

Exploring the language of technology with student-teachers through genre pedagogy

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Abstract

Teachers can open up the world of technology through language, but they are often unaware of the specific features of the language of science and technology. Genre pedagogy is an approach whereby students learn to understand domain specific text characteristics in order to produce such texts. In this paper an explorative study is presented in which students at a teacher education institution were trained to produce oral and written language that is an inherent part of the domain of technology and society.

Introduction

Language proficiency and learning are strongly related in all subject areas. The explicit integration of language development in content teaching can improve learning results. This also holds for science and technology (Hajer en Geerdink 2010; Lee & Buxton 2010). In The Netherlands – as in many countries - schools opt for language across the curriculum policies, but the chosen pedagogical approaches are general in nature and lack a subject specific component (Hajer & Meestringa, 2009). In Australia and Sweden an interesting pedagogy, based on analyses of subject specific text types, has given way for a practice that explicitly addresses subject specific language.

For teachers of technology it is important to understand the language of their subject, if they are to introduce their students in the domain of technology and its language. It is doubtful to what extend teachers are aware of these linguistic features. In teacher training we observed a lacking proficiency in e.g. writing tasks. Therefore we decided to start the development of a two step approach: designing tasks that would raise teachers awareness and proficiency, and then designing training modules that would enable teachers to raise their students awareness and proficiency in the language of technology. This paper reports on the exploratory first phase of the research.

We will first characterize the genre approach and pedagogy and then describe how we applied these ideas in the course for technology teachers.

A genre approach to subject specific language

In genre pedagogy, a subject teacher is assumed to take part in, or at least have access to, a domain bound community of practice that uses language in specific ways (Martin, 2009). A technology teacher may not be a professional engineer, designer or philosopher of technology, but he is certainly expected to know how professionals in these fields use language to do their work and to communicate about it.

“Genre refers to abstract, socially recognized ways of using language. It is based on the idea that members of a community usually have little difficulty in recognizing similarities in the texts they use frequently and are able to draw on their repeated experiences with such texts to read, understand, and perhaps write them relatively easily.” (Hyland, 2007).

This specific notion of text genres is rooted in the so called *systemic functional linguistics* (SFL) that was elaborated by Michael Halliday. The Sydney School elaborated a taxonomy of texts, categorized to its function as for instance narrative, report, recount, procedure, explanation or discussion, each with its own preferred structure (Derewianka, 1990). A threefold conception of meaning is employed when texts are further analyzed in terms of A) ideational linguistic resources that are an inherent part of the content, B) interpersonal resources for negotiating social relations, and C) textual resources for managing information flow (Martin, 2009). Once teachers have a better understanding of texts, in terms of these three categories of analysis, they can explicate relevant characteristics to their students. This enables students to understand these texts and produce similar texts at their own level.

In the Australian practice, a teaching-learning cycle has been developed, called genre pedagogy that is to a large degree based on modeling strategies. It often employs a four stage teaching-learning cycle, whereby cycle one (building the field) is continued throughout.

1. Building the field: development of concepts
2. Deconstruction: pinpointing field, tenor, mode
3. Joint construction: Writing with students
4. Independent writing



(Gibbons, 2002)

Genre pedagogy has become a standard in teaching in Australia. When studying and discussing its potential, we were doubtful, however, whether the complex analytical approach would be considered useful for teachers without specific linguistic schooling.

Method

In order to understand the benefits of genre pedagogy, we chose to outline a educational design experiment (Van den Akker, Gravemeijer, McKenney & Nieveen 2006). In educational design studies a learning environment for researchers is created in order to build a theory about learning processes. Hypothetical learning trajectories are formulated and tested through case studies in a cyclic iterative process.

The main research question was: *Can genre pedagogy be realized within our context and does it contribute to the awareness and proficiency in writing a specific genre in technology education, e.g. the essay in philosophy of technology.*

In order to design such a trajectory in technology teaching we studied available literature on the language of technology and science. Subsequently we designed a first cycle of the design research project in which genre pedagogy was applied in teacher education, in a course about technology and society.

The course was delivered through eight sessions, of three hours each, by one of the authors of this paper. The group of students consisted of 17 students, all with a job in secondary or tertiary education, ranging in age from 23 to 55. As a final product for the course, they were requested to write an article for a technology teacher's journal on a topic within the domain of technology and society. We will refer to this macro genre as 'essay in philosophy of technology'. Throughout the course, lessons were videotaped, student material was gathered and analysed and students were interviewed.

Characteristics of genres in technology and science

If we want to identify science and technology texts in terms of genres, we will have to collect and analyze samples. This choice and selection, however, is not neutral. Especially in technology education, which is a contested field, the outcome of an analysis highly depends on our conception of our very school subject (Dakers, 2006; Vries de, 2005). If we would conceive technology mainly as a collection of artefacts, we would perhaps analyse a manual of some apparatus, whereas a conception of 'technology as volition' could yield an analysis of a newspaper article that addresses the dangers of nano-technology to society. In short: If genre pedagogy aims to provide students with the means to become participants in the world of technology, the question arises which texts represent this world best. It is our position that 'thinking about technology' is an inherent part of the subject, at least in education, and therefore we set out to analyse argumentative texts by authors who do so for a living and who communicate their ideas to a wider audience through newspaper articles and popular philosophy journals.

Much has been written about one important feature of the field of genres in science and technology, e.g. the frequent use of nominalizations: A process or a series of processes is packed into a single noun or small group of words.

A fragment of a lesson about simple machines illustrates this principle (Christie, 1998).

*[Teacher:] And each machine is used to give you a mechanical advantage
(writes 'work—mechanical advantage' on the board).*

According to Christie:

A more congruent way to make the point might have been to say: "machines work for you".

In both cases, the piece of experiential information is constructed in a transitivity process, in which the process itself is material while 'machines' operates in the participant role of actor. The same point is made, but metaphorically, when the activity is turned into a thing, through the resource of a nominal group: 'mechanical advantage'. With the entry to some awareness of the latter, the students have reached a new, more abstract stage of understanding (Christie, 1998).

In this way the grammar of scientific and technological English becomes increasingly abstract and harder to learn (Rose, 1997). Halliday shows that such nominalizations have become commonplace since the early days of the natural sciences. Halliday (1998) demonstrates this by means of a sentence from Newton's *optica*, in which three instances of nominalizations can be recognized.

Now those colours argue a diverging and separation of the heterogeneous rays from one another by means of their unequal refractions, as in what follows will more fully appear.

SFL uses the term 'tenor' to describe the way the relation between the writer and the reader becomes manifest in texts. Science and technology texts do not usually focus on the writer or reader directly. Nature, in its broad sense, is described as an entity that is positioned separate from humans. This becomes manifest in language, for instance in Newton's writing above, where agents are things and nominalized processes rather than humans. An exception in science texts can be

found in texts about the environment and in texts about technology and society (Veel, 1998). In such texts the writer will often try to convince the reader of his opinion, for instance in a discussion. Not only will the writer use words such as ‘I’ or ‘we’, but he will also likely pinpoint at groups of people who gain or lose by the introduction of certain technological innovations.

In terms of ‘mode’, or ‘how’ meaning is being exchanged, a large proportion of the language that students encounter, be it at secondary school or at university, can be called pedagogic discourse. Texts, spoken or written, are directed at students in order to make them understand or do something. Technology students may for instance encounter many texts of the type: “A program of requirements is ...” or “Write a program of requirements for your ‘silent music room’”. The field of such texts may be similar to texts such as: “Walls that separate rooms will have a minimal Sound Reduction Index of 50 dB”. The tenor and the mode, however, are radically different.

In our literature study, few analyses were found specifically for design and technology, but if we borrow from the sciences, the following text structures stand out (Derewianka, 1990) (Love, Baker, & Quinn, 2005) (Gibbons, 2002).

Genre	structure
Procedure	Aim, materials, steps, suggestions
Report	Introduction and classification, characteristics aspect A, characteristics aspect B etc.
Explanation	Identification of phenomenon, sequential explanation
Discussion	Introduction, arguments pro and contra, conclusion

Combinations of genres are called macro genres. A science report could for instance comprise of a procedure, a recount and an explanation (Love, Baker, & Quinn, 2005).

As a next step, after this study of how science and technology texts differ from other texts on three dimensions and the identification of different genres in science and technology, we outlined how these genres might be taught.

We haven’t found any systemic functional linguistic analyses of the genre that was at the core of the technology course, the ‘essay in philosophy of technology’. In order to identify genre characteristics ourselves, we analyzed a few students’ papers of previous years. We then found that those articles were a rather unclear amalgam of genres, lacking in structure and coherence. This finding was consistent with the feedback of the editor of the journal a year before. Consequently a newspaper article of a philosopher of technology was analyzed in terms of genre (Zuijderland, 2009). It appeared to be suitable as an example and its analysis showed characteristics of a historical essay and a discussion. Other newspaper articles as well as two articles in a journal for popular philosophy confirmed these findings. Moreover, we deemed these findings consistent with our understanding of the field of philosophy of technology and society, which, among other things, is concerned with a historical perspective on technological innovation as well as with technology as being a ‘value laden’ domain.

When we had established the vital characteristics of the macro genre, we could design course materials. In our design we consistently tried to make the training in language production functional in the light of developing knowledge in the domain of philosophy of technology.

Findings during a first proof of the learning trajectory

Phase 1: Building the field

During the first three sessions we worked primarily on the development of subject concepts, such as ‘the socio-technological system’, ‘disciplinary agency of artefacts’ and ‘the moralizing of apparatus’. In an exercise that was particularly valued by students, they had to identify core themes of the course in an exemplary article.

John: Since I had never read a text this way, it was very useful, because I also started this kind of focused reading for subsequent texts.

In the students’ work we saw that they all managed to link relevant overarching concepts and themes, which weren’t always explicitly used in the article, to specific text fragments. After a remark by the lecturer about the usefulness of the new concepts, one of the students however commented that it all sounded very good, and that he would use these sophisticated words because it was expected of him, but that he wasn’t convinced of the relevancy of all this attention to formal language. Reading of the book (Achterhuis, 2001) was experienced as difficult by many of the students, despite two preparatory lectures and various attempts at microscaffolding (Martin & Rose 2007).

In order to learn to express themselves in matters of technology and society in the same manner as philosophers would, students were requested to prepare and execute a structured debate. The idea was that students would use the knowledge they had acquired during the first lectures and their homework to debate more convincingly. A debate was chosen, because in genre pedagogy students are scaffolded to develop skills on a spectrum from informal spoken language to formal written language. A structured debate facilitates the exchange of language somewhere halfway in this spectrum.

Students were pleased with the learning gains of the debate, particularly with regard to the preparatory task whereby they had to write a position paper pro and contra a proposition.

Hans: By thinking in advance about the possible arguments of the other party, you become a better debater.

Only a few students were able to really make use of genre characteristics that had been covered in phase 2. One student started a sentence with the expression “research has shown that”, which is a way of using the authority of institutions for one’s own goals (tenor). Use of philosophical concepts was scarce, even though the lecturer had encouraged students to do so.

Jane: When writing, one can take all the time necessary to think. In a debate one can be well prepared, but one has to say the right things at the right moment. Preparation was necessary though, to be able to debate well.

What was perceived as relatively easy by the lecturer, was to discuss the differences between oral and written language with students. In the videos we see a number of instances where similarities and differences in mode and tenor between the debate and the journal article were discussed. A comparison was made, for instance, between the resources used to express opinions baldly or with moderation. Also the students identified effective ways to compete in a debate by means of exaggeration and humor.

Phase 2 'Deconstruction': Attention to structure of entire text, level of sentences and words.

From the syllabus for students:

In the analysis of the exemplary article, we have seen that in a philosophical essay certain words are used to pinpoint time and that changes in society are described. Causes and effects of these changes are often linked to technological innovation. Words to describe such relations are 'because of', 'hence', 'thus', 'as a result' etc. The article also emphasizes the notion of certain human behavior that is encouraged by technology. In philosophical literature the concept of 'disciplinary agency of artifacts' refers to this idea.

Identify similar textual characteristics in the next article.

Other exercises were meant to practice describing technological innovation in a historical perspective (field), to identify the reader and his motivation to read the target journal (tenor) and to structure a text around arguments and counter arguments (mode).

Phase 3 Joint Construction

This phase, in which the lecturer modeled and wrote a fragment of text in cooperation with the students on the whiteboard, was perceived as relatively difficult. The videos also showed that the approach as described in literature wasn't entirely successful in this case. Collaborative construction of sentences was slow and tedious. The lecturer did not feel that he was able to 'think out loud' while writing in order to model writing strategies. The students, however, remained task oriented throughout, and their evaluation of this phase certainly wasn't predominantly negative.

Phase 4 Independent writing

Students wrote their final text independently with one round of peer feedback, organized during a lecture. Two students remarked that they'd rather co-written the article with another student. All papers were rated by the lecturer and a random sample of three student products was graded also by a colleague who knew the course well. Her grades were approximately the same as the lecturer's. Three students failed to attain the expected standards, whereby one student failed because of severe plagiarism. The best three articles were qualified as being up to the standards of the target journal.

Fragment of a product

The development of the internet has been strongly beneficial to narrowcasting. No longer did marketers have to visit every shop in order to supply them with adverts on video tape. Instead they could now send tailor made videos to retailers via the internet.

Conclusions

Deconstructing exemplary articles was perceived as effective by both the students and the lecturer. An interesting finding was that it proved to be possible to avoid the complexity of Systemic Functional text analyses and its new terminology which could have discouraged technology students (Rose, 2008). It seems reasonable to assess that the exercises were generally perceived as effective by the students as a result of the fundamentals of SFL that had dictated the underlying linguistic analysis. In genre pedagogy, functionality, or 'what is accomplished by means of text', dictates every step along the way from analysis of exemplary texts to delivery of the curriculum.

Students did not only find the course effective because they found that they had gained more insight in philosophy of technology, but also because they thought it had been valuable to learn to write down their ideas in a clear way. The lecturer had repeatedly emphasized the importance of clear speaking and writing for teachers. Possibly this made the students think that the emphasis on language in the course was legitimate, rather than for reasons of content development. In other words: Perhaps the students deemed it necessary to become better at explaining, which made them think that genre pedagogy had been useful. The assumption had been, however, that genre pedagogy would provide an effective intervention with the aim to develop content, e.g. understanding of the function of technology in society and critical reflection on it. The data of this study only provide weak evidence to back up this assumption. In a next round of this ongoing study, we will ask students to make this distinction in their assessment of the effectiveness of the course.

We also asked students whether they would incorporate elements of genre pedagogy in their own teaching. The majority of the students replied that they would from now on incorporate technology and society in their own teaching and that they would do so by means of oral discussions with students. Writing is a rare activity in their lessons, most students said. There is no evidence that our course will change that.

Our literature study in combination with the empirical study indicates that genre pedagogy can provide valuable tools to deliver curriculum in teacher education. The next step will be to proof a new version of the course and to connect it to the teachers' practice with their students in secondary schools. We will also extend the teaching learning cycle to improve students' writing of science practical reports and other genres. We also hope to extend our work to find out what competencies our students need to use genre pedagogy in their own teaching and how we can help them to acquire such competencies.

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