LabTeX Document Generator
UX Report
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Axel Informatics

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Introduction

Researchers are tasked with collecting, organizing, and analyzing data to solve problems and predict trends. A vital portion of this process is creating a document to show the data that was collected and interpreting that data to draw conclusions. Having the document organized and easy to read is an important part of sharing the research with the rest of the world. This is why many scientists are drawn to LaTeX, a high-quality typesetting software for technical documents. LaTeX is especially powerful when for handling/formatting equations, graphs, tables, and figures which are often the most effective way to display data and findings to an audience. LaTeX is a powerful tool, but it also has a learning curve. LaTeX syntax can be cumbersome and unintuitive, especially for researchers less familiar with markup languages and coding (such as a biologist).

This is where LabTeX Jupyter Extension comes in. LabTeX Jupyter Extension is a LaTeX editor that lives inside of Jupyter Labs. We plan to add a graphical user interface to LabTeX for the most common/useful LaTeX commands. This will reduce the steep learning curve of creating documents with LaTeX as well as improve the workflow of experienced users.

In this UX report, we've including our prototype which has been critique and improved with a heuristic evaluation. Furthermore, it describes the important findings we discovered while developing and improving this prototype. These findings will have lasting impacts on how we approach the planning and creation of the final product.

Prototype

Since our program is designed as a GUI layer on top of LaTeX, its functionality mostly revolves around inserting various objects into a document (e.g. images, tables, fractions). Thus, the second to fifth screens we'll focus on will be those related to such an action, which are inserting tables, shapes, images, and fractions respectively. The first screen will be the main screen the user sees and uses while typing out text, and the last will be the preview which shows the processed document. The remaining screens are displayed in Appendix C: Ancillary Screens.

Main Page (Screen 1)

This is the first and most common screen the user will see, as it's what will be used for typing most of the LaTeX for the document. At the top, we see the tabs showing currently open documents with their names and an "x" button to close them. Below that is the menu, which is what the user will use to access the many features provided in LabTeX. It provides a button for each category of operation and a home button to allow the user to quickly return to the main page at any time. Finally, we have the text editor area which provides line numbers and syntax highlighting.
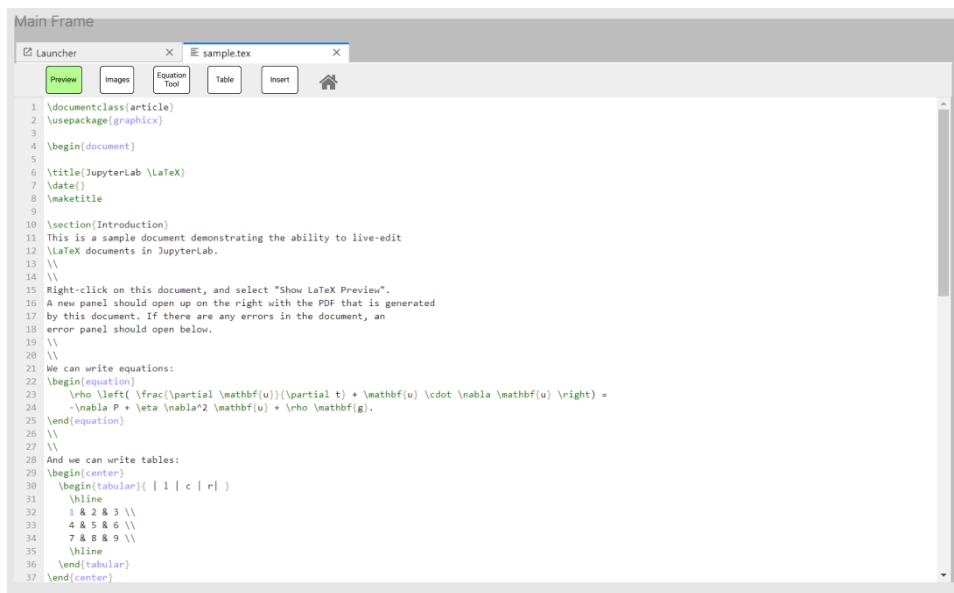

Figure 1: Screen 1 of LabTeX Software or Main Page

Inset Table Page (Screen 2)

This screen pops up when the user clicks the table button in the menu. The menu is color-coded (red showing the current screen) so that recall is unnecessary. A title is also provided in the popup to assist in this. This allows the user to insert a table, which can quickly become complicated or overwhelming for an inexperienced LaTeX user trying to create large tables with complex elements. Two boxes labeled "Dimensions" allow the user to choose the dimensions of the table to be inserted. After which, the user is free to enter his elements into the provided boxes, which follows the same layout as the table to be inserted. Two buttons are also provided in the bottom right corner called cancel, for when the user is not satisfied for whatever reason, and done, for proceeding with the operation.
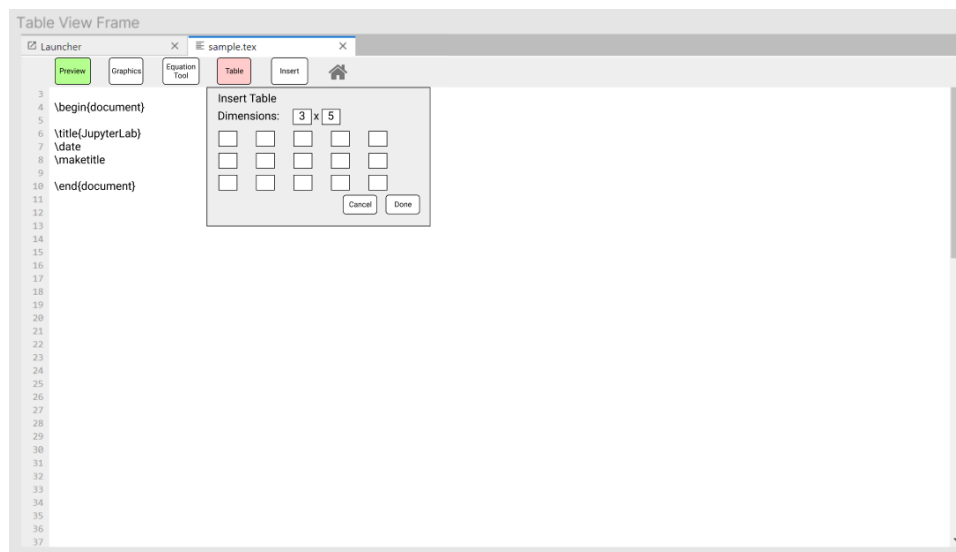

Figure 2: Screen 2 of LabTeX Software or Inset Table Page

Insert Shape Page (Screen 3)

This screen pops up when the user selects the rectangle option from the "insert shape" dropdown (shown in appendix C as Figure 11) and allows one to insert a rectangle into the current document. As with before, the menu is color-coded (red showing the current screen) so that recall is unnecessary. A title is also provided in the popup to assist in this. Two text boxes are present to allow the user to choose the exact size of their desired shape. Intuitive color wheels allow the user to select both the fill color and the stoke color. Lastly,

an option is provided to allow the border width to be selected. And, in keeping consistent with other screens, two buttons are provided called cancel, for when the user is not satisfied for whatever reason, and done, for proceeding with the operation.
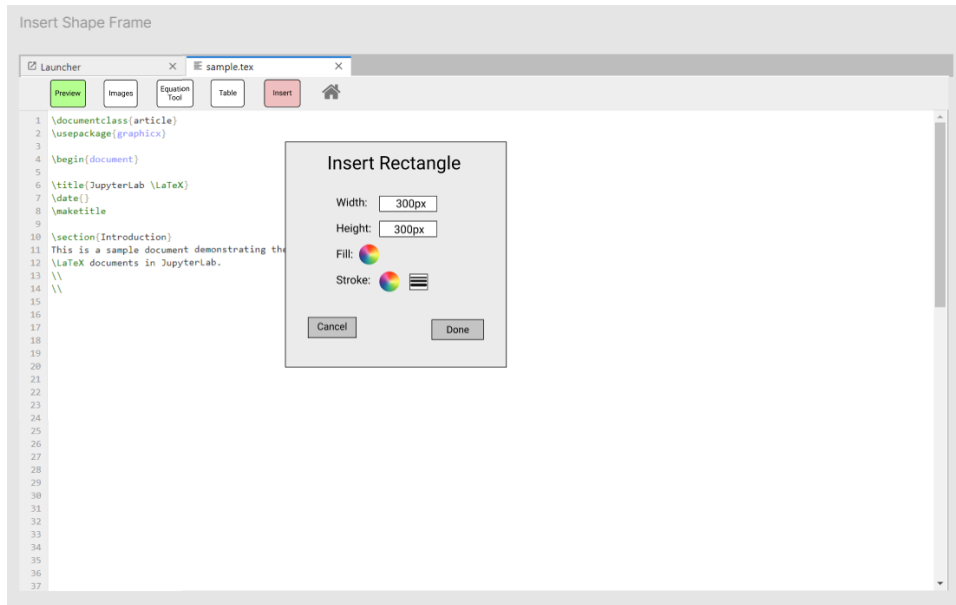

Figure 3: Screen 3 of LabTeX Software or Insert Shape Page

Insert Image Page (Screen 4)

This screen pops up when the user selects the images option from the menu. This allows the user to insert an image into a document. As with before, the menu is color-coded (red showing the current screen) so that recall is unnecessary. The popup title also aids in this goal. We provide a few options for the user, such as two optional ways to include text (as either a caption or label) with a text box, tick box, and name saying what they do. Four radio buttons are also shown under the Position label, allowing for basic positioning. A preview is also displayed so the user can see what is about to be inserted. (This is clearly titled "Image preview"). Finally, we provide a cancel button, if the user is not satisfied for whatever reason, and done button to proceed with the operation.
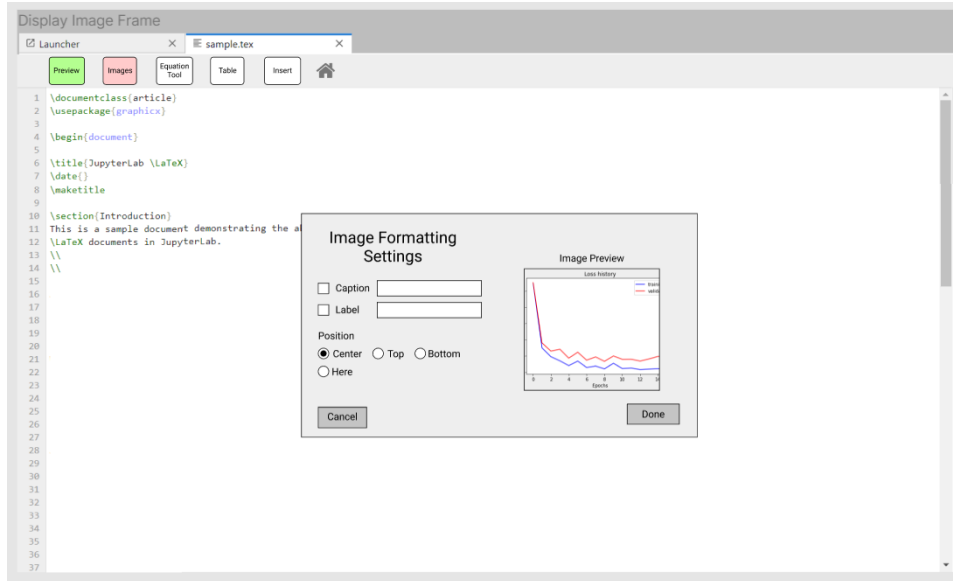
Figure 4: Screen 4 of LabTeX Software or Insert Image Page

Insert Fraction Page (Screen 5)

This screen pops up when the user selects the "insert fraction" option from a dropdown (shown in appendix C as Figure 12) and allows one to insert a fraction into the document, which can otherwise become complicated with multiple layers of nesting on larger equations. Here one can enter the denominator (bottom text box) and numerator (top text box) as LaTeX into intuitively located text boxes and view a generated preview of the relevant fraction that would be generated by the full document.

The user can choose to insert the fraction into the document if they are satisfied or cancel the operation if not through two well labeled buttons located on the bottom right of the popup. As with previous screens, we provide a color-coded menu (red showing the current screen) to the user so that recall is unnecessary. The title of the popup provides further and more specific information on the current operation.
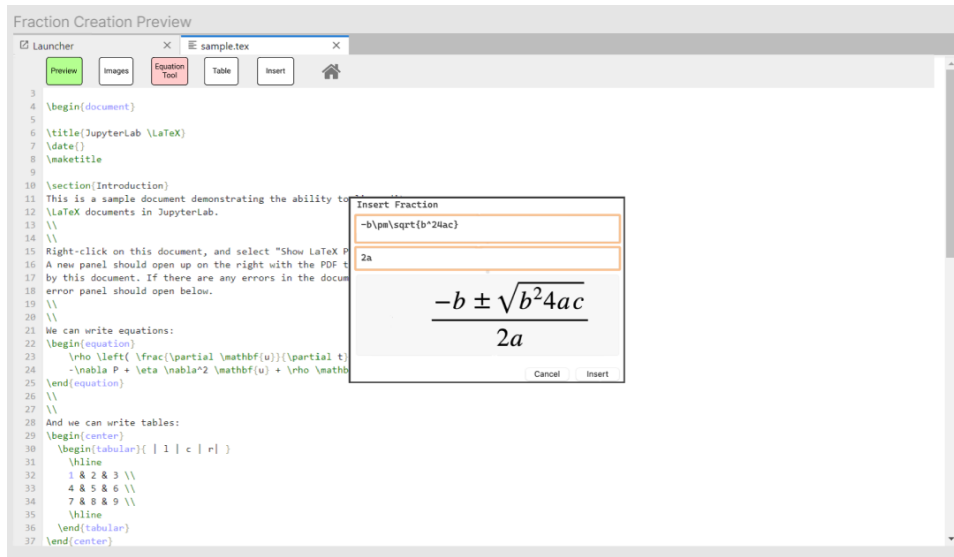
Figure 5: Screen 5 of LabTeX Software or Insert Fraction Page

Preview Page (Screen 6)

This is the preview screen which shows the user what his document (as it currently exists) will produce as the final product. This is intuitive, as we show the users document on the left and the generated document on the right, allowing the user to compare specific parts of the documents LaTeX with its generated counterpart. We also continue to show the menu buttons as we do in all other screens, allowing the user to quickly move between them. In this menu we highlight the "Preview" button red, to tell the user where he is without having to recall what was done. Typical features are provided such as fullscreen, zoom, and a download option.
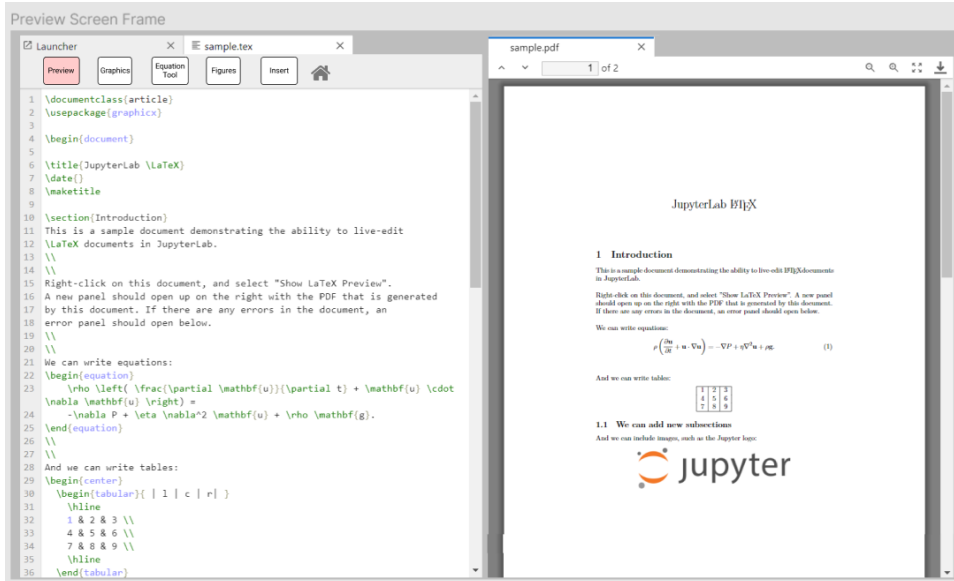
Figure 6: Screen 6 of LabTeX Software or Preview Page

Methods

Intro: To conduct our heuristic evaluation we used user scenarios that cover all the functionalities required to produce the minimum viable version of our application. As an extension of LaTeX, meant to integrate Jupyter Labs and LaTeX, our application is built of a pre-existing LaTeX software. This software is rather difficult for new users to pick up and has a steep learning curve. Our application is focused on alleviating the technical difficulties of using LaTeX by providing an intuitive user interface that helps users, of all backgrounds in coding, quickly and efficiently create LaTeX documents from Jupyter Labs.

Our heuristic evaluation is centered around the main page that a user will first notice our extension. Many of the user's actions will take them to variations of the main page, all with slightly different options apart from the preview button. It is important to focus on the utility and flexibility of the main scene as it is the main facilitator of user productivity. If each part of the prototype does not function properly and intuitively then our design quickly loses its viability.

Our heuristic evaluations were conducted internally by some of our own team members, and externally by another group. The heuristic evaluation done by another team is located in Appendix 1 of the appendices section, and the internal heuristic evaluation is located in Appendix 2 of the appendices section.

Our heuristic evaluation focused on Nielsen's ten usability heuristics for user interface design. These ten usability heuristics focus on the product's user groups and the conventions which will provide the best experience given the spectrum from our users come from. The first heuristic our application was evaluated on was visibility of system status. This principle focuses on the feedback our product is giving a user. For example, a loading bar when a page is loading, or a waiting screen while servers are trying to connect. Next, the application was evaluated on its "match with the real world". This focuses on the forms of communication our application uses. It is most beneficial to use vocabulary,

images and icons that are user are accustomed to rather than LaTeX vernacular which may be more confusing or misleading. The third heuristic is user freedom and control. Here it is important that a user can quickly undo or exit a process he or she has initiated. This is a key heuristic to our application's ability to increase user productivity. The fourth heuristic is consistency and design standards. To create the most intuitive extension possible, we must follow design conventions that are already used by LaTeX and Jupyter Labs. This also leads to the creation of a more aesthetic application. Next, we were evaluated on our application's ability to avoid error prone situations and prevent users from making errors. This is probably the most difficult and important part of our product. Since our product is a LaTeX editor, there are hundreds of combinations with which users can implement some of the application's functionalities, making it difficult to foresee all possible error's a user could make. Thus, strategically limiting the functionality of some processes would be an important part of error prevention. The sixth heuristic is recall and recognition. Ideally, we do not want our users to have to memorize or recall how to use our application. Doing this properly involves making an intuitive UI and using appropriate icons/labels to label elements. Furthermore, our application was evaluated based on its efficiency and flexibility. This involved evaluating the tailor-ability of the application and the use of editing shortcuts for more advanced users. The eighth heuristic evaluated the applications aesthetic and design. This standard ties into consistency and heuristic standards. By keeping a continuous color scheme and design, and by displaying only necessary information the product will look more aesthetically mature. Next, error recovery was assessed. This means displaying error messages in ways that are visible and understandable to the user. Meaning the user can easily recover from errors because of functionality implemented or error messages presented. Lastly, the product was evaluated based on its help and documentation. These are items such as hyperlinks, animations, or even just message bubbles that help a user navigate or understand the system.

Table 1: User Scenario and Tasks

Scenario	Tasks in Order
Write and run preview of current LaTeX code	1. Click "Preview" button to view complied version of the document. 2. Click "Preview" button a second time to return to initial screen.
Insert and adjust image	1. Click the "Image" button on the menu bar. 2. Browse your device for the desired image. 3. Adjust and format the image. 4. Press the "Done" button.
View Equation Tool and use to insert a fraction	1. Click the "Equations Tool" button on the menu bar. 2. Select "Fraction" from the drop-down menu. 3. Enter desired numerator and denominator values. 4. Press "Done" and insert the equation into the document.
View and use Table tab to generate a table	1. Click the "Table" button in the menu bar. 2. Fill information for desired number of height and width cells in the Table GUI. 3. Pres the "Done" button.
Press the Insert drop down insert a shape into LaTeX code.	1. Click "Insert" button on top menu bar. 2. Click desired shape to insert from shape list. 3. Specify the shape's height, width, fill and stroke. 4. Press the "Done" button.

Findings & Recommendations

Key Findings:

From the heuristic evaluations, we have found that our prototype has achieved the user-friendly, and efficient UI design as we initially hoped for. Our heuristic evaluations also reported that the functionality of our prototype is user-friendly, allowing the completion of tasks to be straightforward, efficient, and simple. Overall, the extension prototype provides a streamlined and user-friendly way for our user to generate certain features into their LaTeX research document.

Through the heuristic evaluations, we have successfully applied almost all the ten heuristic principles.

Throughout the completion of the tasks, it is always clear what task is being performed and the system gives appropriate feedback within a reasonable time when performing the task. There is a clear placement of the buttons within the document features menu bar, clear labeling, and layout that shows the status of document. This all satisfies the visibility of system status heuristic of our prototype.

The match between the system and the real world is also present. The text uses real world language and phrases. The system also follows standard conventions and uses familiar design that matches existing software. The use of standard and familiar design allows our prototype to satisfy the recognition rather than recall heuristic as well. The menu bar is placed as expected and at an appropriate size, and the buttons on the menu use familiar design. Each feature on the menu bar when clicked use familiar and simple design. For example, when clicking the *Table* button, the user will see a grid in which the user can choose the number of rows and columns to add to the table, similar to how inserting a table works with Microsoft Word and Google Docs. This adds to our simple and user-friendly design for our project. In addition, because of the familiar design, the system is self-explanatory to the user, and the user will find little-to-no problems with the LaTeX extension.

The heuristic evaluation reports that the user has easy control and freedom with our prototype. The user can easily navigate away from the current task, with certain features

having a cancel function when clicked. This also adds to the user's error prevention. All the features in our prototype have a preview, which allows for the user to recognize, diagnose, and prevent or recover from errors. For example, for the *Shape* button, the popup window associated with the feature has a series of customizations for the user to go through. In addition to the preview window and the cancel button, the user has control and can prevent or recover errors, which increase efficiency.

Recommendation 1

One recommendation most useful would be the use of shortcut key-commands. For example, a command "ctrl-z" or "command-z" that would exist to allow for easy correction of mistakes to the document. It would also add to flexibility and efficiency of use for the user. A list of more complex key commands–for example "ctrl-e" or "command-e" for the Equation tool window to popup, for more experienced users would also allow the LaTeX extension to be much more effective and add to the ease of use and functionality of the interface.

Recommendation 2

Another recommendation would be to increase clarity on certain features. For example, dimming the background content for additional clarity when pop-up windows are used would allow for the user to easily look at the screen and finish their task. The blur would contrast against the text-heavy background, which would allow the user additional clarity, and in turn increased efficiency.

Recommendation 3

One small but essential recommendation would be to have a clearer input system for the *Equation Tool* popup window. Translating a math equation into computer text can leave the user confused, so implementing a system that is easier for the user to just input numbers and symbols would increase efficiency and ease-of-use.

Revision of Prototype

In both heuristic evaluations there was consistent criticism of Task 4, the task to insert a table into a LaTeX document. There were two main criticisms. The first issue was that this task lacked a title in the window that displayed on the screen. This is a concern because it fails the heuristic to favor user recognition over user recall. In this instance the user is required to remember the purpose of this window. This issue was addressed by simply adding a title to the top of the window, similar to the other tasks. The second criticism was that this task had the only window that lacked a cancel button. Every other task that opens a similar window has a cancel button that the user can press to stop the action. Lacking a cancel button infringes on user control and decreases consistency with the rest of the system. To rectify this issue a cancel button was added to the relevant window.
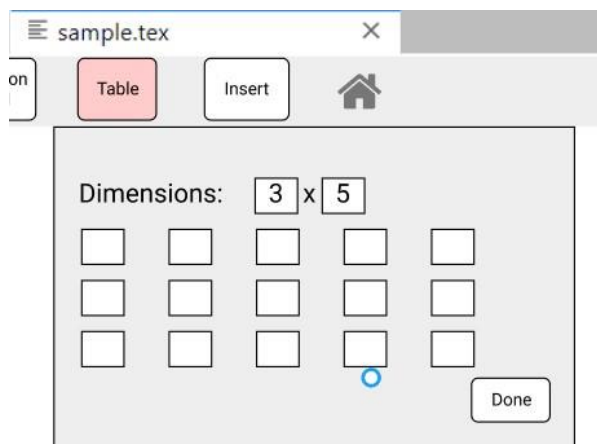
Figure 7: Original Prototype Task 4   Figure 8: Revised Prototype Task 4
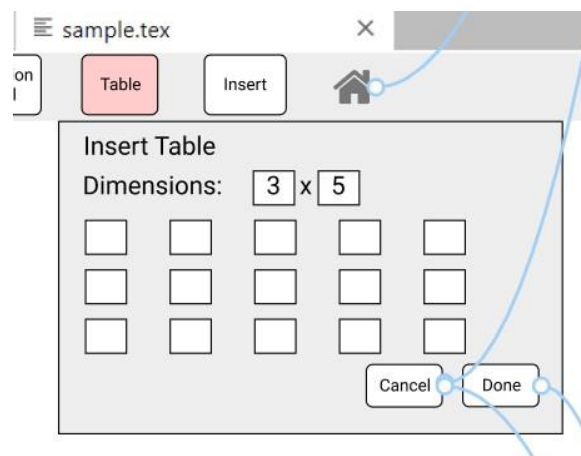
The only other task that received criticism in the heuristic evaluation was Task 5, the task to insert a shape into the LaTeX document. In the original prototype an error was made where add highlighting to the "Insert" button after the button was pressed. This error was caught in our heuristic evaluation. This mistake would have meant that the system would not have been displaying its current status to the user. This issue was corrected in the revised prototype by adding highlighting to indicate the status that the button had been pressed.
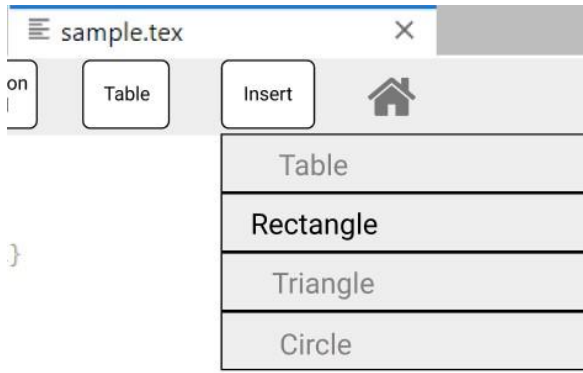
Figure 9: Original Prototype Task 5   Figure 10: Revised Prototype Task 5
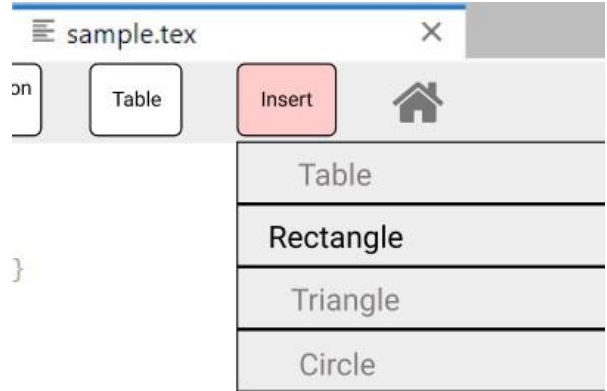
The last change made between the original and revised prototypes was the addition of keyboard shortcuts. "Ctrl+P" can be used to view a preview of the document. "Ctrl+I" can be used to insert images into a document. "Ctrl+E" can be used to insert an equation. "Ctrl+B" can be used to insert a table and lastly "Ctrl+S" can be used to insert a shape. Our peer heuristic evaluation suggested that our users may benefit from having the functionality of the buttons duplicated via a key command. We agreed that this addition would likely help any users who intend to use them. Our only concern is that the system may need some additional documentation to teach users about these key commands. Despite the need for increased documentation these key commands were added to the revised prototype.

Works Cited

[1] A. Rezi and M. Allam, "Techniques in array processing by means of transformations, " in *Control and Dynamic Systems*,Vol. 69, Multidimensional Systems, C. T. Leondes, Ed. San Diego: Academic Press, 1995, pp. 133-180.

[2] G. O. Young, "Synthetic structure of industrial plastics," in *Plastics*,2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

[3] S. M. Hemmington, *Soft Science*.Saskatoon: Univ. of Saskatchewan Press, 1997.

[4] N. Osifchin and G. Vau, "Power considerations for the modernization of

telecommunications in Central and Eastern European and former Soviet Union (CEE/FSU) countries," in *Second Int. Telecommunications Energy Special Conf.*,1997, pp. 9-16.

[5] D. Sarunyagate, Ed., *Lasers*.New York: McGraw-Hill, 1996.

Appendix A: Overview of top three criteria and their requirements

Criteria Category	Criteria Requirement/s	Criteria Success Measure
Design	● Real time transactions of food, books and notes	The system must enable **real-time** purchases of meals through university ID cards, textbooks and supplies either through ID cards or through the campus network, and purchase and delivery of online course notes through the campus network.
	● Real-time debiting and crediting of accounts	At the time of purchase, the system must debit the user's account for the amount of the sale and credit the appropriate vendor's account.
User Experience	● intuitive navigation	● The system must adhere to established heuristics for user navigation
	● Completion of tasks	● The user must complete each tasks within three clicks

Appendix B: Heuristic Evaluation Tool

Nielsen's Heuristic Evaluation

Based on: Nielsen, J. (1993) *Usability Engineering*. Academic Press. Chapter 5, p. 115. | About quest.cgi

Please evaluate the system according to Nielsen's usability heuristics.

- Try to respond to all the items.
- For items that are not applicable, use: **NA**

		1	2	3	4	5	6	7		NA
1. Simple and Natural Dialogue	bad	○	○	○	○	○	○	○	good	○
2. Speak the Users' Language	bad	○	○	○	○	○	○	○	good	○
3. Minimize User Memory Load	bad	○	○	○	○	○	○	○	good	○
4. Consistency	bad	○	○	○	○	○	○	○	good	○
5. Feedback	bad	○	○	○	○	○	○	○	good	○
6. Clearly Marked Exits	bad	○	○	○	○	○	○	○	good	○
7. Shortcuts	bad	○	○	○	○	○	○	○	good	○
8. Good Error Messages	bad	○	○	○	○	○	○	○	good	○
9. Prevent Errors	bad	○	○	○	○	○	○	○	good	○
10. Help and Documentation	bad	○	○	○	○	○	○	○	good	○
		1	2	3	4	5	6	7		NA

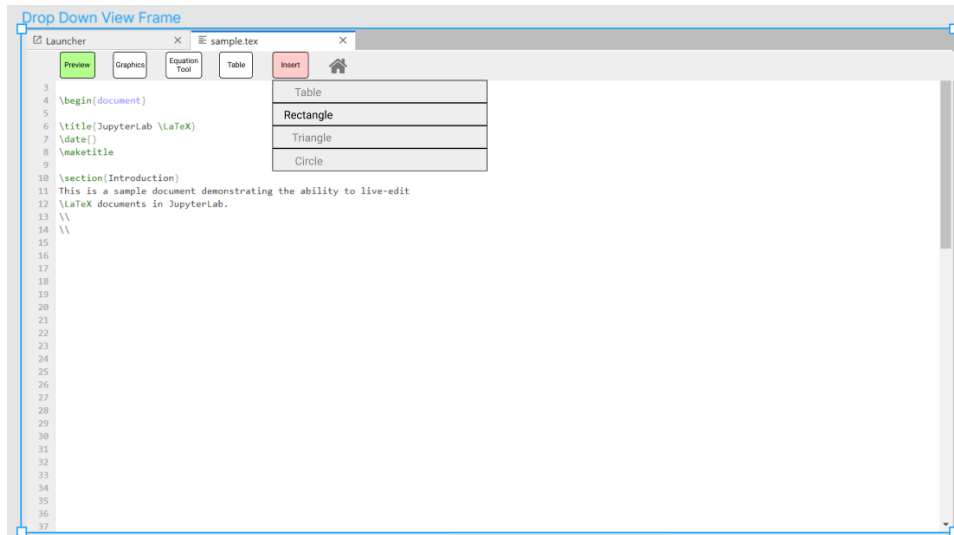# Appendix C: Ancillary Screens

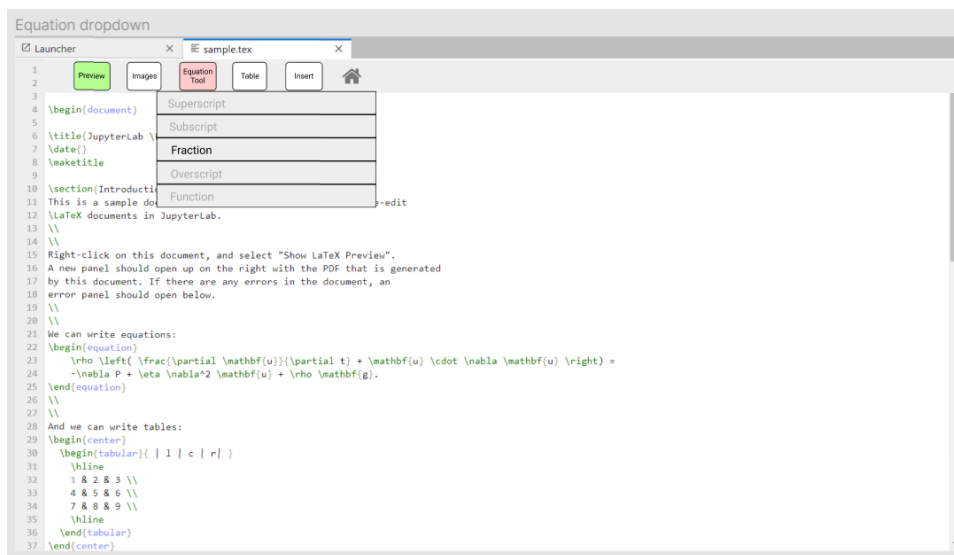Figure 11: Insert shape dropdown menu
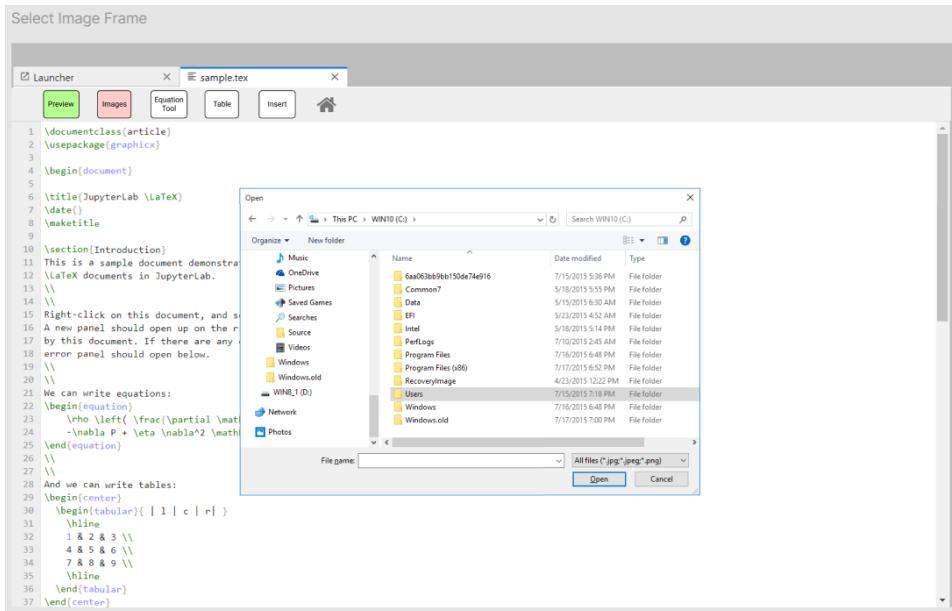

Figure 12: Insert fraction dropdown menu

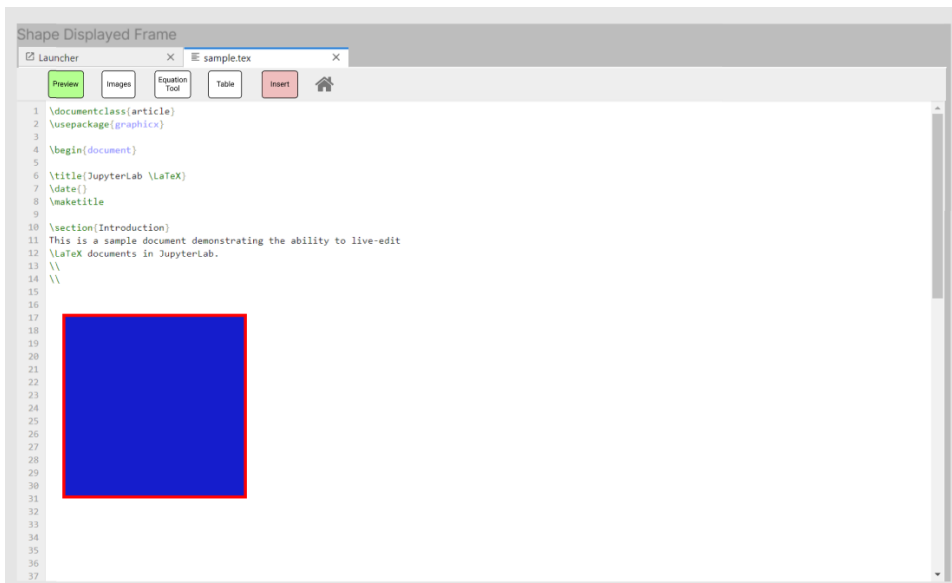Figure 13: Select image explorer

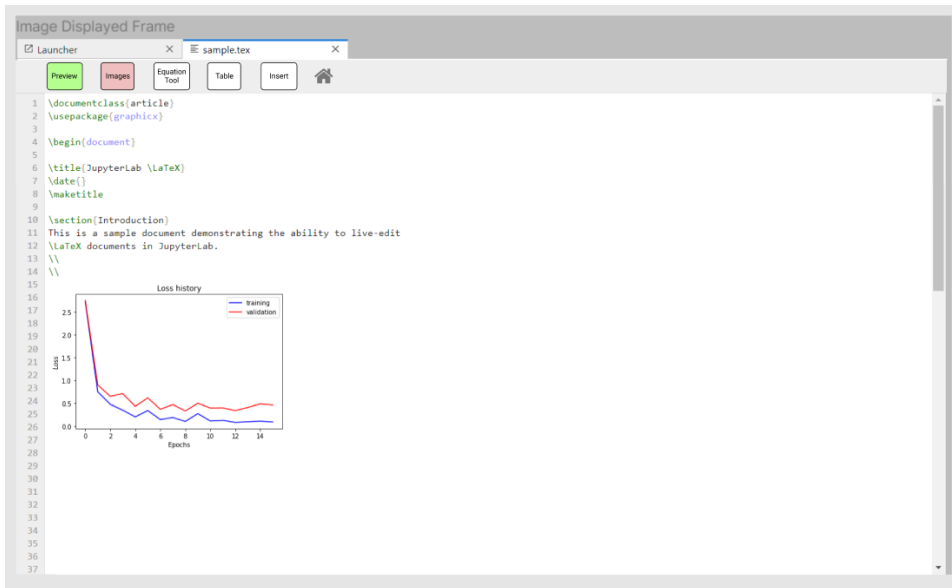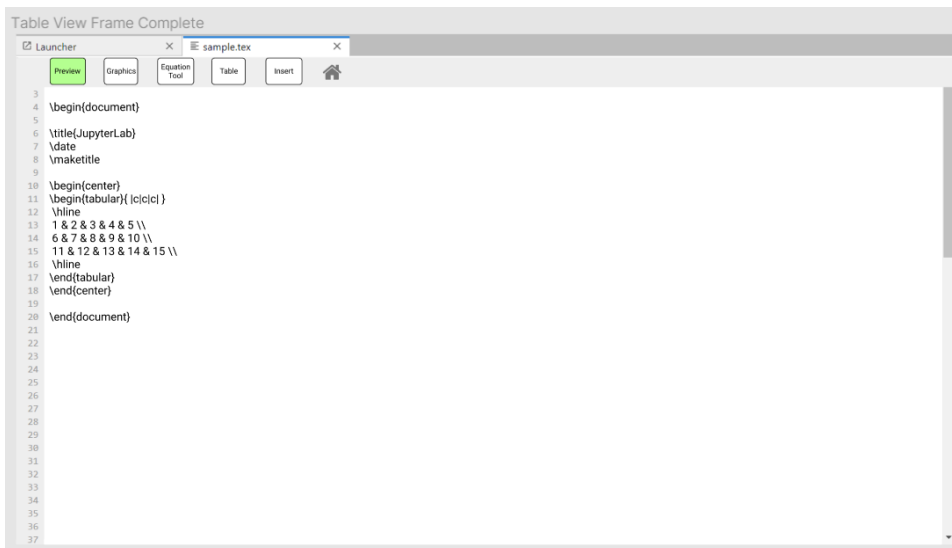Figure 14: Document after rectangle was inserted

Figure 15: Document after image was inserted

Figure 16: Document after table was inserted