AC 2011-2150: PREPARING UNDERGRADUATES FOR SCHOLARSHIP: SMALL STEPS YOU CAN TAKE IN YOUR CLASSES

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Preparing Undergraduates for Scholarship:
Small Steps You Can Take in Your Classes

Abstract

New faculty members may be overloaded and stressed trying to meet expectations for teaching and scholarship and looking for ways to make their workload more manageable. One resource for scholarship is undergraduates, however some may have little experience in scholarship but would enjoy working with a faculty member on research and publications. There are small steps that new faculty can take in their classes that will help students be better prepared for scholarship. For example, conversion of a class project report from a generic format to a journal paper format introduces students to a logical and structured way of presenting information coupled with a process of multiple revisions. Results of using such an approach in a third year technical class are presented. The students' efforts resulted in a professional-looking paper and a sense of pride in the final product.

Introduction

New faculty members are often expected to produce scholarly publications in addition to teaching. Typically, a faculty member spends most of their time teaching and the remaining time on research and service/committee work. However, colleges expect more and more time to be spent on scholarship, creating an overload. To survive, it is helpful to find synergy between teaching and research. Faculty who teach in a program with no graduate students may depend upon undergraduates as part of their research and scholarship efforts. Finding ways to prepare undergraduates to do scholarship as part of normal teaching will help students have successful undergraduate research experiences. It will also help faculty find it easier to communicate those results through scholarly publications co-authored with students.

What is Scholarship?

Scholarship consists of two parts:

1) doing something interesting and new, and
2) telling people about it

New faculty have expertise in their field and ideas for new research to pursue. Students also have ideas for research. The focus of this paper is on part two, helping students tell people about what

they have done, in particular, communicating what they have done in writing.

The Small Step

One small step that can be taken towards better preparing undergraduates, is to have students submit their project reports in two-column journal paper format, e.g. IEEE format. This introduces students a logical and structured way of presenting information coupled with a process of multiple revisions.

Realistic Expectations

While this idea is by no means new, it is useful. However, the expectations must be realistic. The goal is not to produce a conference paper publication. The goal is to get practice writing in a format and style similar to a conference paper publication, so that should they later produce interesting research, the process of writing a conference paper will be easier.

Application to an Existing Class Project

As an illustration of the approach, the technique was used in a 3rd year class in mathematics and transform methods for engineers. The course covered Laplace and Z-transforms, Fourier series, digital filters, differential equations, discrete time systems. The class size was 30 students, divided into 7 groups. Each group had a project where students used Matlab to analyze the frequency spectrum of a corrupted audio file. They then designed a digital filter and demonstrated its effectiveness in improving intelligibility of the file. In the past, each group submitted a project report with no special format at the end of the course. In the new approach, students were required to submit their report in IEEE two-column journal paper format. The report had to be submitted two weeks before the final due date. They could submit as many drafts as they wanted, each draft being returned quickly with feedback from the instructor.

With the new approach, the main goals for the students were:
1. Introduce students to the look and feel of a journal article.
2. Have students experience rewriting, not just writing.
3. Provide students a take-away item that they can use to sell themselves at job interviews.

The third goal, of providing students a take-away item that they can use to sell themselves at job interviews, is particularly important because:
- It adds to their lifelong portfolio, increases hire-ability and potentially salary
- It helps students recognize their own motivations for doing high quality work.

Implementation of Goals – How

Goal number one was to introduce students to the look and feel of a journal article. This was done by providing a Word Template in the two column journal paper format. Students learned what each standard section of a paper addresses.

Students got accustomed to working with
- Two columns
- Figure labels
- The look, feel, and density of journal paper

Goal number two was to have students experience rewriting, not just writing. This was done by having students submit a draft two weeks before the deadline. Feedback was given right away and students could submit draft after draft and get feedback each time, right up until the final draft. Multiple drafts were highly encouraged. That rationale is that any comments or corrections that are suggested after the final submission aren't going to get made by the student. They probably would not get read by the student. They were not likely to make any difference in the students learning or the final product.

All the learning is in the draft <u>rewriting</u>

"There is no such thing as good writing. There is only good rewriting."
– Harry Shaw, in *Errors in English and Ways to Correct Them*

Writing is rewriting!

Goal number three was to provide students a take-away item that they can use to sell themselves at job interviews. The journal paper was their <u>take-away item</u>. No extra effort was required.

Consider this interview dialogue:

Co-op Employer : "What skills do you have?"
Student : "Well, I can design analog and digital filters.
Here's a copy of a paper I wrote where I
used spectral analysis to ….."
Co-op Employer: *(looking over easy-to-read paper)*
"Impressive! When can you start?"

Goal number three has a second purpose. When the students realize they are producing a report not for a class but to help them get a job, they start to recognize their own motivation for doing high quality work. To help the students make the connection, the instructor should talk to them about the value of having tangible items to document what they've done when they are talking to anyone. The paper they produce can go into their portfolio. They can also put the filtered and un-filtered audio files on an MP3 player to show interviewer how effective the filter they designed was. These discussions help the students get internally motivated to do a good job and put the time in, <u>not just for a grade, but for themselves.</u>

Does it work?

A survey of the students (N=25) was conducted to assess the impact of the new journal paper format approach. The questions and responses are shown below:

Goal 1: Introduce Journal Paper Format

True or False: This was the first time that you either read (or wrote) a paper in two-column journal paper format.
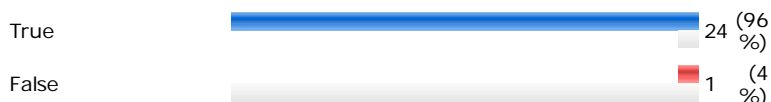
True	17	(68 %)
False	8	(32 %)

Number of Responses: 25

Figure 1 Survey response - introducing journal paper format.

For two-thirds of the students, the project was their first exposure to two-column journal paper format.

True or False:

Concepts 333 was the first time you wrote a paper in journal format (e.g. two column, IEEE).

True	24	(96 %)
False	1	(4 %)

Number of Responses: 25

Figure 2 Survey response - introducing two column format.

Goal 2: Experience Rewriting

- One group submitted 4 drafts in one week!
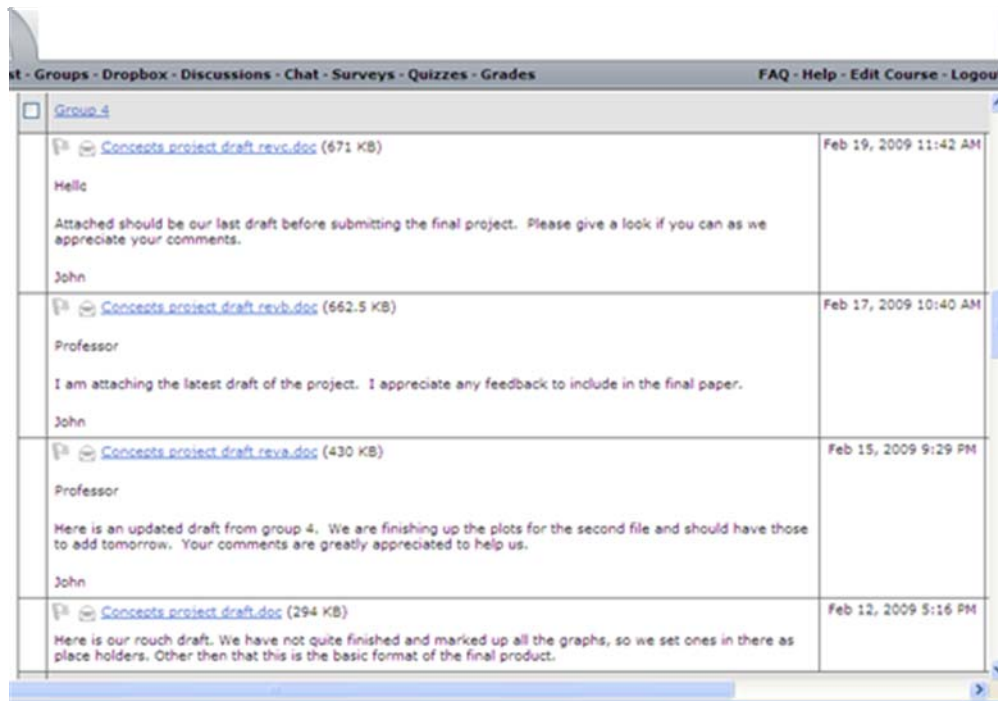- Others submitted 2-3 drafts, plus office visits.

Figure 3 Example of number of rewrites.

Student Comments

"It was great to be able to submit the paper for feedback."

"Your comments are greatly appreciated to help us. "

"more review submissions"

Goal 2: Experience Rewriting

By putting my project report in journal paper format, I had to pay more attention to the quality of writing, quality of explanation, and quality of figures than I would have for a typical term paper project report.

True 16 (64%)

False 9 (36%)

Number of Responses: 25

Figure 4 Survey response - increased attention to quality.

64% of the students paid more attention to the quality of their work!

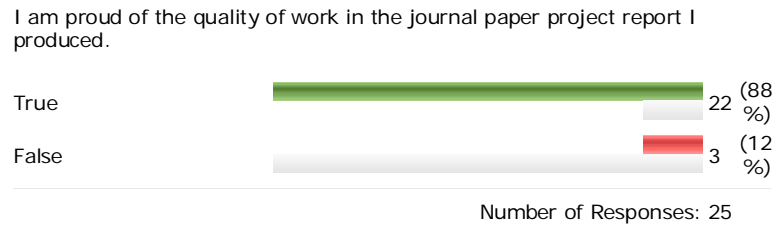Goal 3: Have a take-away item that is useful and they are proud of

I am proud of the quality of work in the journal paper project report I produced.

True	████████████████████	22 (88%)
False	██	3 (12%)

Number of Responses: 25

Figure 5 Survey response - pride in work.

Implementation Tips

New faculty wishing to use this approach may want to consider creating their own short list of guidelines for what you want in each section of the paper (abstract, methodology, etc.) Such a guideline can help fill the gap for students who have little or no idea of what is expected. The detail in the guidelines can be adjusted based on what level the class is (junior, senior).

Below is an example guideline created for writing the abstract.

Example: Guidance on Writing the Abstract

- The abstract is all that the world will ever see of your paper.
    - It is the only part for which a search database does not require payment. *(so make it good)*
- Four sentences
    - Establish the Context for the problem
    - Specify What problem is being solved.
    - How it is solved
    - Why or How well

Faculty may also want to require student groups to use a monitored discussion board for discussions on the project (scheduling meetings, task assignments, exchanging fragments of documents, sample code, working files.) The discussion provides an way to track contribution, daily progress and see when students are off-course. It gives the instructor information needed to nudge an individual when nudging is required.

Figure 6 Example of relation between number of discussion messages and success of teams for the test class.

Revision is an essential part of the process.

- Plan for and provide fast overnight feedback on the drafts.
- Schedule time for this in the week before the due date, to prevent faculty overload.
- Be brief and fix only a few things in each draft, not everything. Students will also fix what they find when they re-read it.
- Avoid giving feedback 30 minutes before the final deadline. It will be too late.
- Avoid rewriting student's documents even if they are nonsensical jargon gibberish. Give a little feedback, edit one sentence, and trust that it will improve in the next draft.

The goal of the revision process is to get students hooked on rewriting.

It is recommend using only the carrot when providing feedback. The stick of grades is always there, but the goals is to have students find their own motivation for this project. That is what will propel them beyond college. As an instructor, just try to help them find it. Don't look for 100% of students to find the motivation this time, this class. There's time for that.

Carrot Instructor: *"I'm really glad to see groups are turning in a second draft, I'll get you the comments by tomorrow morning and then send me your next draft right away"*
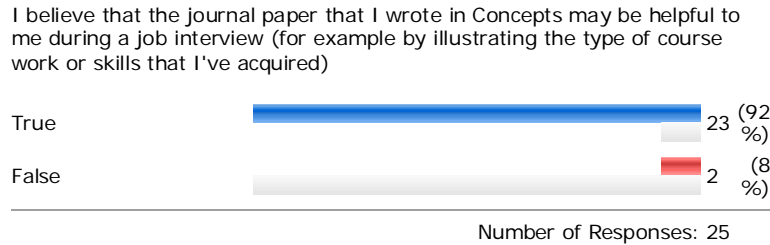
Results: Self Motivation

One student who met with the instructor after the course was finished and grades were submitted who wanted to make their paper even better.

Student 1: *"…polishing it up would be a good idea. Should I set up a meeting with you about the corrections during your office hours?"*

Student 2: *"Attached is the final project for Group 4. Thank you for your constructive comments. I know I speak for the group when I say that the project really helped to tie many of the various concepts we learned this quarter together into a real-world practical application that illustrates them nicely."*

The survey results also show that the proposed approach was effective in helping students recognize their own motivations for doing good work.

I believe that the journal paper that I wrote in Concepts may be helpful to me during a job interview (for example by illustrating the type of course work or skills that I've acquired)

True	23 (92 %)
False	2 (8 %)

Number of Responses: 25

The new approach, focusing on a take-away product of a journal paper, helped students get the tangible connection between their work today and their future success.

Closing Comments

This paper presents small steps, small goals, towards preparing undergraduates to write scholarly publications. Of course it is only a small piece of the broader scholarship picture, but I recommend that you don't try and cover everything, just work on one little piece – how to communicate in a scholarly way. Other pieces, e.g. doing the something cool, can be brought in through other courses, research experiences, etc.

The students benefit from going through a process of multiple revisions. To manage your workload, only make a few small suggestions in each cycle. Four comments or corrections are enough to get the students to look at the paper again. When they do, they'll see other things they want to fix and will start to learn the rewriting process. In the end, the students' efforts result in a professional-looking paper and a sense of pride in the final product.

References

1. Bransford, J. (2000). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academy Press.