WRITING ABOUT BIOLOGY:
HOW SHOULD WE MARK STUDENTS' ESSAYS?

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Many reports have concluded that today's students are poor writers. Most writing assignments have been mechanical and trivial (see discussion in Applebee 1981; Ordovensky 1991); for example, in most secondary schools and colleges only about 3% of assigned writing tasks require that students write more than one sentence (see discussion in Moore 1992b). Similarly, a recent survey of 95,000 high-school seniors found that 76% of the students could not write a persuasive letter, and 62% wrote unsatisfactory prose (see discussion in Moore 1992b). As European leaders consider requiring all secondary-school students to learn three languages, only 14% of U.S. eleventh-graders can write an adequate analytical piece in English (Sprout 1990). Consequently, U.S. employers must spend millions of dollars teaching their employees to write effectively. Because students know little about basic writing strategies (e.g., eighth-graders spend only 10 to 20 minutes per week learning how to write), we should not be surprised that college students cannot write well, much less use writing as a tool for learning (see discussions in Healy 1992; Landis 1991).

Many colleges and universities have implemented writing-across-the-curriculum (WAC) as a means of improving students' ability to write and learn. There are many considerations for effectively using writing in a science class to enhance learning (see discussion in Moore in press). Among the most influential of these considerations is the feedback given students when we mark the early drafts and, to a lesser extent, grade the final draft of a paper (Jewett 1991; see discussion in Moore 1992b). Indeed, one of the tenets of WAC is that students' writing, thinking, and understanding improve in response to guidance provided by teachers' marks and comments on early drafts of papers. These comments influence how students revise their papers and how they write, think, and learn about science. However, I contend that there is a bigger question that is seldom considered: do our marks and comments help students develop a writing style that will serve them well in their careers?

Most undergraduate science majors do not get jobs in fields closely related to their field of study (e.g., only 27% of biology majors get jobs in fields that are closely related to biology; see discussion in Graham and Cockrel 1990). Thus, our assignments and grading must help students write effectively, not just correctly, and must not merely reflect our biases regarding writing about a particular subject or discipline (see discussion in Moore 1992a). Are our assignments doing this? As scientists, are our sensitivities about writing similar to those of professionals in other fields? To answer these questions, we need to know 1) the errors that students make in their writing, 2) which of these errors are marked by teachers, and 3) the importance of these errors (i.e., how other professionals react to different kinds of errors in students' writings).
How Professors Mark Students' Essays

Connors and Lunsford (1988) studied 3,000 essays written by college students and graded by faculty from across the country. Their results, which are summarized in Table 1, documented 1) errors in writing, and 2) errors in writing that were marked by the instructor. Spelling errors, the most common mistake, are excluded from Table 1.

The most frequently occurring errors in students' writing involve punctuation (e.g., commas: 1, 3, 5, 8, 15, 17; apostrophes: 9, 20), verbs (6, 10, 13, 14), pronouns (2, 11, 16), diction (4), sentence boundaries (12, 18), prepositions (7), and modifiers (19). Five of the ten most frequent errors involve punctuation. Misuse of commas comprises three of the top ten stylistic errors, and half of the comma errors involve clause or sentence boundaries (e.g., lack of comma in a compound sentence or after an introductory element). Sentence or clause boundary errors (e.g., sentence fragments and run-on sentences) accounted for seven of the top 20 (and four of the top 10) stylistic errors. These results indicate that many students do not understand how to write a complete, much less an effective, sentence. Stressing how to write a complete, effective sentence when we grade students' papers will remedy many of the stylistic errors common in students' writing.

When teachers grade students' papers, the frequency of teachers' markings of errors does not correlate with the frequency of the error's occurrence (Table 1). For example, diction errors rank fourth in frequency of occurrence, but first in frequency of marking. Similarly, possessive apostrophe errors rank ninth in frequency of occurrence, but third in frequency of marking. Thus, although errors are common in students' writing, teachers do not always mark them. Moreover, teachers mark some errors more frequently than others. For example, teachers mark 62% of apostrophe errors, but only 29% of dangling modifiers and misplaced modifiers. This difference probably results from the ease of marking the error and the degree of annoyance of the error to the teacher. That is, apos-

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<td>6. Wrong/missing inflected endings 5.9</td>
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* This is a condensation of Table 1 from Connors and Lunsford (1988).
trophe errors are marked more often than are comma splices, incorrect verb tense, and sentence fragments not because these errors are considered to be more serious, but merely because they are easy to mark (Connors and Lunsford 1988). Interestingly, teachers mark only 43% of the most serious errors and only about two-thirds of the most frequently occurring errors in students' papers (Table 1).

**How Biologists Mark Students' Essays**

To determine if biologists mark students' essays differently than do other teachers, I repeated the study of Connors and Lunsford (1988) using papers written by biology students. I collected papers from graduate students enrolled at Wright State University (Dayton, OH) and Baylor University (Waco, TX). Because these papers were written when the students were undergraduates at various colleges and universities throughout the country, I was able to randomly select a group of papers that minimized regional or institutional biases. I did not analyze papers that professors had not marked (these papers accounted for 42% of my 82-paper sample). I evaluated papers subjectively and with the help of Sensible Grammar, Correct Grammar, Grammatik Mac, Doug Clapp's Word Tools, Mac-Proof, and Right Writer, all of which are "grammar checking" and "style checking" programs.

The results of my study are shown in Table 2. Not surprisingly, the frequency of errors reported by Connors and Lunsford (1988) was similar in papers written by students in undergraduate biology classes. Thus, students make the same errors when they write about biology as they do when they write about other subjects. However, biologists who grade students' papers do not mark nearly as many of these errors as did the teachers evaluated by Connors and Lunsford (Table 2). This could reflect 1) an insensitivity to the errors, 2) a belief that marking the errors will not enhance learning, or 3) an inability to identify the error. Whatever the cause, biologists provide students with much less feedback about writing than do the professors included in the study of Connors and Lunsford (1988).

Many of the errors in students' writing can be corrected without burdening students with grammatical explanations or contexts. For example, errors involving spelling and possessive apostrophes can be corrected with simple explanations (e.g., its vs. it's) or a dictionary. Similarly, problems involving vague pronoun-reference and dangling modifiers can be corrected by insisting that students ask "What does this word or phrase refer to

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or describe?" Grammatic explanations are unnecessary to correct problems involving wrong words, wrong or missing prepositions, vague pronoun reference, unnecessary shift in person, and pronoun agreement errors.

Is Our Sensitivity to Errors in Writing Similar to That of the Public?

From Connors and Lunsford's (1988) data and my own in Table 2 I infer that professors grade students' essays in predictable ways: we consistently mark some kinds of errors, and tend to overlook other kinds of errors. However, these data do not reveal the seriousness of errors that faculty mark or ignore. Indeed, the comparatively high percentage of errors that we do not mark does not mean that these errors go unnoticed by others in influential positions.

Are the most frequently occurring errors the most serious errors? Are the most frequently marked errors the most serious errors? To answer these questions, Hairston (1981) sent a list of 65 sentences containing a variety of usage errors to more than 100 professionals, including 63 professionals in fields other than English teaching. These professionals, many of whom occupy influential, high management-positions, were asked to classify the errors in one of the following groups:

- status marking error
- very serious error
- serious error
- moderately serious error
- minor or unimportant error

The responses, which are summarized in Table 3, indicate that professionals recognize and often react strongly to several kinds of errors in writing. For example, professionals respond most strongly to "status marking" errors such as improper use of a verb (e.g., bring/brung; has went/ has gone), use of double negatives, and the use of objective-case pronouns as subjects. All of these errors are syntactic errors, as are those that elicit a "very serious" response: sentence fragments, run-on sentences, failure to capitalize proper nouns, nonparallelism, etc.

(Table 3). Conversely, readers are not bothered by punctuation or semantic errors (e.g., among/between, data/datum, its/it's, unique/very unique).

Scientists can learn much from Hairston's study. For example:

*The sensitivity of professors to errors in writing differs significantly from that of influential people in other professions.

*Writing-errors that we call "superficial" are often important to people having the power to affect others' lives. Although teachers may mistakenly overlook "writing quality" in search of "content," the public does not.

*Rightly or wrongly, the professional public can be offended by apparently "minor" features of writing. If, as all writing instructors and writing books proclaim, writers should write with their audience in mind, we should stress to students not only the importance of avoiding the errors listed in Table 3, but also how to write effectively.

*Ineffective writing creates problems in and out of the classroom. We should inform students of the socioeconomic consequences of poor writing. If students do not understand the stylistic options available to them or the consequences of poor writing, then what they don't know will hurt them. When it comes to writing, ignorance is not bliss.

Noting these findings, Hairston (1981) concluded her study with this:

I was not surprised to have the comments indicate that the qualities in writing that business and professional people value most are clarity and economy. I was surprised, however, at how vehement and specific they were about misspellings, faulty punctuation, and what they un-abashedly call "errors." I think it is important for us and for our students to realize that this fairly representative sample of middle-aged and influential Americans has strongly conservative views about usage. Although there seem to be some signs of change, and on some usage items the public may be ahead of the professions, I
Table 3. *Hairston’s (1981) Classification of Errors in Students’ Writing*

**Status Marking**
- nonstandard verb forms in past or past participle: brung instead of brought; had went instead of had gone
- lack of subject-verb agreement: We was instead of We were; Jones don’t think it’s acceptable instead of Jones doesn’t think it’s acceptable
- double negatives
- objective pronoun as subject: Him and Richard were the last ones to leave the lab.

**Very Serious**
- sentence fragments
- run-on sentences
- noncapitalization of proper nouns
- would of instead of would have
- lack of subject-verb agreement (non-status marking)
- insertion of comma between the verb and its complement
- nonparallelism
- faulty adverb forms: He treats his students bad.
- use of transitive verb set for intransitive sit

**Serious**
- predicative errors: The policy intimidates creativity in the lab.
- dangling modifiers
- I as an objective pronoun
- lack of commas to set off interrupters like however
- lack of commas in a series
- tense switching
- use of a plural modifier with a singular noun: These kind of errors

**Moderately Serious**
- lack of possessive form before a gerund
- lack of commas to set off an appositive
- inappropriate use of quotation marks
- lack of subjunctive mood
- writing That is her across the street
- use of whoever instead of whomever
- use of the construction The situation is...when
- failure to distinguish between among and between
- comma splices

**Minor or Unimportant**
- use of a qualifier before unique: That is the most unique organism
- writing different than instead of different from
- use of a singular verb with data
- use of a colon after a linking verb: Three causes of hypertension are:
- omission of the apostrophe in the contraction it’s
think that we cannot afford to let students leave our classrooms thinking that surface features of discourse do not matter. They do.

To ignore Hairston’s study is to unnecessarily penalize our students by making their writing vulnerable to ridicule and negative reaction by people that the students seek most to impress.

Of What Value Are Our Comments on Students’ Papers?

Professors have traditionally written comments on students’ essays and term papers, assuming that students learn from such comments and that students will apply this knowledge to later writing assignments. Unless students have a chance to revise their papers, such comments have little effect on the quality of subsequent writing assignments. However, if students can revise their papers, students’ revisions in response to teachers’ comments can enhance learning and improve the quality of the students’ writing (see discussion in Doher 1991 and references therein).

Some professors go to great lengths when marking students’ essays. Interestingly, some of this work accomplishes little or nothing (Lees 1979). For example,

• There is no significant difference in the writing quality of students whose teachers mark all mistakes as compared to those whose teachers mark only a few of the mistakes (Arnold 1964).

• Writing an overwhelming number of comments on a paper does not improve a student’s writing (Harris 1978; Lamberg 1980). Few students read their papers start-to-finish when they revise their papers. Rather, they jump from comment to comment, making only the necessary “corrections.” Most students cannot respond effectively to more than about five marks per paper (Shuman 1979).

• Marks on final drafts of a paper have little effect on students’ learning or subsequent writing (Dudenhyer 1976; Beach 1979; Thompson 1981; Harris 1978).

For a more thorough discussion of how to mark students’ essays, see Moore (1992b).

Putting Research Into Practice: How We Should Mark Students’ Essays

The studies of Connors and Lunsford (1988) and Hairston (1981) and the data in Table 2 can help us appreciate 1) errors in students’ writing, 2) our sensitivity to those errors, and 3) the impact of those errors on professionals that students need most to impress. Many of the most serious errors described by Hairston (e.g., “status marking” and “very serious” errors, including use of double negatives, use of direct object as subject, and nonparallelism) do not appear in the Connors-Lunsford “top 20” list of errors. Similarly, many of the errors in the Connors-Lunsford “top 20” list are not viewed by professionals in other disciplines as “status marking” or “very serious.” However, some are. For example, use of the wrong verb form (sit/set) is a “status marking” error, while run-on sentences, sentence fragments, and lack of subject-verb agreement are “very serious” errors.

We can improve students’ writing by concentrating on the errors in Table 3 as we help students revise their papers. To be most effective, our instruction must include explanations of usage, semantic errors (i.e., word choice; e.g., sit/set), and syntactic errors (i.e., relationships between words; e.g., sentence fragments, subject-verb agreement). Connors and Lunsford (1988) and Hairston (1981) suggest that it would be foolish for us to concentrate on strict grammatical contexts such as infinitive phrases and nominative absolutes. Rather, we should concentrate on the writing strategies studied by Hairston (1981) that most affect other professionals’ views of our students’ writing.
Literature Cited


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