New Orleans JAZZED about Engineering Education

Paper ID #15886

Developing Personal and Community Graduate Student Growth through the Implementation of a LaTeX Workshop

Nadra Guizani, Purdue Univeristy

Currently pursuing a PhD in Computer Engineering with an emphasis on data management with respect to access control. Other research interests include teaching research practices with regards to the electrical and computer engineering field.

Mr. Hector Enrique Rodriguez-Simmonds, Purdue Engineering Education

Raised in South Florida, born in Mexico. Half Colombian and half Mexican; proud Mexilombian. Héctor has an MS in Electrical and Computer Engineering and is currently pursuing a PhD in Engineering Education, both from Purdue University. His research interests are investigating LGBTQIA+ engineering student perception's of the culture of engineering. He's an avid videographer, eater of tasty food, moped enthusiast, and user/tweaker of computers.

Developing Personal and Community Graduate Student Growth through the Implementation of a LaTeX Workshop

Nadra M Guizani and Héctor E. Rodríguez-Simmonds

Abstract

In this paper, we will discuss the development of a LaTeX workshop and how this innovative academic outreach experience has contributed to our success and growth as graduate students. Through this workshop, we developed a community of LaTeX practitioners in our university. LaTeX is a typesetting tool that is widely used to write research papers, theses, and dissertations.

In our home department of Electrical and Computer Engineering (ECE), we've often experienced a student climate that is less than helpful and borderline dismissive of new learners acquiring concepts and tools that are indirectly related to classes. Specifically, our perception of the ECE environment is that it views LaTeX as a tool that should have been learned implicitly throughout our education. Through the creation of our workshop, we sought to counter this dismissive climate and bring implicit concepts to the forefront, aiding in the creation of a more unified graduate student body. During our workshop, we emphasized an exploratory methodology to learn LaTeX, modeling behaviors of openness and vulnerability that we want to encourage in our community.

We went through two cycles of our workshop creation process. After the first iteration, participant feedback showed that we omitted important information for new users, effectively isolating them from using LaTeX. In the creation of the second iteration, a more structured and explicit organizational strategy was adopted, incorporating the feedback we received to address the issues we faced in the first workshop. Teaming with the graduate school at our university obliged us to consider the workshop more seriously, professionally, and to be more critical of our approach. This additional accountability and the need to structure our time increased our ownership of the workshop while contributing to our professional graduate student development.

The two authors of this paper have differing instructional approaches. During the creation of the workshop, many obstacles regarding how to deliver the instructional material in the most effective way were encountered. However, our differences in teaching styles complemented each other, resulting in a more reflective practice, aware of participant needs, balanced by the need to cover all the necessary technical content. Our yin and yang approach helps both authors enhance their experience, culminating in an effective community building LaTeX workshop. Having a student led seminar creates a more open relationship between graduate students, making a better environment for research and creation.

Introduction

LaTeX is a document preparation system that is widely used to write research papers, theses, and dissertations. LaTeX is especially suited to create technical and scientific documents[1]. Héctor and Nadra, the authors of this paper, needed to write masters theses and journal publications using LaTeX. Both of us had no experience using LaTeX, putting us in the tough position of learning LaTeX in a very short amount of time. At the time, we were both students of the Electrical and Computer Engineering (ECE) department. We perceived the ECE climate as one in which LaTeX was viewed as a tool that should have been learned implicitly throughout our prior education. In our home department of ECE, we've often experienced a student climate that is less than helpful and borders on dismissive of new learners acquiring concepts and tools that are indirectly related to classes, such as LaTeX.

Many professors and students recommend the use of LaTeX. However, there is no mention of how to go about learning or acquiring knowledge of the tool. We feel there is an expectation that one be knowledgeable about LaTeX. When probed about how to learn the tool, fellow ECE graduate students would give the impression that learning the tool is a simple task, but didn't offer words of encouragement. No one discusses their learning journey: how they solved their problem, how they developed their LaTeX solution, how they failed, or how they learned from failure. In our case, because we were in similar time-intensive predicaments to succeed in learning and using LaTeX, we collaborated intensively: bouncing ideas off of each other, attacking errors, and debugging code cooperatively. Our shared experience spurred the idea to lead a LaTeX workshop. The notion of using a power sharing pedagogy as influenced by Problem Based Learning, Liberative Pedagogies, and Communities of Practice was intuitively adopted.

We wanted to create a workshop that would be inclusive and accessible to a breadth of students, especially those outside of ECE. Our thought process was to create a shared learning community workshop that emphasized an exploratory mindset to learn LaTeX by modeling behaviors of openness, transparency, and vulnerability. This exemplifies the habits that we want to encourage in our ECE community and the greater graduate student community.

Motivation

We were motivated to create the workshop when we each realized we were not alone. Having a peer going through a similar struggle to learn new software by themselves motivated each of us separately. We each benefited from the other's learning process, sharing ideas, tips, frustrations, and learning resources. Furthermore, we figured other students would benefit from this transparent mindset. Additionally, both of us had separate personal motivation with regards to contributing to our professional graduate student development. Nadra's motivation came in the form of striving to increase her instructional experience for her academic career. Creating this workshop was a good first step into gaining experience in creating a lecture and communicating with different parts of the school. Having a collaborative team building experience was also an important graduate career goal. Co-leading the workshop increased Nadra's confidence in her teaching style and helped to pinpoint areas that required improvement.

Héctor's motivations for conducting this workshop were to practice knowledge sharing across different disciplines and to put engineering education research into practice. Héctor's been interested in sharing programming skills with non-programmers since he ventured outside ECE and into Engineering Education. This workshop allowed him to practice this by sharing his LaTeX knowledge. In order to put engineering education research into practice, he shared the instructional load with the students and assistants, leveraged participant problem solving strategies, and talked through his thought process.

Working together as co-creators was also a challenge we both had to face. The way we approached learning a new subject is very different. For example, Nadra prefers to attack a problem through experimentation, whereas Héctor chooses to look into the background material of the problem first before attacking it. These approaches manifested in the way we structured the workshop, and how much material we needed to provide the participants. This led to multiple discussions about what we wanted students to leave with after leaving the workshop. We decided that instilling a sense of exploration with regards to learning any new subject or problem was the answer.

Cycle 1

We felt a workshop was an appropriate venue to foster a community based learning style. It would get students together from different backgrounds and disciplines and give them a chance to look at all the different problems that could arise while learning to use LaTeX.

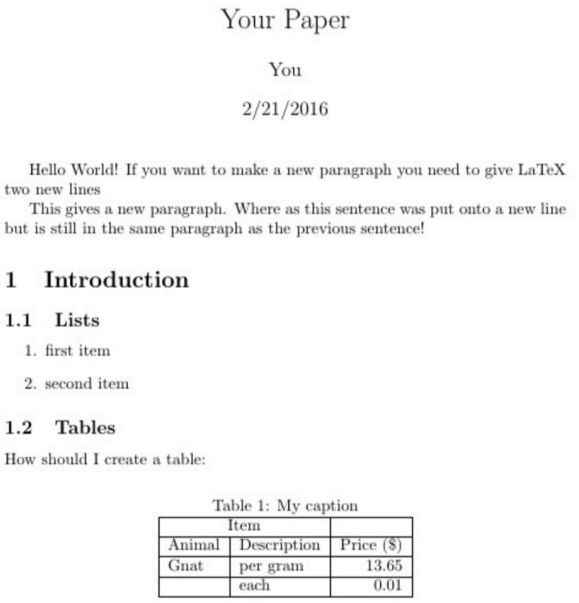
To put the workshop together, we began by looking at different LaTeX for beginner's websites to get a feel for the important areas of LaTeX. This helped inform the content we considered important to cover. In addition to the online content, we also reflected on our own LaTeX learning journey as beginners. In our reflections, we focused on empathizing with a beginner LaTeX student, building a strong theoretical foundation, and opening a collaborative dialogue.

In the first part of the workshop, we talked about the background of LaTeX. We discussed how it is not a what-you-see-is-what-you-get text editor like Microsoft Word. It is more similar to writing code. LaTeX can be used through a native installation onto the computer or via a web-based text editing tool. In this first cycle, we asked the students to have a native installation ready to work on. This presented many issues during the workshop since the native installation has many dependency errors when trying to compile documents. Whereas this was an important moment for the participants to learn and understand how to fix these issues, the issues took time and attention away from the focus of learning LaTeX. During and after the workshop, we both agreed we needed to figure out a solution to this. This need was also relayed to us by the participants in the feedback we collected.

We explored the structure of LaTeX code using a demo-like approach through the creation of a simple document. An example of the simple document we used as well as the code are found in Figures 1 and 2. After this, we led the students in hands-on practice. During this practice, we would walk around the class and help students as needed. We would be around to troubleshoot any errors and answer any questions. We asked students to bring a document they were currently

```latex
\documentclass[a4paper]{article}

\usepackage[english]{babel}
\usepackage{graphicx}
\begin{document}
\title{Your Paper}
\author{You}
\date{2/21/2016}
\maketitle
Hello World! If you want to make a new paragraph you need to give LaTeX two new lines

This gives a new paragraph.
Where as this sentence was put onto a new line but is still in the same paragraph as the previous sentence!

\section{Introduction}

\subsection{Lists}
\begin{enumerate}
\item first item
\item second item
\end{enumerate}

\subsection{Tables}
How should I create a table:

\begin{table}[hl
\centering
\caption{My caption}
\label{my-label}
\begin{tabular}{|l|l|r|}
\hline
\multicolumn{2}{|c|}{Item} &            \\ \hline
Animal      & Description  & Price (\$) \\ \hline
Gnat        & per gram     & 13.65      \\ \hline
            & each         & 0.01       \\ \hline
\end{tabular}
\end{table}
\end{document}
```

Figure 1: Cycle 1 Sample code



Your Paper

You

2/21/2016

Hello World! If you want to make a new paragraph you need to give LaTeX two new lines

This gives a new paragraph. Where as this sentence was put onto a new line but is still in the same paragraph as the previous sentence!

1 Introduction

1.1 Lists

1. first item
2. second item

1.2 Tables

How should I create a table:

Table 1: My caption

Item		
Animal	Description	Price ($)
Gnat	per gram	13.65
	each	0.01

Figure 2: Cycle 1 Sample Document

working on or to have some project in mind they'd like to work on. If students didn't bring anything to work on, we provided the Figure 2 document to practice with.

As the content of the workshop started coming together, a clash in how to present the information came about due to the difference in our learning and teaching styles. Héctor insisted we keep in mind that the course be driven by the needs of the students attending. Nadra agreed in part, but was focused on creating a solid foundation of LaTeX for students. This was needed to balance the breadth of students that would attend from different disciplines. After the first workshop, Héctor realized that Nadra's and his dynamic would be something they would need to practice more and carry over. It could be leveraged as an asset. We thought the workshop would be stronger if we honed in on our differences, strengths, and contrasts. We could use these differences to augment our instruction. We each brought different perspectives to the way we learn, solve problems, and use LaTeX. Given that students learn differently; they could benefit from our differences in the classroom.

Cycle 1 was hastily put together. We did not put in the preparation time necessary for an effective workshop. We fell short in terms of practicing the presentation and our feedback illustrated this. For this cycle we invited people we knew and felt comfortable presenting in front of and a handful of individuals from other departments. Running the alpha version of the workshop with people we felt comfortable making mistakes in front of allowed us the space to experiment with the structure of the workshop. It also allowed us to test our ideas on individuals we knew would feel comfortable giving us critical feedback.

The first workshop was attended by 20 students. The students were from the College of Engineering and the College of Food Science. Since we are both ECE students and LaTeX is similar to a coding environment, we overlooked multiple things that students from different majors who aren't as familiar with coding found difficult or unclear. This did not help us foster the sense of community based learning that we wanted to achieve. We would need to find a way of jostling our prior knowledge to remember how we learned how to program. Students can "model their solutions on the basis of experts' thought processes"[2]. Our initial inability to relay to students how we were problem solving in LaTeX is similar to the problems experts face in summarizing their thought processes and "making key aspects of expertise visible"[3].

After the first workshop was over we reviewed the following feedback from the students:

- Students said we were in too much of a rush to get through material
- Students wanted us to cover the basics of LaTeX's structure first before jumping into the advanced thesis document template
- We didn't do enough practical hands-on activities
- There wasn't enough time to play with the LaTeX program
- The live programming took too long and didn't leave enough time to follow along on their own computers
- Students wanted to work on more specific projects (e.g. resumes, conference papers)

We reviewed this feedback and took it into account in the next cycle of the workshop.

```latex
\documentclass[a4paper]{article}
\usepackage[english]{babel}
\usepackage[utf8]{inputenc}
\usepackage{amsmath}
\usepackage{graphicx}
\usepackage[colorinlistoftodos]{todonotes}

\title{Your Paper}

\author{You}

\date{\today}

\begin{document}
\maketitle
\begin{abstract}
Your abstract.
\end{abstract}

\section{Introduction}

Your introduction goes here! Some examples of commonly used commands and features are listed below, to help you get started. If you have a question, please use the help menu (``?'') on the top bar to search for help or ask us a question.

\section{Some \LaTeX{} Examples}
\label{sec:examples}


\subsection{How to Include Figures}

First you have to upload the image file (JPEG, PNG or PDF) from your computer to writeLaTeX using the upload link the project menu. Then use the includegraphics command to include it in your document. Use the figure environment and the caption command to add a number and a caption to your figure. See the code for Figure \ref{fig:frog} in this section for an example.
\begin{figure}
\centering
\includegraphics[width=0.3\textwidth]{frog.jpg}
\caption{\label{fig:frog}This frog was uploaded to writeLaTeX via the project menu.}
\end{figure}
```

Figure 3: Simple LaTeX Document Code

Table 1: Cycle 2 Implementation Based on Cycle 1 Feedback

Criticism	Our Solution
Too fast	Added more time to the workshop
Student's native installation issues	Used Overleaf
Lost during the workshop, missed steps	Created code handout, inserted 5-10 minute gaps
Not much hands on experience	Example of a more structured document example
Should have started with the basics	More fundamental introduction to the structure of a LaTeX

Cycle 2

For this cycle, we decided to team up with the graduate school administration. The graduate school at Purdue endorses the use of LaTeX for prelim, thesis, and dissertation creation and submission. The involvement of the graduate school gave us access to advertise across all colleges in our university. Advertising through the graduate school widened the departments from which participants came from. This cycle of the workshop had over 60 participants from electrical and computer engineering, engineering technology, computer graphics technology, civil, industrial, chemical, mechanical, geomatics, and agricultural and biological engineering; physics, biological sciences, and mathematical and computational cognitive sciences. The breadth of disciplines at this workshop added fuel to our desire to cover LaTeX more transparently, from a more basic level to be more inclusive of novice users.

We started preparations for our second cycle by reading the student feedback from the previous iteration. Many changes were incorporated into the second cycle of the workshop based on this

Your Paper

You

March 20, 2016

Abstract

Your abstract.

1 Introduction

Your introduction goes here! Some examples of commonly used commands and features are listed below, to help you get started. If you have a question, please use the help menu ("?") on the top bar to search for help or ask us a question.

2 Some LaTeX Examples

2.1 How to Include Figures

First you have to upload the image file (JPEG, PNG or PDF) from your computer to writeLaTeX using the upload link the project menu. Then use the includegraphics command to include it in your document. Use the figure environment and the caption command to add a number and a caption to your figure. See the code for Figure 1 in this section for an example.

2.2 How to Make Tables

Use the table and tabular commands for basic tables — see Table 1, for example.

Figure 1: This frog was uploaded to writeLaTeX via the project menu.

Figure 4: Simple LaTeX Document

feedback. See table 1. First, we opted to use a cloud version of LaTeX called Overleaf to avoid problems with each student's native installation. The structure of this workshop was significantly different from the first. Second, we decided to give a more animated and incremental introduction, focusing more on the fundamental structure of a LaTeX document to allow more time for hands-on exploration of the tool.

Thirdly, the pace of the workshop in the first cycle was too fast for the participants. To help with this, we broke up the hands-on coding portion of the workshop into several parts. We also created a more structured example document handout so that students could follow the material step-by-step and at their own pace as seen in Figures 3 and 4. After the description of each part and a small live-coding example the students would take 5-10 minutes to practice the example. In essence, we were aligning our foundational introduction to LaTeX with the example we would all complete during the workshop.

We used Problem Based Learning to have students work collaboratively with their peers to find solutions to the problems they faced[3,4]. When needed, Nadra, Héctor, and the other peer teachers served as More Knowledgeable Others (MKOs) to help scaffold student's problem solving strategies[5]. We would ask them to walk us through their coding practice and problem solving strategy. We would then ask students questions to get them to think about how they might solve the problem alternatively, and systematically break down their debugging process to understand how they were attempting to solve the problem. We would then offer suggestions for alternative options, different search queries in Google that might provide results to the problem at hand, or ask fellow neighbors if they might have some ideas about how to fix the issue the student is having.

Additionally, we encouraged students to challenge us by asking us questions and presenting us with problems we didn't know the answers to emphasizing our vulnerability. To solve these problems, we would similarly engage with all participants to collectively generate a solution. This served to de-elevate us as instructors from a position of power, foster an equitable community environment, and give students agency over their own learning; making us facilitators and making them authorities in the classroom[3,6].

Throughout the live-coding, we would intentionally make mistakes often 'breaking' the document. We would then talk our way out loud through our problem solving process and show participants how we fixed problems. We would make our best effort to talk out what we were thinking. When either Nadra or Héctor noticed that the other was not fully communicating 'to the participants what was being done during live-coding, we would wait for them to finish their statement and then ask them to explain what they did. We would ask these questions loudly enough for the entire class to hear and for the benefit of all students. This practice helped jostle ourselves out of autopilot mode, reminding us to communicate *with* students as facilitators, and not *at* them as instructors. This modeled behavior participants could follow when they work with others on future LaTeX projects. At the end of the workshop, we took any advanced or specific thesis template questions that participants had.

Because we wanted to create a community of LaTeX graduate student practitioners, leading the students at the workshop to be responsible for their own learning was very important. We assumed students came in with some amount of agency; needing to learn LaTeX for their thesis or

dissertations. But we further wanted to increase their self-efficacy and confidence in solving any problems that may occur during their LaTeX authoring experience. Our informal presentation style may have run counter to many student's previous classroom experiences. But we wanted to make it clear that we weren't LaTeX authorities. We wanted to show them that the intimidation to learn LaTeX was common, that anyone regardless of (disciplinary) background could effectively use the tool, and that they were a part of an empathetic community of fellow LaTeX users.

There were multiple reasons we believe the second cycle was more successful than the first. Firstly, the feedback from the first cycle helped us redesign a workshop that was attuned to graduate students across disciplines. Secondly, the involvement of the graduate school gave us the responsibility and accountability to deliver a quality, lasting instructional product. Lastly, the overarching goals of the workshop were clearer to us.

Conclusion

We both have personal and professional motivations for creating this workshop. These include increasing instructional experience and to practice putting engineering education research into practice. We had to work together to consolidate our different teaching styles, resulting in stronger instruction once we learned how to leverage our differences.

We held several iterations of this workshop. Throughout, we learned about what content to teach, how to effectively communicate this content, and how to handle the logistical issues of teaching LaTeX. We experienced great interest from students wanting to attend our workshop. This critical demand across departments throughout the university prompted us to partner up with the graduate school. They helped us register participants, market the workshop across the school, and provide accountability for our efforts.

In addition to the graduate school we also partnered with Eta Kappa Nu (HKN), the ECE honors society. HKN provided student volunteers from ECE who had varying degrees of experience with LaTeX. Our hope was that exposing ECE students to novice users would remind them of their learning experiences with coding, increase their empathy towards novice LaTeX users, and let ECE students share their knowledge with others. Partnering with the graduate school and ECE through HKN helped us achieve our goal of creating a more inclusive student community that would be more welcoming of students with no LaTeX programming experience.

Creating a community of LaTeX practitioners on our campus seems to us an effective solution to the cumbersome LaTeX learning climate we've perceived. Casting this workshop as a learning experience based around the social and participatory aspects of learning and of creating an identity of LaTeX learners in relation to others, rather than simply the acquisition of knowledge, helped us foster a community of practice[7]. The PBL pedagogy we adopted in our workshop was our first foray into increasing the effectiveness of instruction that would foster a more equitable learning environment to counter the less than helpful, dismissive climate we perceived in our home department of ECE[6]. During our workshop we strived to remind students of the collaborative nature of learning. When answering questions, we asked other students what they thought first. Students coming into the workshop had agency in wanting to learn LaTeX. We harnessed their agency by allowing them to practice knowledge acquisition in a social

environment – working with peers and ourselves. By asking students about their problem solving process we also aimed to augment their LaTeX learner identity. Augmenting this identity would make students feel like a more legitimate part of the group of LaTeX users, moving from the periphery of LaTeX knowledge and increasing to full participation[7,8]. Eventually, these students would be responsible for mentoring other beginning LaTeX users.

Tips for others

- It is very important to pilot test any workshop with a smaller group to help you pinpoint issues with material or lecturing.
- Make sure to align the lecture materials, pedagogy, in-class activities, assessment methods, and enduring understandings together.
- Collaborate with individuals across disciplines. The diversity of approaches different people bring to the table adds to any endeavor.
- Make sure to instill a spirit of community and exploration in instructional activities. This serves to increase students self-efficacy with the subject matter and creates a more sustainable education model.
- Ask for critical feedback from students, participants, peers, and others. External perspectives help with alignment and point out issues you may not be able to see.
- "Take chances, make mistakes, get messy!" -Miss Frizzle

References

[1] Latex – a document preparation system. `https://www.latex-project.org/`. Accessed: 2015-12-30.

[2] Said Hadjerrouit. A constructivist approach to object-oriented design and programming. *ACM SIGCSE Bulletin*, pages 171–174, 1999.

[3] Cindey Hmelo-Silver. Problem-based learning: What and how do students learn? *Educational Psychology Review*, 16(3):235–266, Sep 2004.

[4] Aman Yadav, Dipendra Subedi, Mary A. Lundeburg, and Charles F. Bunting. Problem-based learning : Influence on students' learning in an electrical engineering course. 2(2):253–280, 2011.

[5] Jerome Bruner. Celebrating divergence: Piaget and Vygotsky. *Human Development*, 40(2):63–73, 1997.

[6] Donna Riley. Employing liberative pedagogies in engineering education. *Journal of Women and Minorities in Science and Engineering*, 9(2):137–158, 2003.

[7] T.S.C. Douglas. *A Case Study of an Undergraduate Engineering Peer Tutoring Group: An Investigation in the Structure of a Community of Practice and the Value Members Gain from Participation*. Doctoral dissertation, Purdue University, 2010.

[8] J. Lave and E. Wenger. *Situated learning: Legitimate peripheral participation*. Cambridge University Press, Cambridge, 1991.