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Writing anxiety in computer science students

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Abstract: Effective written communication skills are recognized as essential for computing professions, but are notoriously difficult to impart to our students. One problem in teaching computing students to write may be their attitudes toward writing; anecdotally, computing students are (often justifiably) lacking in confidence about their writing skills, and avoid writing when possible. This paper explores the degree of writing anxiety/apprehension in computing majors through the administration of a standard survey instrument, the Daly and Miller Writing Apprehension Test.

Introduction

The computer education literature documents a longstanding concern about the difficulty of imparting adequate written communication skills to computing majors (see, for example, [Sellars and Lynn, 1985]; [Jackowitz et al, 1990]; and [Taylor and Paine, 1993]). Approaches to upgrading student skills range from incorporating writing assignments into courses at all levels of the computing curriculum, to providing intensive writing experiences within selected "traditional" computing courses such as databases or networks, to collaborative teaching efforts between technical writing and computer science lecturers. The concern that computer science graduates have learned to communicate only with their terminals is also reflected in recent reviews of the computer science and computer engineering curricula, which consistently recommend that writing training and practice be emphasized ([Christianson, 1992]; [CSAB, 190]; [Tucker et al, 1991]).

Given the amount of effort put into teaching writing over the years, and into developing interesting, imaginative, and (hopefully) effective writing assignments and courses, why can't our students write? One possibility, raised by Taylor and Paine (1993), is that the "computing anxiety" commonly encountered in non-science majors may be paralleled by a "writing anxiety" in computer science students. These researchers included several attitudinal questions in a survey administered to fourth year computing majors that measured the students' writing backgrounds. Taylor and Paine report that over half of the students exhibited "tendencies" towards writing anxiety. Unfortunately, their paper does not go into further detail about the survey or its results.

Anecdotal evidence supports their results. Many, if not most, of us have watched significant groups of our students complain bitterly about writing assignments, ask for programming projects to be substituted for writing, refuse to do adequate program documentation, and indeed simply refuse to write at all and accept lower course grades as a consequence.

In this paper we investigate Taylor and Paine's hypothesis that writing anxiety is common in computing students. We measure the attitudes of computing students to writing by administering the Daly and Miller Writing Apprehension Scale [Daly and Miller, 1975], a standard measure in use since 1975, to a group of 80 computer science majors.

The identification of specific forms of writing anxiety can be useful in tailoring instruction for our computing students. Previous studies of other student groups have shown that there is a significant correlation between anxiety about writing and the ability to write (as reflected in course grades), and that this anxiety causes students not only to avoid writing, but to avoid writing instruction as well [Walsh, 1986].

The local situation

We first investigated the writing backgrounds of our students. Many, but not all, of our computing majors have taken English courses in their last two years of high school (New Zealand secondary students can specialize in their final years, and may enrol in additional science courses at the expense of the humanities, or vice versa). We examined a representative set of our majors' "6th Form Certificate" English scores, selected as a broad measure of the attainment level of our students as they enter their first year of university. The 6th form examination are taken in the next to last year of high school (7th form "bursary" scores were not available when we engaged in this study). Scores are given in a range of 1 - 9, with 1 the best.

Our results for incoming students in 1994 are shown in Table 1. Note that the national averages are over *all* students taking the exam, including the majority of high school students who do not go on to university. Clearly our students are better prepared in mathematics than English - a common pattern worldwide, given the perceived closeness between the two disciplines.

6th form test	average (our 1994 incoming)	NZ national average
English	4.28	4.9
Mathematics	3.34	4.49

Table 1. 6th Form Certificate scores

At the tertiary level, New Zealand university degrees typically require three, rather than four, years of study; the American style "general study" courses are absent from the degree requirements, and for "honours" students a fourth year of specialist courses in the major subject is added. In our institution in particular, computer science majors are not required to take a composition class, and relatively few students avail themselves of the opportunity to take the "writing for university purposes" course. Further, an examination of our computer science curriculum revealed that our first three years of CS classes contain a grand total of 9 hours of writing instruction, spread across 21 courses!

In sum, our students come to us with average or weak backgrounds in writing, are not required to take formal writing courses, and are not given writing instruction in computing classes. Students wishing to avoid writing and writing courses can easily do so - both in high school and at university. Given that nearly all of our courses require at least one essay, it is obvious that there is a mismatch between our expectations of our students and the instructional background required for learning to write at a university level.

At this point, we hypothesized that a significant degree of "writing anxiety" would exist in our students, since anxiety is correlated with lack of basic skills and formal preparation for writing tasks ([Daly and Wilson, 1983]; [Walsh, 1986]).

The survey instrument

The Daly and Miller instrument is a 26 question, Likert-scale survey measuring attitudes toward writing [Daly and Miller, 1975]. This standard instrument has been used since 1975, and has been formally validated by a number of researchers (see, for example, Shaver, 1990l Reed et al, 1988). The survey can yield both a raw "apprehension score" as well as finer-grained insights into specific sources of anxiety or comfort in the writing process.

Methodology

Before administering the survey to our students, we made minor adjustments to the wording of several questions to adapt it to New Zealand terminology; for example, substituting "essay" for "composition" (see figure 1). This rewording did not change the intent or focus of the questions involved.

The survey was administered in 1994 to a sampling of 89 computer science majors in their second, third, and fourth years of study. In addition to the survey questions, we also collected demographic data (sex, race, and years at university).

1.	I avoid writing.
2.	I have no fear of my writing being evaluated.
3.	I look forward to writing down my ideas.
4.	I am afraid of writing essays when I know they will be evaluated.
5.	Taking a course with a lot of essays is a very frightening experience.
6.	Handing in an essay makes me feel good.
7.	My mind seems to go blank when I start to work on an essay.
8.	Expressing ideas through writing seems to be a waste of time.
9.	I would enjoy submitting my writing to magazines for evaluation and publication.
10.	I like to write my ideas down.
11.	I feel confident in my ability to express my ideas clearly in writing.
12.	I like to have my friends read what I have written.
13.	I'm nervous about writing.
14.	People seem to enjoy what I write.
15.	I enjoy writing.
16.	I never seem to be able to write down my ideas clearly.
17	Writing is a lot of fun.
18.	I expect to do poorly in classes with a lot of essays even before I enter them.
19.	I like seeing my thoughts on paper.
20.	Discussing my writing with others is an enjoyable experience.
21.	I have a terrible time organising my ideas in an essay assignment.
22.	When I hand in an essay I know I'm going to do poorly.
23.	It's easy for me to write good essays.
24.	I don't think I write as well as most other people.
25.	I don't like my essays to be evaluated.
27.	I'm no good at writing.

Figure 1. The Daly-Miller Survey

Student anxiety scores

Raw anxiety scores can be calculated by labelling each statement in the survey as a "+" if it is a high anxiety statement, and a "-" if it is a low anxiety statement. The "+" and the "-" numerical responses are then separately summed, and these sums are inserted into the following writing apprehension formula [Reed et al, 1988]:

A = 78 + negative_statements - positive_statements

Previous studies have established that scores of 85 or higher indicate high degrees of writing apprehension, while scores of 50 and below indicate low apprehension. Our student score distributions are presented in Figure 2. While 22% of students survey reported low writing anxiety, a similar number - 24% - fell in the high anxiety category. The overall average, 74.53, falls in the moderate apprehension range.

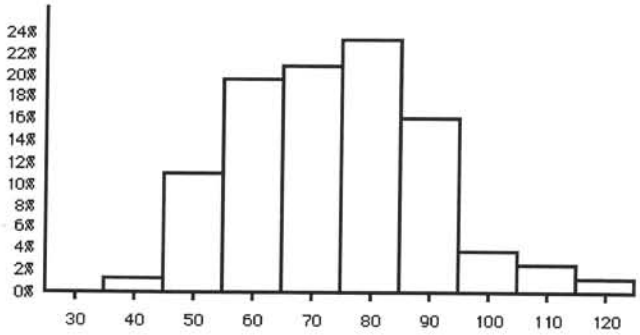


Figure 2. Distribution of anxiety scores

Because of errors in filling out the survey forms, full anxiety scores could be calculated for 81 of the respondents. An analysis by sex reveals no significant difference between male and female anxiety scores ($p < 0.01$, Table 2). Examining the scores by race, we again see no significant difference between the two major groups of students (those of European descent, and the "others" - primarily Asians). There were too few Maori and Pacific Islanders to make a meaningful comparison.

	average	# of students
males	74.6	67
females	73.5	14
all students	74.53	81

	average	# of students
European descent	74.07	57
Pacific Islander or Maori	77.8	5
Other	74.7	19
all students	74.53	81

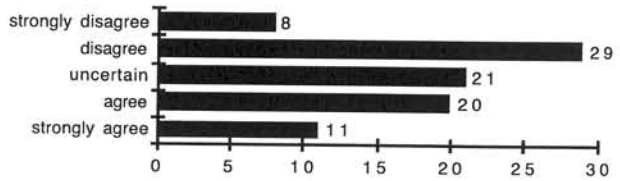
Tables 2a-b. Anxiety scores on the Daly & Miller survey

In conclusion, the survey instrument indicates that writing anxiety exists in a significant minority of our computing majors. This anxiety is evenly spread among our students, and is not associated with race or sex.

Responses to individual questions

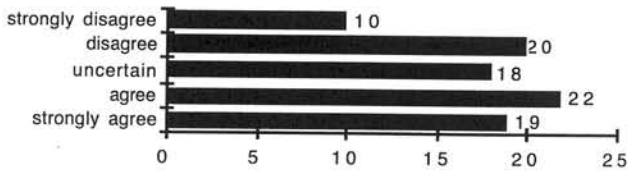
By examining patterns of responses to individual survey questions, we can gain a finer-grained insight into student attitudes towards writing. At this point, we examine several survey questions whose response distributions seemed particularly illuminating or surprising:

1. I avoid writing.



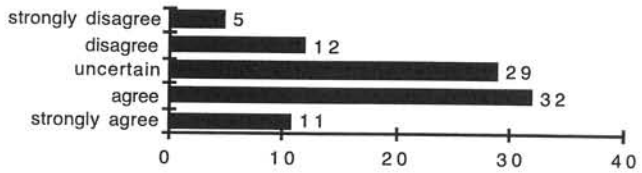
A significant minority of our students - 34.8% - report actively avoiding writing. This response bears out anecdotal reports from lecturers. We have identified one particular mechanism that students with poor writing skills may use to avoid writing: several of our courses require group projects, and these students appear to be relying on others in the group to produce written portions of the project.

5. Taking a course with a lot of essays is a very frightening experience.



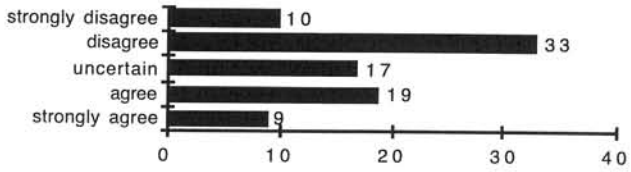
46% of the respondents agree with this statement, while 33.7% disagree - confirming lecturer reports that courses with a large number of writing assignments are perceived as stressful by students. Clearly this type of response should be taken into account when designing courses with a significant writing component, perhaps by offering writing tutorial support or leading students through a series of drafts (rather than placing the entire course emphasis on a few finished products).

11. I feel confident in my ability to express my ideas clearly in writing.



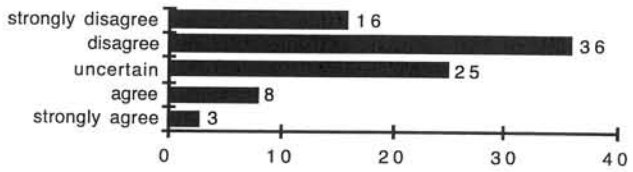
Surprisingly – at least to the computing lecturers! – 48% of the respondents agreed with this statement. Anecdotal evidence suggests that some students may be unaware of their writing problems, as lecturers report difficulty in convincing some students that their work is disorganized or ungrammatical. Note also that this question examines writing confidence in the absence of evaluation; questions 18 and 22 explore student expectations of graded assignments.

18. I expect to do poorly in classes with a lot of essays even before I enter them.



While nearly half (48.3%) of the respondents did not report expectations of failure in classes involving writing, a significant minority (31.5%) felt that they would not do well in those courses. The key here appears to be the phrase "a lot of essays"; significantly fewer students (12.4%) felt that they would get a low grade when asked about a single writing assignment (see question 22 below).

22. When I hand in an essay I know I'm going to do poorly.



The comparison of this response with that of question 18 supports the hypothesis that the *amount* of writing that is evaluated is an important factor in writing anxiety among our students.

Conclusions

Previous studies have shown that writing anxiety is a significant variable in predicting writing ability, and that surveys such as the Daly and Miller instruments have been found to be useful for measuring strong negative reactions to writing [Walsh, 1986]. By identifying anxious students, we can tailor instruction to alleviate their anxiety when incorporating written assignments into computer science courses. For example, there is abundant evidence that anxiety is intensified in formal, marked writing, with the corollary that this anxiety can be substantially reduced by substituting peer review for a teacher's evaluation in some portion of the assignments. Providing small group tutorials is also helpful when introducing instruction and practise to bolster writing skills [Aikman, 1985].

In administering the survey to a sampling of our computer science majors, we found that a significant minority of our students (24%) experience high degrees of writing anxiety, and the average score is in the moderate apprehension range. This anxiety is not confined to racial or gender subgroups of our students. Clearly a problem exists, to as significant a degree as the much studied "computer anxiety" that plagues students in non-science majors.

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