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LaTeX at a liberal arts college

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Abstract

Does LaTeX have a place in a liberal arts education? Yes, and in this article I present my reasons for introducing LaTeX in an undergraduate liberal arts setting. I also present how I introduced LaTeX, issues that were encountered, and what students and faculty think the impact has been.

1 Background

The College of Wooster is a small liberal arts college located in northeastern Ohio. Wooster's annual enrollment is around 1800 students and the Mathematics and Computer Science Department typically has 25–30 majors per year. One of the distinguishing features about Wooster is its Independent Study (IS) program founded by its seventh president Howard Lowry. The independent study program requires every senior to complete a year long independent research project. A typical faculty member will advise 3–4 such projects. One of the challenges I encountered in my first advising experience was getting students to write technical mathematics. This is what lead me to introduce LaTeX at Wooster.

The majority of seniors use Microsoft Word. This probably comes as no surprise to most of the readers. In fact, for the vast majority of seniors, Word is the appropriate tool. However, Word is not the best tool for everyone. Students writing in foreign languages that requires special fonts and the ability to have text go from right to left could benefit from using LaTeX in conjunction with XeTeX. Students in music might find MusiXTeX to be a better environment for preparing their theses. However, I think the science majors have the most to be gained from switching to LaTeX. Science majors typically have a large number of equations, figures, and tables. Having used LaTeX for my dissertation, I knew that it could do a much better job of formatting the theses of the science majors. I decided to introduce LaTeX into my department first and then to expand into other departments. In this article I would like to outline my approach, some of the issues that I encountered, and student reaction.

2 Why LaTeX?

As a student at Wooster I had struggled with Word version 5.5 on the Mac to produce a passable document. Some of you may remember that the earlier versions of Word were not too different from TeX. One would type in a command sequence to get a sum, product, or other symbols. It may even be the case that some of these command sequences survived into the present day, but people have long forgotten their existence.

When I returned to teach at Wooster I was shocked by the poor quality of the Independent Study theses. Current students were not able to produce a document that looked anywhere near the quality of my thesis from nine years earlier, and this was with more advanced versions of Word. I found that the students spent weeks trying to format their theses to make sure that section numbering, equation numbering, and figure numbering were correct (and most did not succeed). Almost none of the students knew how to have an automatic Table of Contents, Figures, etc. created by Word. It was at this point that I asked myself whether LaTeX could make the process of writing a thesis more about the writing and less about the formatting. Why LaTeX? Because I felt like it was strong in all of the areas with which students were having trouble. LaTeX would handle the numbering, formatting, front matter and back matter and the students could just worry about the content.

However, there is a down side which Neuwirth touches on in Neuwirth [1991]; none of the students know LaTeX. This means that someone has to be willing to teach them and answer their questions. However, this situation is different than that addressed by Neuwirth. Neuwirth was discussing the place of TeX in what would be considered middle school and high school in the United States. And I agree that those students don't need the full power of TeX, but I'm not sure that they couldn't benefit from an introduction to LaTeX. One of the questions that my experiences have raised is, "Where do our students learn how to use Word or other document preparation software?" I have been unable to find anyone that knows the answer to this question. Some of my colleagues assumed that our Writing Center was helping students learn how to write technical documents, but in talking to the Writing Center staff I found this was not the case. What we have found is that most of our math and science students begin college or university study with no idea of how to use Word or other tools to write a technical paper. However, they are expected to be able to produce a technical paper when they get to graduate school. With this being the case, then it is incumbent on us to teach them, and so that is what I decided to do with the students at Wooster. There is no release time or other compensation for this; I do it because I love doing it.

3 The Process

So how did I go about getting LaTeX into our program? The first step was to identify exactly what I wanted to accomplish. As mentioned above, I really want the students to let LaTeX handle all of the formatting. What does that mean? I decided it means that I don't want students to have to load packages, learn the intricacies of incorporating graphics, or have to try to force LaTeX to do something that Word can do. What this really means is that I needed to construct a Wooster thesis class. (I leave the explanation of the difference between a class and package to a more knowledgeable TeXpert.)

Before trying to construct a thesis class for Wooster, I examined a number of classes available at other institutions. During this process I discovered two things: none of the classes did exactly what I wanted and almost all of them were modifications of the standard book or article class. After realizing this, I decided to

try to modify the book class myself using a couple of other thesis classes[1] as models. To meet the stated goal above, my class has to load all of the packages I think students will need or provide a class option which will load certain packages. At first I was only loading a few packages, but as students have used the class I have added more packages and options. I think the current mix[2] serves my students very well, and I don't envision them needing any more packages. This process was not easy and I wish I knew and had known more about writing a class file. I would recommend that a beginner or intermediate user find a TEXpert to help them write or modify a class file. Doing so will save a lot of hair pulling and time spent in trial and error.

At this point I sought input from my colleagues, the Registrar, the Secretary of the College, and the Vice President for College Relations and Marketing to make sure that the format and images used were acceptable. Others might not need to include so many people, but since IS is such a major component of our curriculum, I needed to make sure everyone liked the design. I was told to change a few things and resubmit, at which point my design was approved. Others will probably find that they will have a similar experience. Now it was time to involve the students.

3.1 Editors, platforms, and documentation, oh my!

There are a few things that I had to do before I could start showing students how to use LATEX and my class file. The first is dealing with the platform issue. I am very committed to allowing users to choose the operating system they are comfortable with using. I have almost 20 years of experience on the Mac OS and as such I know almost all the TEX editors available. On the other hand, I don't know much about Linux and have only seven or so years of experience with Windows. So my first task was to identify software packages for each of the three major OS variants. If you find that you need to do this keep in mind that the school will probably not want to buy software, so you need to find free or low-cost shareware solutions. After some research I settled on the following: TeXShop/GWTEX for OS X, TeXnicCenter/MikTEX for Windows XP, and Kile/teTEX for GNU/Linux. Why these packages? I chose these packages because they all provide panels or menus

[1] I used the kthesis and osuthesis classes as models.

[2] My class loads ifpdf, amsthm, amssymb, amsmath, setspace, graphicx, eso-pic, natbib, float, caption, subfig, hyperref, and color and has options for pxfonts, floatflt, and listings.

for common LaTeX tasks, are free, and are as close to the point-and-click Word model as I could find. They also do not require nearly as much technical ability to install and use as something like Emacs. Remember a number of the students may not be technically savvy, so the more like Word the better. Emacs is great and would have made for a more uniform environment, but I was afraid the level of technical ability required to install and use Emacs would scare away the weaker students (the ones I most want to use LaTeX).

Once I settled on software packages I am comfortable supporting, it was time to document the thesis class and introduce LaTeX. I chose to document LaTeX and the thesis class by using the thesis class to write the documentation. In this way I am able to give students a zip archive containing all the files needed to produce the documentation. In addition the students can use the archive as a template for creating their theses; they just need to make a copy of the folder they get when they unzip the download and start putting their content into the files. This has worked very well as they can see the code that I used to achieve something and copy and paste or alter it to their needs.

My documentation[3] covers very basic things like starting new chapters and sections, creating lists, making things bold or italics, including graphics, inputting mathematics, and inputting computer code and does not cover installation of a TeX system or the software (that is left to the authors of the software). It is really a summary of things found in Kopka and Daly [2003], Mittelbach et al. [2004] and Flynn [2003], except for the Typesetting Mathematical Formulae chapter which comes from Oetiker et al. [2003]. The intent is for students to teach themselves how to use the few LaTeX commands that they need and to come to me if they have difficulty. Choosing editors with panels or menus for LaTeX input makes this possible. This is a much different approach than used by Gray and Costanza [2003] and Childs [1989] where there is an actual course where students learn TeX or LaTeX. Students have done reasonably well under my setup, but a course where some introductory LaTeX could be covered would be desirable. My department is considering trying to move technical writing issues into the proofs/introduction to higher level mathematics course, but it is hard to cut content in favor of this new material.

[3] http://jbreitenbuch.wooster.edu/pdf/latex/IS_guide.pdf

3.2 Involving others

In writing the class file I tried to make it as general as possible to allow other departments to use it. After a year of use in the Math and CS department, I introduced the class file and LaTeX to the physics students. The students picked up LaTeX very easily and liked the results. They particularly liked the fact that I had set everything up to use pdfTeX and produce a "live" document. However, some of the physics faculty did not like the design of the output and so they have modified the class to produce a different-looking document. Others trying to introduce LaTeX may find this as well. Make sure everyone knows you are not responsible for modifying the class file or troubleshooting others' changes; otherwise you will find yourself maintaining ten slightly different versions of the same class.

After introducing LaTeX to the physics students, I approached Chemistry and Biology. My plan was to move through the sciences and then approach Music, Classical Studies, Chinese, and Arabic. I discovered that neither the Chemistry nor the Biology department were interested in introducing this to their students, their main concern being that no one in their departments was familiar with LaTeX. I met with the same response from Classical Studies, but in this case no one had even heard of LaTeX. This is a real issue when trying to introduce LaTeX. In retrospect, I should have identified a few individuals in each department to learn LaTeX from me. Those people would then act as point people for their students and would use me as backup. A faculty workshop designed around the material of Gray and Costanza [2003] might be a way to accomplish this.

So, as it stands now, Math and CS and Physics are the only departments using LaTeX, which is not surprising when one browses through the various mailing lists and samples peoples' fields-of-study. Involving people from other departments from the start might have made a difference. I would suggest that if others try this that they develop a clear plan for implementation and have a timeline to measure progress.

4 Assessment

So how did I do? That's hard to say because I didn't have a formal assessment plan in place. My assessment has been in the form of an informal Pizza Party after all the seniors have completed their theses, and two questions on the departmental IS

evaluation form. This is not what I would recommend for others. Unfortunately, I am beyond the stage for assessing the success of the introduction, and have lost that chance. What I am doing is developing materials to assess the process of learning LaTeX so that I can improve that process and make it easier for students.

There are a few things that I can communicate in an anecdotal manner. In general the students have felt that this model is working well. The first group of students suggested introducing LaTeX earlier in the curriculum. I took that recommendation and created a homework package and template file and encourage sophomores to use it and require juniors to do one assignment in LaTeX. I have also started requiring all homework submissions to be typed in sophomore-level classes and above. Students also suggested the need for various capabilities for placing images and styling chapter headings. I incorporated the packages necessary to accomplish this in the class file. The result has been that no one had any suggestions at this year's pizza party.

The students also felt like they did focus more on the writing, but there are some formatting issues that really bother them. Image placement is a big source of frustration. The students are used to dragging an image into the document exactly where they want it and having it stay. It takes them some time to get used to letting the images float and to use references to refer the their images. The other frustration is learning commands. It takes them a few weeks to really get the hang of things. However all of them said these minor issues are more than compensated for by the auto-generation features of LaTeX, and they are glad they took the time to learn LaTeX.

Has this process improved the writing? This is difficult to answer. The questions I used to measure this on the IS evaluation are:

- Based on your discussions with this IS student, the bibliography, and the final written document, which statement best describes the student's assimilation of the material?

  1. The student assimilated material from a wide variety of sources.
  2. The student used material from multiple sources and did some assimilation of that material.
  3. The student used material from multiple sources.
  4. The student primarily used material from one source, but did use some material from at least one other source.

5. The student used one primary source from which all material is taken.

- Based on the final written document, which statement best describes this IS?

1. The IS is written in a clear and well-organized manner, with excellent grammar, spelling, and typesetting. Moreover, it is written in the student's unique style and directed toward an audience of peers.
2. The IS is very readable, with very few errors in spelling, grammar, or typesetting. The thesis is well-organized.
3. The IS is readable, despite some errors in spelling, grammar, or typesetting. The thesis is well-organized.
4. A number of errors in spelling, grammar, or typesetting make this IS somewhat difficult to read. A better organization of ideas would have made it more clear.
5. The IS lacks organization, the grammar is poor, and it is difficult to read.

I chose these questions because my goal is to make the IS experience more about the writing and less about the formatting. If I am succeeding then students using LaTeX should assimilate more and produce a better written document. Of course I cannot set up a control group and conduct a true study to control for all the confounding factors, but anecdotally I can say that, in general, students using LaTeX have scored better on these questions than those who have not. My colleagues also agree that in their judgement LaTeX has increased the overall quality of the IS produced by the students.

So I would say that my attempt has accomplished my goal. For anyone planning on doing something similar, an assessment plan for all phases is a must. I say this because more and more accreditation bodies want to see evidence showing the success or failure to meet stated goals. Also, I do not think that you have to have a senior thesis to try this. Programs with writing across the curriculum could also see an improvement in student performance, and might have an easier time of assessing LaTeX's impact.

5 The Future

So now what do I do? There are a few things I hope to do in the next few years. One is to expand the use of LaTeX into is the foreign languages. The introduction of XeTeX and OS X makes it extremely easy to typeset in foreign languages. I think that students studying Eastern languages would find great benefits to using the XeTeX system, and I hope to be able to talk to the faculty in those disciplines in the near future. Another goal is to increase the use of LaTeX in lower level courses, which will require training my colleagues in the use of LaTeX and will allow students to learn LaTeX at a much slower pace.

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