Logic in Undergraduate Writing Education*

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Classical liberal arts education was based in part on the trivium—training in grammar, logic, and rhetoric. Writing pedagogy in contemporary university education includes grammar as well as rhetoric. This paper argues that additional attention to informal logic in undergraduate English courses can have positive effects on students and improve the writing they produce. The paper shares two techniques for first-year English courses designed to improve student writing. A recipe approach to paragraph writing is used in introductory courses. Lab report writing is used in intermediate courses.

Keywords: writing/composition education, logic, college students

1. Introduction

Like many global universities, Nagoya University employs liberal arts and sciences courses for all undergraduate students, which complement the specialized training that students receive in their individual departments and schools. Part of this liberal arts and sciences training is a series of "Academic English" courses. These courses are designed to expand upon the English knowledge that students have acquired prior to joining the university, and to develop skills in writing, reading, and communication that are appropriate to study in a global university.

Classical liberal arts education was based in part on the trivium—a foundation of training in grammar, logic, and rhetoric. While rhetoric is frequently a foundation for training in contemporary universities, and grammar is commonly taught at least to second-language users, there is less agreement about the importance of logic for general undergraduate education. This paper argues that attention to logic, especially to informal logic, is a valuable addition to English education in a global university. It also introduces two techniques for use with basic and intermediate English courses for first-year undergraduate students.

2. Logic and natural language

Attention to logic, in addition to rhetoric and grammar, helps teachers and students keep in mind the functions of language and writing. By "functions of language" I refer primarily to the communicative ends of language use, and secondarily to the role of language use in various cognitive processes. Thinking about logic helps us bear these functions in mind and not let them be overshadowed by the formal aspects of language.

What, then, does *logic* mean in the exhortation to bear logic in mind? Typically when we hear

the word *logic*, we think of something like this.

Taro is a bachelor.
All bachelors are men.
Therefore, Taro is a man.

This is a classical syllogism, in the mode of Aristotle. A syllogism consists of two propositions (here, *Taro is a bachelor* and *All bachelors are men*) that entail a conclusion. If the syllogism is valid and the propositions are true, then we know that the conclusion must be true. If we define *bachelor* to mean "an unmarried adult man" in both propositions, then the conclusion is necessarily entailed by the syllogism.

Tom Gally (2013) of the Center for Global Communication Strategies at Tokyo University argues that logic of this kind is not useful for writing in ordinary language. In mathematics, the terms of an argument can be defined precisely so that they have only one meaning. Certain fields, such as physics or chemistry, can use mathematics to define their arguments so that no one can misunderstand the meaning of the conclusion. But, Gally says, that is not true for ordinary human language.

To see the incompatibility of ordinary human language with classical syllogistic logic, consider the example above beginning with *Taro is a bachelor*. What if *Taro* refers to a certain person who lives in Fukuoka, and who is gay. Taro and his Canadian boyfriend, Stephen, got married last year when they were in Vancouver. These particulars are easily compatible with our ordinary understanding of the name *Taro*. In this case, is the sentence "Taro is a bachelor" true? Taro is an adult. He is a man. But the question of whether he is unmarried is more difficult to deal with. The Canadian government would say that Taro and Stephen are married. In Fukuoka, the city recognizes their relationship as something similar to, but not quite the same as marriage. Since the government of Japan does not legally recognize same-sex weddings performed abroad, they would not recognize Taro and Stephen as a married couple. So, is the premise *Taro is a bachelor* true? We cannot say that this is categorically untrue, but neither can we say that it is true. If we cannot say that the term *Taro is a bachelor* is categorically true, then we cannot use the syllogism above.

Human language is full of sentences that lack a single obvious meaning, like those above. Most words admit multiple meanings through homonymy, polysemy, or other less well-defined sources of ambiguity or vagueness (Brown 2008). In addition, sentences or phrases can demonstrate further structural ambiguity when a single string of words can represent more than one grammatical structure. In a famous example, "Flying planes can be dangerous" (Chomsky 1965) may assert either that the action of *flying* is dangerous or that the machines, *planes*, are dangerous, depending on the syntax underlying the sentence.

If most strings of words cannot be defined precisely, it follows that most sentences in ordinary human language cannot be understood as categorically true or untrue. Since syllogisms depend on two categorical statements that necessarily entail a third statement, ordinary sentences would seem to be incompatible with Aristotelian syllogism. Therefore, as Gally (2013) argues, traditional logic seems incompatible with the complexities of human language. Forms of pedagogy based on such logic would not appear to be useful for helping novice scholars develop into academic writers.

However, it is not necessary to identify *logic* with classical syllogism, nor indeed with only

formal systems of deductive reasoning. In fact, most academic or professional writing employs forms of argument that are not intended to prove a definite truth, but to support a likely conclusion (Romantz 2003, Lunsford and Ruszkiewicz 2004, inter alia). It is not logic as such but formal systems based on categorical truth values that appear to be at odds with the reasoning used in natural language discourses, including academic writing. Not all forms of logic depend on categorical truth.

To improve writing pedagogy, various types of inductive, abductive, or informal logic may be useful. In most academic fields, it is not usually the author's goal to deduce the absolute truth of a conclusion. Rather, the goals of writing tend to be some combination of exploring, explaining, informing, and persuading. While categorical statements and deductive arguments are not useful for many of these goals, some form of argument can be both useful and necessary.

Literature professor Hal McDonald (2006), for example, calls for the use of informal logic in writing education. McDonald suggests an approach to writing pedagogy based on the classical trivium and informed by speech act theory (Austin 1962, Searle 1969). Speech act theory views language as *performative*: utterances do not merely report; they also perform social action. In academic writing, McDonald argues, the actions performed are fundamentally persuasive. A writer must consider what effect a piece of writing is intended to produce in the reader, and then to use the tools of grammar, logic, and rhetoric to achieve these goals. The form of logic that McDonald advocates is not Aristotle's deductive reasoning but "the internal sequence of thought processes that caused a person to act" (to write or to think) as they do (2006, 3). To employ logic in this sense, he instructs readers to think critically about the author's goals that underlie a piece of writing, and then to decide consciously whether or not to agree with the author. In writing, one should begin by determining what effects a piece of writing is intended to produce in readers, and then choose both the logical arguments and the rhetorical appeals that seem most likely to achieve these effects.

McDonald's definition of informal logic as the internal thought processes that affect social goals, and the choice of arguments as well as appeals to achieve social goals, turns out to be quite similar to Gally's (2013) preferred mode, *reasoning*. Gally defines reasoning as socially-situated methods and standards of argumentation. Under this definition, logic is a subset of reasoning. What Hal McDonald calls *logic*, encompassing or at least relating to the choice of rhetorical appeals and not limited to categorical truth, is in practical terms very similar to what Tom Gally calls *reasoning*. The major difference seems to be that Gally begins from socially situated practices, which writers are taught to understand. On the other hand, McDonald begins from the internal thought processes, which writers are taught to relate to a social situation.

Whether logic is taken as a useful adjunct to rhetoric, or both logic and rhetoric are taken as subsets of reasoning more broadly, it seems useful to include attention to logic in writing pedagogy. This logic, however, need not be limited to deductive reasoning. To become an academic writer, it is less important that students have a well-developed theory of logic than that they be made aware of *argument*, meaning patterns of thought that lead to a conclusion.

An argument, put simply, is a pattern of one or more premises that support a conclusion. That definition would include syllogism, in which two categorical premises entail a conclusion. Arguments also include simpler patterns such as the following.

I should proofread my manuscript before I submit it to the journal because I don't want to look unprofessional.

This is an argument. It contains a premise (*I don't want to look unprofessional*) and that premise supports a conclusion (*I should proofread my manuscript before I submit it*).[1] Notice that the reasoning is not categorical, nor is it objective. Proofreading a manuscript does not necessarily entail professional presentation, and my desired self-presentation has no categorical truth value. The conclusion relates to what I should do, rather than a statement about the world. The sentence, however, contains an argument. There is a premise that leads to a conclusion, and the relation between premise and conclusion is essentially clear. Making students aware of the relationship between reasons and conclusions and encouraging them to think about how their reasoning may affect readers can have salutary effects on their writing.

In the next two sections I will illustrate two techniques that I use in first year English courses to encourage students to employ logic or reasoning in their writing assignments. Section three explains a simple recipe used in first-semester basic English courses, modeled on Wai Ling Lai's (2013) "recipe approach" to writing for publication. By breaking the writing process into simpler steps, writers can make writing less daunting while also bearing in mind questions about how ideas are related. Section four describes a lab report assignment used in second-semester intermediate English courses. Neither of these courses teaches logic as such. I do not believe it is necessary for first-year students to have a theory of logic, and certainly not for them to share the same theory of logic that I have. I do, however, want to encourage students to think about writing as the presentation of ideas. I use these techniques to encourage students to bear in mind the functions of language for thought and communication.

3. Recipe approach

The paragraph is the heart of academic writing. Most academic writing is made of paragraphs, so if you cannot write a good paragraph you cannot write a good paper. Moreover, much academic writing resembles paragraph writing to some extent. Just as a good paragraph has a topic sentence, some supporting sentences, and various techniques for emphasizing coherence, an essay, a graduation thesis, or even a monograph has a main idea with support and coherence. Therefore, the basic English courses that I teach to undergraduate students in their first semester focus on writing paragraphs.

In order to help students understand both the structure of paragraph writing and useful writing techniques, the course uses timed writing. Students practice writing for 15 minutes during every class meeting. During this time they are expected to produce a single paragraph. A topic is introduced, and students are instructed to brainstorm ideas related to the topic for two to three minutes. They then plan an outline using ideas from the brainstorming during the next two minutes. For the next eight minutes, students write sentences in English in order to turn the outline into a paragraph. Finally, they read and revise this paragraph for two or three minutes. Of course, most people can't write an elegant paragraph in fifteen minutes, but by writing for a short time during each class students get a lot of practice. In this way, when they later have days or weeks

to write, the process of writing is easier and more familiar.

The most important part of a paragraph, arguably, is the topic sentence. A paragraph may be defined as a set of sentences that together communicate a single main idea. The topic sentence is the general statement of that idea, making it a key to the paragraph. The course therefore starts on the first day with talk about the nature of topic sentences, and practice in writing them. Students are then assigned as homework to write several different topic sentences for the same general topic. In turn, each student uses one of the topic sentences from this homework to begin timed writing during our second class meeting.

One technique that I introduce to first-year undergraduate students is a four-step "recipe" for writing topic sentences that is inspired by work by my colleague, Wai Ling Lai, the director of the Writing Center at Nagoya University. Professor Lai has developed an approach to writing that he calls the "Logical Writing Process Cycle" (e.g. Lai 2013, 2015). LWPC is an approach to research writing that helps researchers step by step to formulate a thesis statement, choose forms of logical argumentation appropriate to support the thesis, and write a paper suitable for publication in scientific or technical journals. The approach makes use of various "recipes" to demystify the writing process and to help graduate students and early-career scientists through the write-up stage of their research. One of these recipes is an eight-step process to develop from a research idea to a specific a thesis statement (Lai 2013). For use with undergraduates, I have simplified the process into four steps.

By using a four-step process, undergraduate students can move from a general idea—often one that comes from a writing assignment or prompt—to a topic sentence. The steps are as follows.

1. Name your topic with a noun or noun phrase.
2. Add a verb and other words to turn the topic into a sentence.
3. Turn the sentence into a *how* or *why* question.
4. Answer that question with one sentence.

Labels such as *noun*, *verb*, and *sentence* are familiar to most Japanese students who have learned English as a foreign language through classroom study. By combining these labels with notions such as *topic* and *question*, the recipe starts students on familiar ground. Moreover, by thinking about *how* or *why* questions, students are primed to develop topic sentences that are amenable to argument, linking conclusions to premises or reasons.

The recipe instructs students to first name the topic with a noun phrase. For some classes, the topic might be given in the assignment. In my class, students read short essays about a different country each week, and then discuss the reading in small groups. Then we practice writing with a topic from the week's reading. Students are able to name something from the reading that interests them using a noun or noun phrase.

Next, writers make a sentence with the topic word or phrase. Writing instruction often instructs students that a topic sentence should have a topic and a focus, or a general idea and a controlling idea, or a theme and a rheme, or other words to that effect. By taking that noun or noun phrase and using it in a sentence, the student writer has to think of some specific idea about the topic. That is, they develop something like a controlling idea, or at least a first approach to one.

Turning the sentence into a how or why question is the heart of the method. By thinking

about questions of *how* or *why*, students naturally have to start connecting reasons to results, arguments to conclusions. A lot of interesting academic writing is focused on how things happen, or why things are as they are. Not all interesting questions are how or why questions, of course; there can be interesting *what*, or *when*, or *who* questions. But I find *how* and *why* especially useful questions for developing topics for writing practice.

Students next answer the question with one sentence. This will often result in a unified sentence with a topic and a controlling idea. Of course, the technique can fail. You can end up with topics that are overly broad, or complicated, or even questions that you can't answer. But often this simple recipe will result in a focused topic sentence. And if it doesn't, you can repeat the process. It's only four steps.

4. Lab reports

An intermediate course taught to first-year students during their second semester builds on the skills of logic and rhetoric, as well as the writing process introduced in the basic course. I use simple experiments and a lab report in my intermediate English class to give students something to write about during the first portion of the course. We spend the first four weeks of class reviewing the process of paragraph writing, as well as introducing a new written form: a lab report.

During these four weeks, students complete four simple experiments during class time, and share their data with one another using an online message board. The experiments are ones developed for use in elementary or junior high schools to teach various scientific concepts. The science is generally well within the grasp of a first-year college student, so that they can understand the content without too much effort. This allows students to think about improving their English while also reviewing the scientific concepts.

Four experiments are carried out during class time. The first, from the Universities Space Research Association (n.d.), involves dropping objects of various sizes into a tray of sand from differing heights to simulate the creation of impact craters, and then measuring the craters made. In the second experiment, from the National Aeronautics and Space Administration (Benson 2014), students make model rockets from balloons and drinking straws in order to see firsthand the role of Newton's third law of motion in rocketry. The following week students simulate coral polyp breeding with an experiment developed by the National Oceanic and Atmospheric Administration's Coral Health and Monitoring Program (2015). Finally, an experiment of my own design uses van Sebille, Fuchs, and Murray's (2018) computer simulation of how plastic moves around in the world's oceans, which in turn is based on their earlier research (van Sebille, England, and Froyland 2012). Details of the classroom experiment are available upon request.

In the fourth week of the intermediate course, students write a lab report describing one of the four experiments. Students are allowed to choose whichever of the four experiments most interests them. The lab report has eight parts.

1. Title
2. Introduction
3. Materials
4. Methods
5. Results
6. Discussion
7. Conclusion
8. References

Academics will probably recognize most of these parts. Introduction, methods, results, and discussion are widely known as IMRaD, a basic structure for papers in the natural sciences. Again, by breaking down the writing process into small steps each step becomes less daunting and easier to approach. Moreover, by doing simple experiments and calling student's attention to how and why the experiments work, I hope that the process encourages them to focus on the logic of the event.

The title should name what was done in no more than about 10 words. The introduction states the objective of the experiment and the student's hypothesis about what would happen. The introduction also briefly summarizes the experiment and states the conclusion. The next section, materials, describes the equipment used, and the methods section describes the procedures followed. In the results section, I tell students just to give the data—the information that they learned from doing the experiment. After that, in the discussion section students need to think about the logical connection between ideas. If their hypothesis was supported, students need to explain *how* the data support the hypothesis; if the hypothesis was rejected, again they need to explain how the data relate to the hypothesis. I also ask students to discuss what they learned by completing the experiment. In the conclusion, students write a one paragraph summary of the earlier sections, including the original hypothesis and whether it was accepted or rejected. Finally, they include a references section. This includes at least the section from their textbook that discusses the scientific principles behind the experiment, as well as any material they may have used either to do the experiment or to write the report. This gives practice making a list of works cited in a relatively low-key context. The lab report is one of four graded assignments, and graded assignments are half of the course grade. (Self-study and standardized test scores are the other half.)

Experiments and writing a lab report takes up the first five weeks of the intermediate course. During the rest of the term students learn more about the writing process and write an essay on a topic of their choice, related to topics discussed in class or in the textbook.

5. Conclusion

Writing a paper in one's second language is indeed difficult. It requires attention not only to the information being communicated but also to grammar and vocabulary. Given the challenge of using appropriate language, it is perhaps unsurprising that second-language writers become focused on linguistic form. In order to succeed in a global university, however, it is necessary for students to think about the connections between ideas. Introducing argument and informal logic in writing courses can help with this challenge.

Simply instructing students to focus on logic rather than grammar, however, will not on its own simplify the writing task. What is needed are some techniques to make the process easier. A step-by-step recipe approach can help by breaking down the writing process into smaller, more approachable steps. Many writers, professional as well as novice, experience a moment known as the blank-page syndrome. Thinking only about a blank piece of paper at the beginning of the writing process and about the report, thesis, or manuscript that must come at the end makes the size of the task so daunting that it appears impossible to approach. Breaking up the command to "write a paper" into smaller steps can make the process easier. The techniques introduced here have proven successful in helping some students focus on the communicative function of writing, and

the logical relationship between information and conclusions.

Note

* This paper is based on a presentation to the Nagoya University Liberal Arts and Sciences Faculty Development series in April 2018. My thanks to attendees of that session for valuable comments and questions.

1 Implicit in this argument is a second premise: *If I do not proofread, I will look unprofessional*.

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