically (Duff 2010). This means that content cannot be taken for granted, as students are still very much in the position of content learners. So how does ALESS work around this?

One key way is that in-class tasks use authentic published papers selected by faculty. Content can be presented as secondary to rhetoric, form, or function—for example students can easily learn to identify a typical topic sentence in a method section without great focus on the content of the paper. Equally they can understand that an author's email address is provided for a practical and social purpose, creating trust and transparency, as well as a means to contact a researcher directly. Inevitably there is engagement with new knowledge and ideas, and some learning of content. Judicious selection of papers can make this doable

and interesting in terms of the content and language of the paper, even for novices, and make it possible to use authentic texts as models.

ALESS students' compositions use data from a simple practical experiment. Students choose scientific topics based on an area of interest or a previously published background paper. Some teaching faculty provide a selection of such papers, and suggest how they can be used to generate a research project, and how they are used in the construction of a new paper. Support structures are in place to help students generate ideas, find and understand background papers, and plan, carry out, and analyse their research. A typical range of titles from a randomly selected class is given in figure 1.

- Turn alteration in the pill bug
- Observation of supercooling and heterogeneous nucleation in three solutions
- Measuring effects of salinity on the germination and growth of plants
- The effect of food additives – a case study of potassium sorbate
- The change of bubbles and taste of beer
- The effect of music of different composers on seed germination
- Temperature of soft drinks and enamel erosion
- Bubbles of beer exhibit exponential decay
- The confirmation of Henry's law with water soluble gas
- Preservation from decay
- The drawing power of crowds of different sizes
- Power of group psychology
- The influence of a sense of time on human development
- The movement of Newton's cradle
- Method to clean coins or hard cash
- Measurement of coefficient of restitution

Figure 1 Titles of papers from one ALESS class showing variation in content

Students are also made aware that they are not being assessed on content knowledge, nor on their experiment. Their final paper, which itself is only fifty percent of the course assessment, should contain appropriate functional sentences, should be logical, and written in the appropriate style. So content is de-emphasised, at least as far as formal assessment goes. But ALESS, students have

a high degree of choice in the kind of content they engage with, and it is hoped that this can be a motivating factor in their engagement with the program. When questioned, 63% (225 of 357 responses, Spring 2011) of ALESS students agreed that they had learnt something new/enjoyed researching their ALESS topic, while 22% neither agreed nor disagreed.

ALESS adopts a project-based and genre-based approach to teaching scientific writing, rather than an explicitly content-based approach (Levis and Levis 2003). A generic IMRaD research paper provides an appropriate target at this level (Levis and Levis 2003), with content knowledge playing a role in the program, but one that is explicitly secondary to form, process, and argument (compare Parkinson 2000, p. 378). This is appropriate given the position of ALESS students, and the mixed specialisms of teaching faculty. A content-based and subject specific approach to writing in specific field genres would not be appropriate.

Given that content can be a catalyst in motivating students, and also that students inevitably learn something by engaging with content in ALESS, it is worth asking whether there is an opportunity to create further educational or social gains by controlling the themes of the content students encounter.

ALESS: An Opportunity to Make a Difference?

The ALESS Program occupies an interesting place in the education of science students at Tokyo University. It is a venue for the intellectual and social transition of students from high school to higher education, in which students' autonomy and responsibility for their own learning increase. It enables students to embody at once the positions of learner and practitioner in both language training and scientific research, combining dual roles of writer and critic, researcher and colleague. And it requires them both to use and increase their general English language ability, their knowledge of specific discourse features and communities, and also their scientific knowledge, and to display these literacies in the production and manipulation of content in specific forms.

Given that ALESS occupies this nodal location, it is possible to ask whether the ALESS Program, as part of science students' introduction to Tokyo University, Japan's leading university, should take more responsibility, not for teaching content as such,

but for directing students to encounter, and therefore learn about, certain kinds of content. In addressing the roles and form of science education, Derek Hodson has raised a number of points that are relevant for considering the ALESS Program and other language and science courses; it is worth quoting him at length. Hodson argues that (2003, p. 654):

> politicization of science education can be achieved by giving students the opportunity to confront real world issues that have a scientific, technological or environmental dimension. By grounding content in socially and personally relevant contexts, an issues-based approach can provide the motivation that is absent from current abstract, decontextualised approaches and can form a base for students to construct understanding that is personally relevant, meaningful and important. It can provide increased opportunities for active learning, collaborative learning and direct experience of the situatedness of scientific and technological practice.

Hodson also writes of science education, and of scientific literacy, as aspects of citizenship education, (2003, p. 654):

> the purpose of such an education is to enable young citizens to look critically at the society we have, and the values that sustain it, and to ask what can and should be changed in order to achieve a more socially just democracy and to ensure more environmentally sustainable lifestyles.

These considerations seem well in line with Tokyo University's FOREST 2015 Action Scenario (Hamada 2011). This document emphasises the social responsibility of universities, the goal of working towards a sustainable society in times of change, and the strong connections that can and should exist between higher education and society. It also points to the encouragement of local and global awareness amongst students, and the leading role of past and future alumni in society.

As mentioned, the topics researched by ALESS students range very widely according to students' interests (figure 1). But compare the themes researched by the finalists of Google's Science Fair 2011 (Google n.d.), an international (participants from

90 countries) school-level contest held at three age groups (13–14, 15–16, 17–18). These included Alzheimer's and ovarian cancer, the efficiency of submersible water turbines, railway safety, and 3D tracking of robots. The leading research carried out by participants was strongly tied to real world issues and applications.

To be sure, the finalists involved were entering a competitive science fair and not carrying out research as part of an additional language writing class (though they did produce texts and presentations). They also likely benefitted from the personal support of schools, universities, parents and teachers. Nevertheless, the scope, applications, and social utility of the research was striking. Participation and focus on topics with clear application in this way could benefit the participants' wider motivation and development.

It seems worth considering whether ALESS students could or should also be encouraged to engage with similarly applied or targeted content (for example related to health, environment, or sustainability), carrying out projects on an appropriate scale within the constraints of a single-semester course. The point is not that students' experiments need to be more complex or even have real application, but rather that the inevitable exposure to such content would be beneficial in several ways, and could increasing the social and educational value of the ALESS Program for students and society. Benefits include engagement with specific kinds of science content which are of local and global social and economic importance, the promotion of a clearer link between the activities of researchers, scientists, and universities and the rest of society, and increased credibility and utility of the experimental aspect of the ALESS Program.

Greening ALESS: Student Projects and Contemporary Issues

Current local and global issues that students are more than likely aware of include agriculture and food, biodiversity, earthquakes and natural disasters, energy and power generation, environmental problems, health and nutrition, pollution, resource use, and issues of sustainability. Such topics often form the content for academic English language and skills classes because of their general interest, relevance to all, and potential to be easily

researched; accessible textbooks such as Seitz's *Global Issues* (2007) are useful.

As topic areas for students in a program like ALESS—a science writing class with a practical experiment, they may sound over-ambitious, but this is not so. Some ALESS students have already directed their projects to practical studies of earthquake-proof buildings, ground liquefaction, water purification, and cooling systems for nuclear plants. All of these issues are important on local and global levels, and can be motivating for students to research.

Encouraging more widespread engagement with such themes in ALESS could be achieved with little change to the present structure and modes of delivery of the course, and without adding any extra workload for students. ALESS faculty currently obtain consistent outcomes from students despite variations in teaching approach taken by individual teachers, and there is no reason to change from this approach to achieving shared goals.

One way in which such encouragement can be given is by changing the focus of materials that support research topic choice. Many students choose a research topic based on ideas from a published background paper. They choose to replicate or extend the research in a simple way, designing and carrying out an original small-scale experiment. Background materials could be limited to appropriate papers, or the proportion of such papers increased.

It could also be possible to pose ALESS research in the form of problem-solving tasks or challenges, and this has been piloted in some ALESS classes. But one problem of this is that the connection between the practical task and the product—the IMRaD paper—is less clear than when proceeding from some kind of previous research. However, this remains an interesting and potentially motivating approach that bears further thought.

Another way to promote a socially aware ALESS would be to adopt strategies that raise students' awareness of how some scientific studies actually require a high degree of co-operation between scientists and the public—and can be fun. For example, biodiversity 'blitzes'—where groups of scientists and members of the public, often families, join forces to identify and count the number of species and specimens present in a given area. Recent concerns over declining bee numbers spawned a number of such

projects (see Brighton and Hove's Big Nature in the appendix), which can provide essential data to help understand biodiversity and the state of ecosystems, as well as increase public knowledge and awareness of the role of science in society.

I provide a brief indication of a few topic areas and possible projects, along with details of relevant published background papers in figure 2. I also list some web sources with project ideas,

Agriculture & food

- Effects on germination, growth & yield through intervention (magnetic fields/culture medium/light/sound) (Hirota et al. 1999)

Biodiversity

- Observation based studies, descriptions, and comparisons of biodiversity, local environments, and ecosystems, and the factors that affect them (Sugimura et al. 2005)
- Study of human impacts on biodiversity (Kinzig et al. 2005)
- Biodiversity 'blitzes' (American Institute of Biological Sciences; Brighton and Hove's Big Count)

Health and nutrition

- Effects of diet on behaviour (Cooper et al. 2011)

Pollution and remediation

- Use of barley straw to inhibit algae growth (Ferrier et al. 2005)
- Use of natural carbon for denitrification of water (Ovez et al. 2006)
- Photocatalysis with titanium dioxide (Fujishima et al. 2000)
- Phytoextraction—using plants (such as Thlaspi) to 'clean' contaminated soil (Wang et al. 2006; Science Fair Projects)
- Growing plants in oil contaminated soil using oil-absorbing polymers (Science Fair Projects)
- Using bacteria to reduce nitrate levels in water (Science Fair Projects)

Earthquakes and natural disasters

- Soil/ground types and liquefaction

Sustainability

- Built environment/materials/insulation/efficiency (Centre for Alternative Technology)
- Green energy projects (Centre for Alternative Technology)

Figure 2 Potential research topics and background/source materials (see references and appendix)

educational resources, and other relevant information and ideas in the appendix.

Final Comments

In a science writing course such as ALESS, it is inevitable that students engage with and learn about scientific content to some degree. Considering the nature of this content reveals opportunities to widen the aims of ALESS, or similar programs, to include a stronger social context by controlling the types of content encountered.

Such a shift would increase the potential for students to develop as more socially aware scientists, researchers and citizens, with a clearer understanding of the connections between science, research, and society. It could also increase motivation in the class by dealing with real world issues in which scientific research and communication plays a role. In addition, it could add greater credibility to the practical experiment that forms part of students' experience of the ALESS Program. Giving a practical or applied spin to ALESS may also provide opportunities to increase interdepartmental co-operation, to raise or ensure funding for ALESS, to provide a broader context for outreach into the community, and for promoting the course.

My intention here has been to describe the ALESS Program as is, and to consider some issues and opportunities relating to possible future directions that could be taken. I have raised the idea of what a slightly alternative, or differently weighted ALESS Program could look like, and to note the potential benefits of connecting the research project to more explicitly 'real world' issues. Universities are an invaluable part of society, but such institutions are also responsible to the societies that sustain them. Those in higher education must always consider the wider context and value of the education they are offering and seek ways in which to make it more beneficial not only to students directly, but also to society at large.

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Appendix

- American Institute of Biological Sciences:
  http://www.aibs.org/eye-on-education/eye_on_education_2003_04.html
- Brighton and Hove's Big Nature:
  http://www.bigbiodiversitycount.org.uk/index.php
- Conservation International:
  http://www.conservation.org/resources/education/science_fair/pages/projects.aspx
- Centre for Alternative Technology:
  http://publications.cat.org.uk/ & http://learning.cat.org.uk/en/resources
- Centre for Ecology and Hydrology:
  http://www.ceh.ac.uk/sci_programmes/AquaticPlantManagement.html
- Science Fair Projects:
  http://www.all-science-fair-projects.com/project1142_120.html