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Introducing LaTeX to the Academic Researcher: Engineering Writing with a Difference (RESUBMISSION)

Ms. Debjani Sarkar,

Ms Debjani Sarkar is an academic teaching specialist in the College of Engineering at Michigan State University. She teaches Technical Writing for Engineers and Scientists at MSU. She also leads the communications and marketing activities of the first-year engineering CoRe Experience. She supervises the College of Engineering Tutoring Center, which offers free tutoring in foundational courses for undergraduate engineering students. She has over a decade of experience on e-communication, curriculum development, web and graphic design, and on teaching Business and Cross-Cultural Communications internationally including Aalto University, Finland, and at IIT Kanpur, India.

Introducing LaTeX to the Freshmen Engineers: Technical Writing with a Difference

Learning Objectives:

The workshop is designed to provide hands-on introduction and instruction to the participants on LaTeX, which is a document preparation system for typesetting high-quality and professional documents. It is intended to achieve the following specific learning objectives:

- Develop an understanding of the philosophy behind LaTeX as a typesetting and publishing software
- Understand the advantage of LaTeX over other commonly used text editors as MS Word
- Understand LaTeX commands, formats, fonts, and environments
- Understand the versatility and flexibility of LaTeX for creating bibliography, tables, mathematical equations, and for inserting figures
- Typeset technical reports such as a conference paper on LaTeX
- Typeset career-related document such as a resume and a cover letter on LaTeX
- Understand how to collaborate and share projects with co-authors, reviewers, instructors using Overleaf: a writing and collaborating tool

Target Audience:

This workshop is designed for a diverse group of participants. These include researchers, K-12 educators, K-12 students, first-year engineering students, technical writers, mathematicians, statisticians, publishers, and university students. The workshop will be particularly beneficial for all who need to write and publish technical and scientific documents that incorporate tables of content, indices, mathematical text, tables, scientific figures, multi-file projects and references, both on print and pdf files, and researchers who work collaboratively.

Overview:

LaTeX is a document preparation system based on a typesetting system called TeX, originally proposed by Donald Knuth in 1979 [1] and recently became extremely popular. A study conducted by Authorea [2] suggested that 92% of scholarly articles in Mathematics and Statistics are written in LaTeX, 60% in Physics and Astronomy, and in Computer Science, 45% are in LaTeX. Academic researchers in the field of engineering, physics, computer science, and mathematics find it extremely beneficial because of its high-quality output, stability, and the capacity to handle complex documents. It is a free and open-source software. A key reason for researchers to use LaTeX is that it can generate bibliography and references of figures, tables, and pages of a manuscript automatically. Publishers prefer submissions in LaTeX as it is apparently easier to edit it before publishing. It also meets their formatting requirements. It is highly scalable and so, large documents can be split up into smaller chunks and later compiled together to create a complete manuscript such as a thesis or a book.

Methodology:

This workshop will discuss the philosophy of LaTeX as a standard for document preparation system. It will demonstrate the significant benefits of writing scientific documents with LaTeX over those with MS Word [3]. Participants will receive hands-on learning experience on understanding LaTeX commands, environments, styles, macros, and packages to create documents. They will learn to create sections, paragraphs, tables, mathematical notations, and insert graphs to typeset professional looking documents both in print and pdf files. The audience will typeset career-related documents, namely, a resume and a cover letter. They will also be introduced to Overleaf, an online writing and collaboration tool which runs on LaTeX, in order to work collaboratively on projects with instructors, co-authors, researchers, and peers [4].

The audience will have takeaways that include a technical document, a mock conference paper on Overleaf, a set of supplementary materials on typesetting, editing, and publishing technical and scientific documents using LaTeX.

Unlike other editing tools, LaTeX has a learning curve. This workshop will provide that opportunity for participants to get introduced to the software and to overcome the learning curve in order to begin using and guiding our first-year engineering students to write technical documents on LaTeX. The presenter has experience teaching LaTeX to engineering students and guiding them on research writing.

Results and Discussion:

This is an evidence-based proposal. I have conducted workshops for my graduate students on writing mock conference/journal articles on LaTeX. They were taught to create technical documents including conference papers and journal publications using LaTeX and its commands and typesetting features. They were then introduced to Overleaf, a cloud-based collaborative platform for typesetting documents in LaTeX. Overleaf is intuitive and simple to use and students were encouraged to collaborate with researchers including their professors and peers on their research, through Overleaf. The feedback from students has been overwhelmingly positive. They developed confidence in writing technical reports, business letters, and research articles, once they understood the style rules of writing. They concentrated on the content, while LaTeX took care of formatting and composing the document, which is its added advantage. This assignment was assessed by me in a traditional classroom setting and is a significant objective of my course. I plan to repeat this activity in my subsequent classes.

This pedagogical practice can be implemented with first-year engineering students as well. A major objective of this workshop is to inspire attendees to encourage first-year engineering students to write lab reports, design projects, resumes, business letters, and other assignments on LaTeX which is more flexible, stable, and versatile than other word processing systems. LaTeX is a powerful and complex tool and getting started can be intimidating and challenging. If freshmen engineers are introduced and guided through the essential steps of LaTeX, then its capabilities far outweigh its initial difficulties [5]. Teaching LaTeX will be a novel approach to motivate freshmen engineers to write, typeset, and publish polished and professionally designed documents, including career and business-related documents and internationally reputed conferences with templates provided.

Our first-year students can also be encouraged to use the templates provided by Overleaf to write efficiently, logically, and collaboratively, and thus reduce their workload. They can invite collaborators into the document to share and provide input, and this in turn will develop their team performance, team management, and team-building skills. There is certainly a bit of a learning curve, but if our freshmen engineering students are introduced to an efficient and high-quality mode of typesetting early on in their careers, it is worth the journey up the curve.

Future Works:

There is a plethora of literature, textbooks, reference materials, supplementary materials, templates, and examples on the internet. Engineers are lifelong learners. Once our students are comfortable with typesetting basic documents like career-related documents and technical reports, which will be demonstrated and practiced in the workshop, they will be propelled and motivated to typeset dissertations [6], research articles, capstone projects, and team-based designed projects. Also, since LaTeX is a scripting language, this can serve as a gateway on learning computer programming, and students can get first-hand experience in programming in their first year.

Workshop Schedule:
Detailed schedule of the workshop is given in Table I below.

Table I: Detailed Schedule of the Proposed Workshop

Activity	Duration (Minutes)
Workshop Objectives	5
Introduction to LaTeX	10
Overview of Technical Report using LaTeX	20
Overview of Conference Paper on Overleaf	15
Question and Answer Session	10
Total Duration	**60**

References:

[1] Donald Knuth, 1979, Mathematical Typography. American Mathematical Society, Vol. 1, No. 2, 337-372.
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[3] Andrew Roberts, 2011, Getting to Grips with LaTeX, https://www.andy-roberts.net/writing/latex/benefits.
[4] Overleaf: a cloud-based LaTeX processing software, https://www.overleaf.com/learn/latex/Headers_and_footers#Standard_page_styles.
[5] Stefan Kottwitz, LaTeX Beginner's Guide, Birmingham, UK: Packt Publishing Ltd., 2011.
[6] Mary Anne, 2017, Case Study - Purdue University - Graduate School improves thesis authoring and submission processes, https://www.overleaf.com/blog/447-case-study-purdue-university-graduate-school-improves-thesis-authoring-and-submission-processes