

# Statement of Methodology

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## Key Questions

Axle Informatics is a bioscience and information technology company that deals heavily with advanced scientific data analytics, specifically health informatics. For that, lab research documents are quite essential. This project aims to help in generating lab research documents in a much more efficient manner. The LaTeX extension should allow users to generate such documents without having to utilize too much of actual coding and allow them to implement and display their data that is simplified and user-friendly. To understand what exactly entails this LaTeX extension and the best way to accomplish this project, we must first understand the current process our users use, who our users are, and their needs.

To best accomplish this project, the following questions need to be answered through this research.

### **How familiar are users with technologies like LaTeX?**

A critical part of developing an intuitive and friendly GUI system is understanding the experience level of our user group. For example, advanced programmers working in low level languages tend to prefer more simplistic text editors with less abstraction since there is less abstraction in their code. On the other hand, new programmers tend to utilize software like IntelliJ which provides elevated levels of abstraction and automation to aid in the learning process. This is not to say that this software is mutually exclusive to each user group. However, this applies as a rule to our product. Knowing user experience guides the development of UI and the depth of software functionality. Helping us tip toe the fine line enhancing user experience while avoiding oversimplification.

### **What functionalities are commonly utilized among users?**

This is important as it will inform us of the core functionalities our product will need to incorporate to be viable. This question is more general since our users vary from data scientists

to bioinformatics specialists, but overall, this should encompass our users' general needs. By understanding the parts of LaTeX that are most utilized by our consumers we can develop applications that most efficiently solve those problems. Increasing efficiency and productivity of work. Furthermore, this guides our group's prioritization of product deliverables. Without an answer to this question, we would be developing in the dark. As a result, we could make a high-quality functional product that completely fails due to its inability to serve the wants and needs of our consumer base.

### **How do users feel about the existing LaTeX Extensions?**

This question would allow us to thoroughly know the core issues our users face with the current LaTeX extension(s). We need to know our users' thoughts, satisfaction, and needs to completely understand what the desired final product should be. This question will inform us as to what will bring the most user satisfaction. It is also valuable in gauging the overall success of development of our product. Throughout the iterations of development, we can sample small user groups to see if our product is surpassing previous extensions or not addressing correct user discrepancies. At the culmination of our project, we can compare the original responses to such a question to with new responses to get an idea of the overall success of the product.

### **Methodologies Utilized**

Our team decided to conduct our research and better understand our users' needs using surveys and several interviews.

The use of surveys as one of our methods of conducting user research was obvious, as surveys are convenient and quick, and as a result allow our team to reach as many participants as possible. Therefore, a survey as a research method would be appropriate and effective in collecting the qualitative and quantitative data user information we need.

The use of observation of the environment our client uses to perform LaTeX research document generation allows our team to understand visually how the current process works. This method is quite useful as it allows us to understand our users' behavior with the current process and also allows us to contextualize our users' needs in their natural setting.

## **Survey**

Interviews are great at helping us visualize user complications and small functionalities that could fix them. However, with our limited time and failure to secure an interview, we had to forgo. Interviews though would have failed to reach a broader section of our user group. This is where surveys come into play. A short and detailed survey provided an easy path for reaching a broader group of users and sampling more problems from more people. This helped our group narrow the functionalities that we could implement. Rather than focus on a few minor problems that only a niche number of users have, we are now able to focus on problems that affect a large swath of our user group.

This research also helped use collect numerical data that we could use to better understand the different fields of study of our users. By understanding our users' demographics, we can develop parts of our application that cater to most users before we begin to focus on smaller demographics. The numerical data from our survey will also allow us to conduct a post product survey that can give some insight into the success of our product.

Finally, we included a free response at the bottom of our survey to gather ideas for the application that we had not yet thought of. Through this we can better leverage the creativity, wants, and needs of our users to provide a better product to our client. Overall, this form of research was good at gathering a large amount of data but fell short of getting detailed data on our user group.

## **Observations**

To better contextualize the desires and struggles of our users we need to conduct hands-on research with the software that is currently being used. We had our client link our group an example of what a typical researcher's Jupyter Notebook would look like, and how it would be integrated with LaTeX. With this we were able to play around with the existing software and get a hands-on feel for how it was being used, and how we might be able to improve it. It also helped us visualize how we might go about implementing certain software to increase usability.

## **Key Findings**

After completing a couple of interviews and reading our survey responses, we gained a better understanding of the current process our user use, who our users are, and their needs. The key findings are summarized below.

### **Users are slightly familiar with LaTeX.**

The survey responses return that 66.7% of our users rated their familiarity with the coding language a 4 out of 5 (on a scale of 1 to 5, 5 being most familiar) as shown in Appendix B.1. Interestingly though, the survey also returns that 55.6% of our users only use LaTeX to create documents only a few times a year, with 22.2% weekly, 11.1% monthly, and 11.1% using it never (Appendix B.2). This information shows us that although most of our users only use LaTeX a few times a year, in those few times, they were able to get quite familiar with the language. Our users' experience with LaTeX is critical to know as it will guide us in how we can build a user-friendly system that is exactly right for our users.

### **Users use the writing equations feature in LaTeX most.**

The survey concluded that 77.8% of our users use the writing equations features—which includes fraction, symbols, and exponents, the most out of all the functionalities in LaTeX. Second most used feature would be label and heading generation with 55.6%. Coming up third, 44.4% of our users use text effects, table generation, and journal/conference templates (Appendix B.5). This information provides us with our users' needs and which features we should absolutely prioritize. With these results, we now know that at least these three features must be absolutely included in our product.

66.7% of our users found that graphing data with LaTeX is difficult to create. Writing equations and table generation both being the second with 55.6%. Shape generation comes up the third most difficult for 33.3 % of users (Appendix B.6). Through this, we can infer that graphics in general are difficult and/or inconvenient to create through our users' current process. These results are essential as it informs us that at least those three features must be improved upon in our product to increase productivity and efficiency of our users.

## **Users are quite unsatisfied with the current process they use.**

We found that 50% of our users rated their satisfaction with their current process in terms of generating research documents with LaTeX a 2 on a scale from 1 to 5 (5 being strongly satisfied) as shown in Appendix B.4. This survey data helps answer one of our key questions mentioned earlier. With this, we are informed of our users' experience with their current process with the LaTeX extension and will guide us in how we can improve user experience with our final product.

The survey also reports that while 44.4% of our users find that using LaTeX improves their productivity and efficiency, 33.3% say it has no effect, 22.2% percent report that it lessens it (Appendix B.3). Our goal is for most of our users—which to say is over 50%, to find that our extension would increase their productivity and efficiency and as a result, have a better experience in creating lab research documents in general.

We intend that we can gain even more knowledge of our users and their needs as we go through the project's development process, and overall create a successful product.

## **Appendix A**

### **Survey Questions**

The following link leads to the survey we sent to our users to gather research data. The responses to the survey are anonymous and not monitored.

Link to survey: <https://forms.gle/E5f4KFAF5KgXcGe89>

1. What is your field of study/work?
  - a. Open-response answer
2. From a scale of 1 to 5, how would you self-describe your familiarity with LaTeX?
  - a. Scale ranging from 1 (Not at all familiar) to 5 (Very familiar)
3. How often do you use LaTeX to create documents?
  - a. Never
  - b. Daily
  - c. Weekly
  - d. Monthly

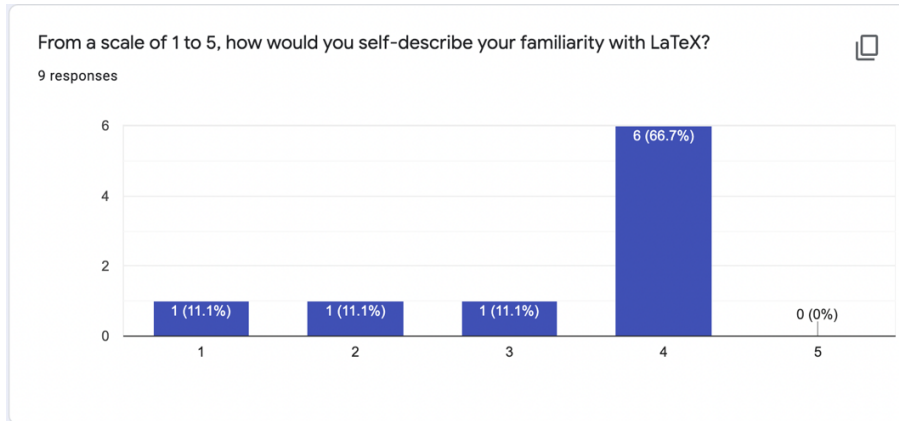
- e. Few times a year
4. How does using LaTeX affect the productivity and efficiency of the rest of your work?
    - a. It makes me more efficient and productive
    - b. No effect
    - c. It makes me less effective and productive
  5. From a scale of 1 to 5, how satisfied are you with the process you use currently in terms of generating research documents with LaTeX?
    - a. Scale ranging from 1 (Very unsatisfied) to 5 (Very satisfied)
  6. Of the following features, which do you use most in LaTeX? (checklist)
    - a.  Text effects (bolding, italicizing, font, etc.)
    - b.  Creating lists
    - c.  Label and heading generation
    - d.  Writing equations (fractions, symbols, exponents, etc.)
    - e.  Table generation
    - f.  Graphic data/Graph creation
    - g.  Inserting and formatting images/figures
    - h.  Function generation
    - i.  Shape generation (squares, circles, arrows, etc)
    - j.  Use journal/conference templates
    - k.  Use macros
    - l.  Other...
  7. Of the following LaTeX features, select all that you find cumbersome to create?
    - a.  Text effects (bolding, italicizing, font, etc.)
    - b.  Creating lists
    - c.  Label and heading generation
    - d.  Writing equations (fractions, symbols, exponents, etc.)
    - e.  Table generation
    - f.  Graphic data/Graph creation
    - g.  Inserting and formatting images/figures
    - h.  Function generation
    - i.  Shape generation (squares, circles, arrows, etc)

- j.  Use journal/conference templates
  - k.  Use macros
  - l.  Other...
8. What do you find most difficult about LaTeX?
- a. Open-response answer
9. Do you use LaTeX within Jupyter environment?
- a. Yes
  - b. No
10. Do you collaborate with other researchers through LaTeX documents?
- a. Yes
  - b. No
11. What are some features you would like to see within Jupyter LaTeX editor?
- a. Open-response answer

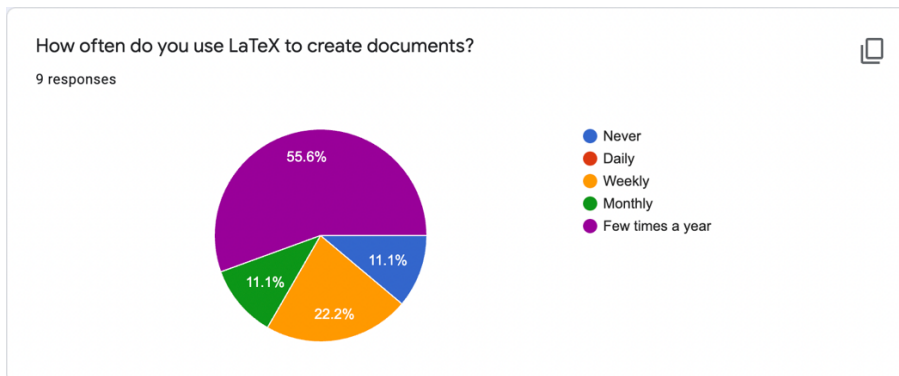
# Appendix B

## Survey Results

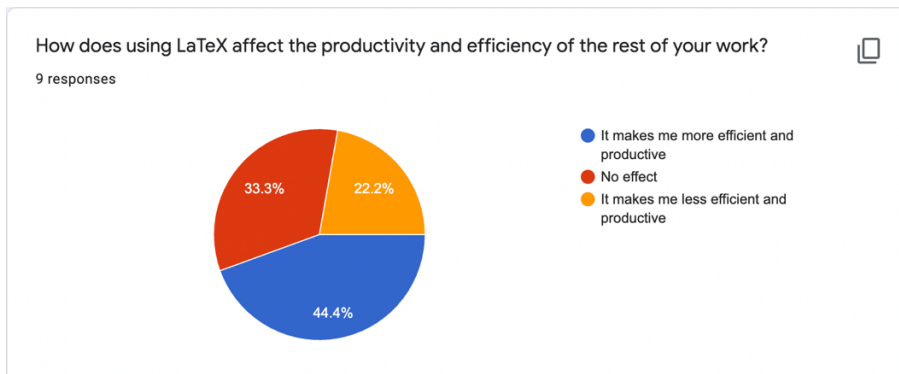
### B.1



### B.2



### B.3

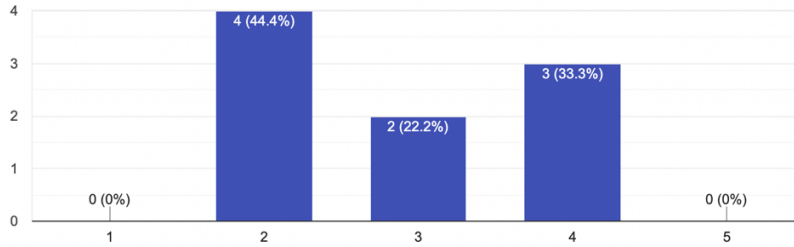




## B.4

From a scale of 1 to 5, how satisfied are you with the process you use currently in terms of generating research documents with LaTeX?

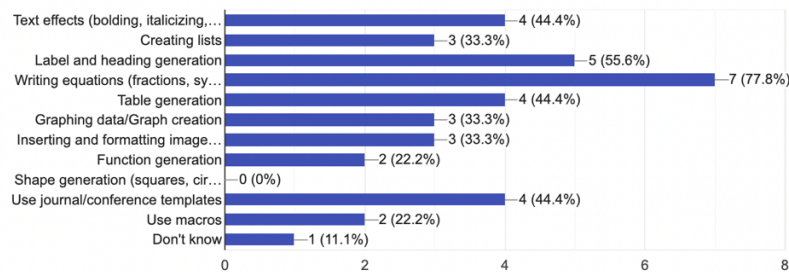
9 responses



## B.5

Of the following features, which do you use most in LaTeX?

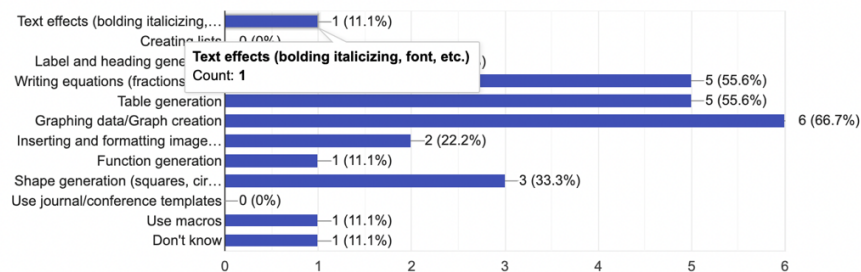
9 responses



## B.6

Of the following LaTeX features, select all that you find cumbersome to create?

9 responses



## Appendix C

### Interview Question Guidelines

1. Please describe your occupation and how/when you use LaTeX in your day-to-day work?
2. What problems do you constantly face/what tasks do you find repetitive and cumbersome while using LaTeX?
3. What collaborative functionalities do you use with Jupyter Notebook/LaTeX and what functionalities (if any) would you like to see implemented?
4. What experience do you have with installing and using LaTeX extensions and how difficult do you find it?
5. What are specific functionalities you would like to see implemented in the LaTeX extension?