

Documenting a user-centered approach for designing and developing an ADA compliant online tool for visualizing acid-base chemistry

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ABOUT

This project created an online tool, that we call "The pkAnalyzer". It enables the exploration of acid-conjugate base distributions in an easy to use Web interface. This project is also an example of the disciplines of Arts and Design into the STEM sciences, i.e. STEM to STEAM, and University Libraries commitment to faculty, students, and staff throughout the Virginia Tech system, in the areas of data visualization and design services to aid in the research process and communication of results.

Beyond the functionality of the tool, this project involved the planning and designing a custom, modifiable, and attractive user interface (UI) and visualization that are "user-friendly", and incorporate the World Wide Web Consortium's Web Content Accessibility Guidelines (WCAG), and falls with the Federal Government's Section 508 guidelines pertaining to creating and maintaining information and communications technology (ICT) that is accessible to people with disabilities relating to vision.

Using a "Design Thinking" approach, all aspects of the design of this tool – User Interface (UI), User Experience (UX), Interaction Design (IXD), Graphic – were taken into account, and developed to enhance the user's experience using the tool, and understanding of a complex chemical concept that is widely used in the basic and applied sciences and engineering.

METHODS

For the prototype, the visualization and interface were built using Plotly, a developer of open source online data analytics, graphing, visualization, and statistical tools and libraries.

The layout is based off an initial mockup that has basic features and functionality outlined. Before more time and money are spent on further development, the tool will be user-tested in courses that involve ionization fractions at Virginia Tech, by PI Professor Andrea Dietrich, and Professor Anne Brown.

DESIGN THINKING

Building an interactive tool requires understanding the user, how the tool will be used, and what the purpose is for building the tool – i.e. learning outcomes. From these three focus areas, basic questions can be formed, answered, and defined that create a framework for the features and functionality of the tool, information architecture, and interaction design - all leading up to creating a positive user experience.

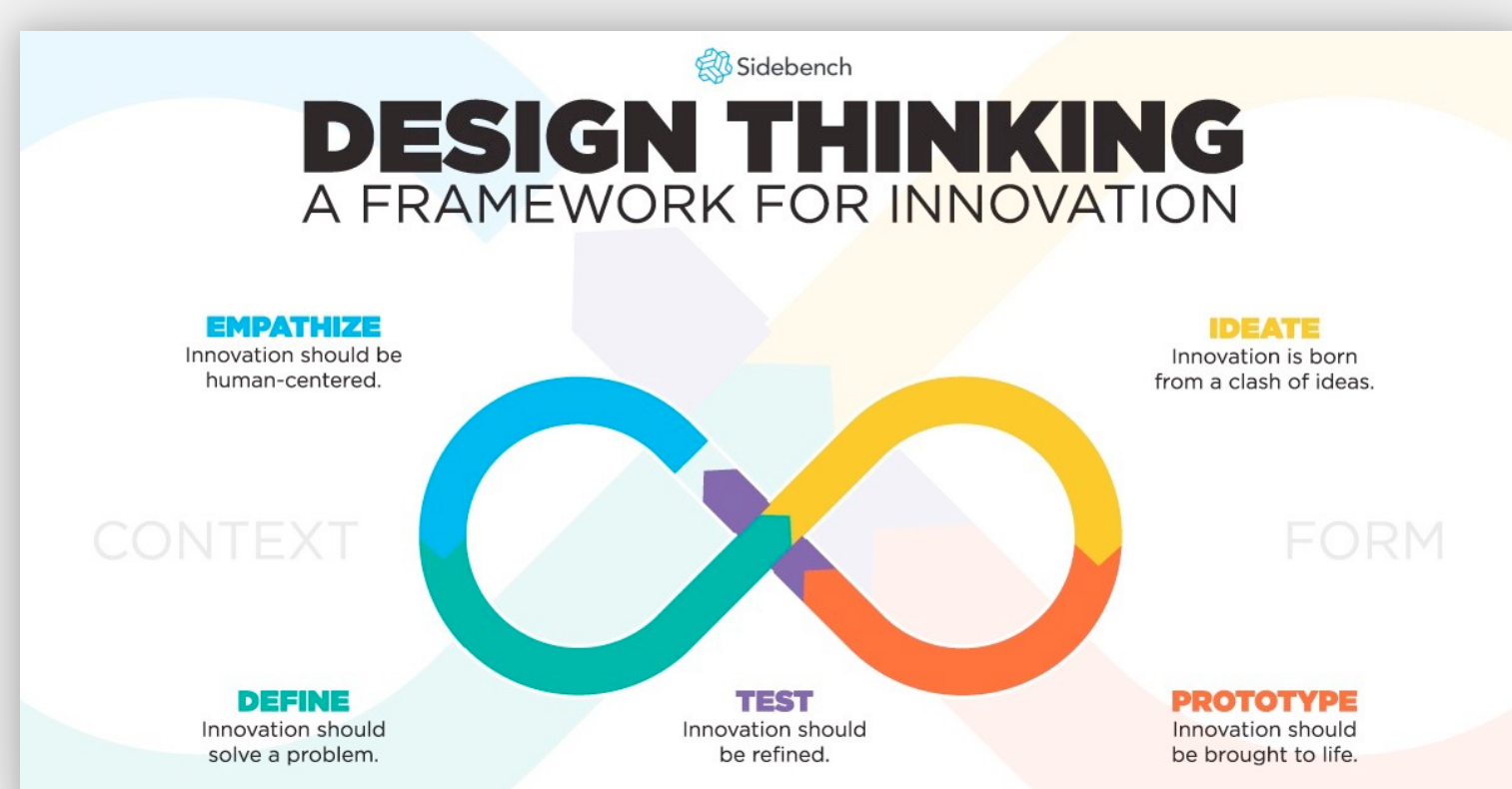
A list of some of the things that were defined during the initial brainstorming and conceptual sessions for the first iteration of this tool include:

- Identifying users
- Defining essential functions (need)
- Defining features (want)
- Creating a list of requirements
- Identifying appropriate fonts, icons, colors
- Identifying a framework (Plotly)

WHAT IS DESIGN THINKING?

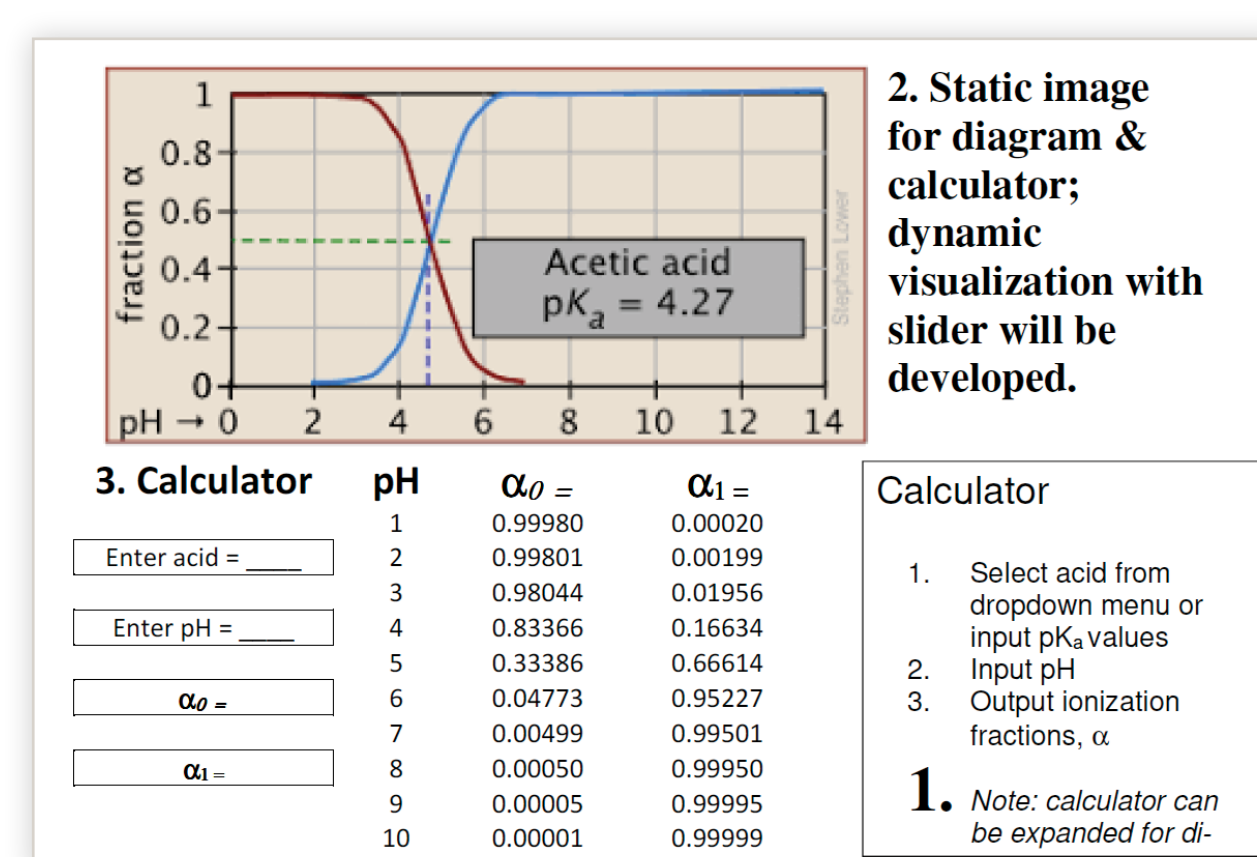
Design thinking is a non-linear, iterative process which seeks to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test. The method consists of 5 phases—Empathize, Define, Ideate, Prototype and Test and is most useful when you want to tackle problems that are ill-defined or unknown.

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<https://productcoalition.com/design-thinking-ist-just-for-your-product-development-team-68>

THE DESIGN PROCESS

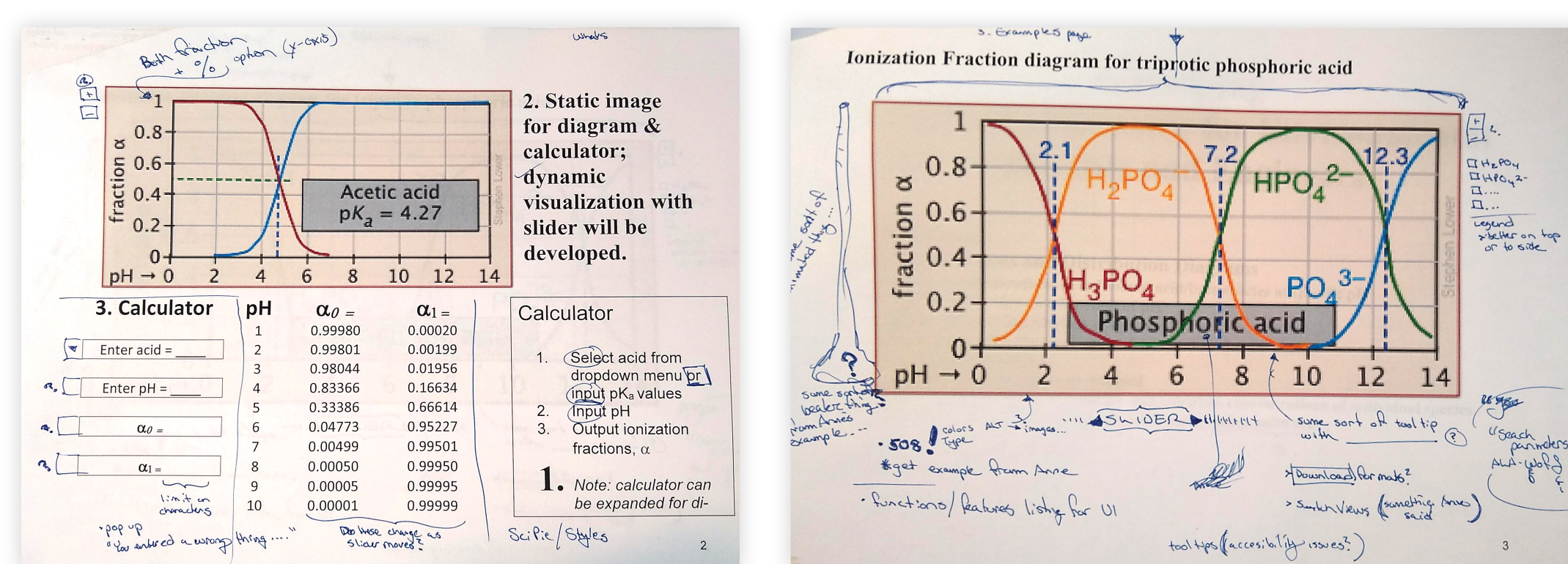


To the right is the initial mockup put together by Prof. Dietrich that outlines the basic layout and functionalities of the tool.

This mockup created a slew of questions, most of which I could answer, some I would need more input from members of my team.

These questions and answers helped form a list of requirements for producing a Minimum Viable Product (MVP).

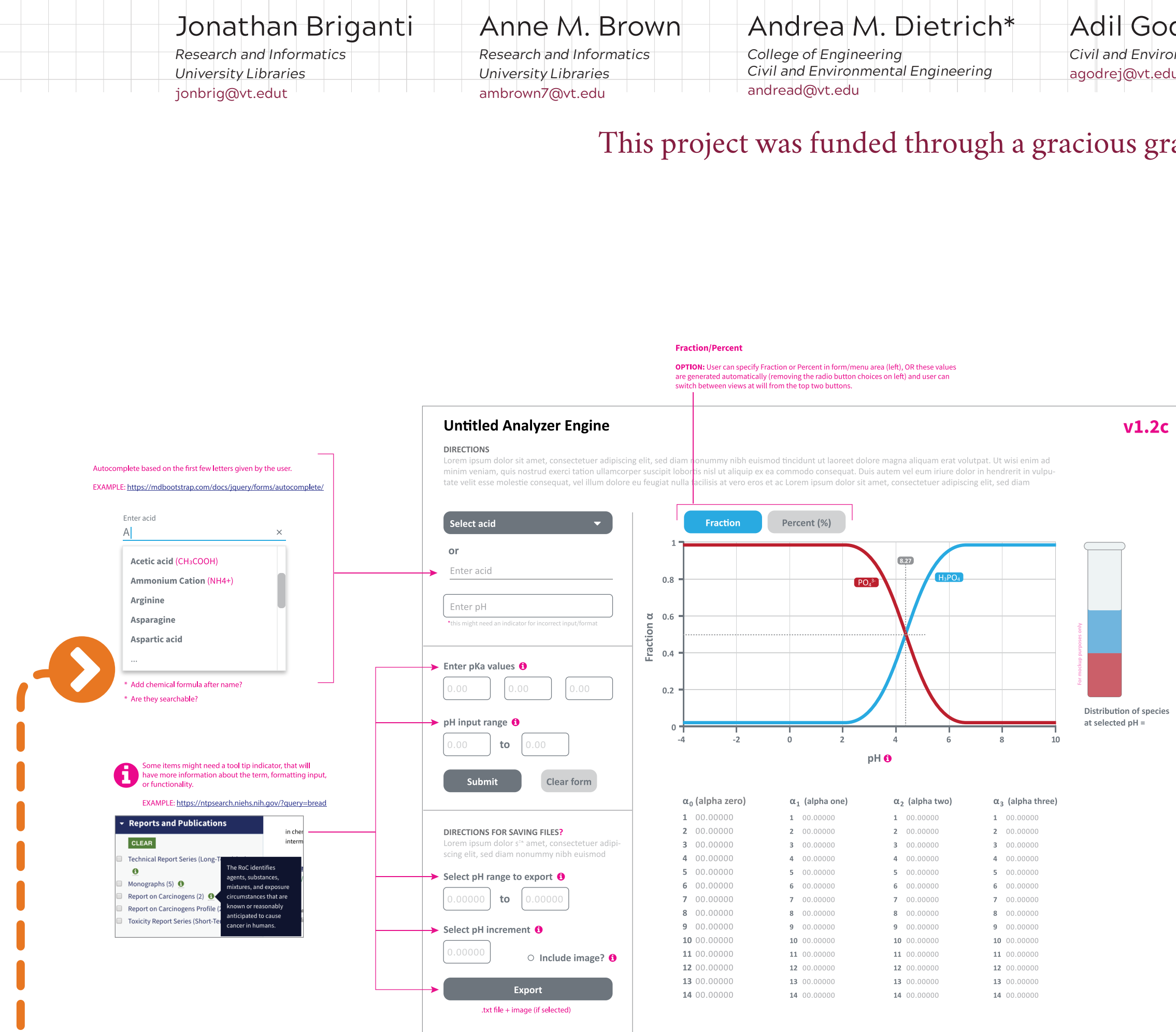
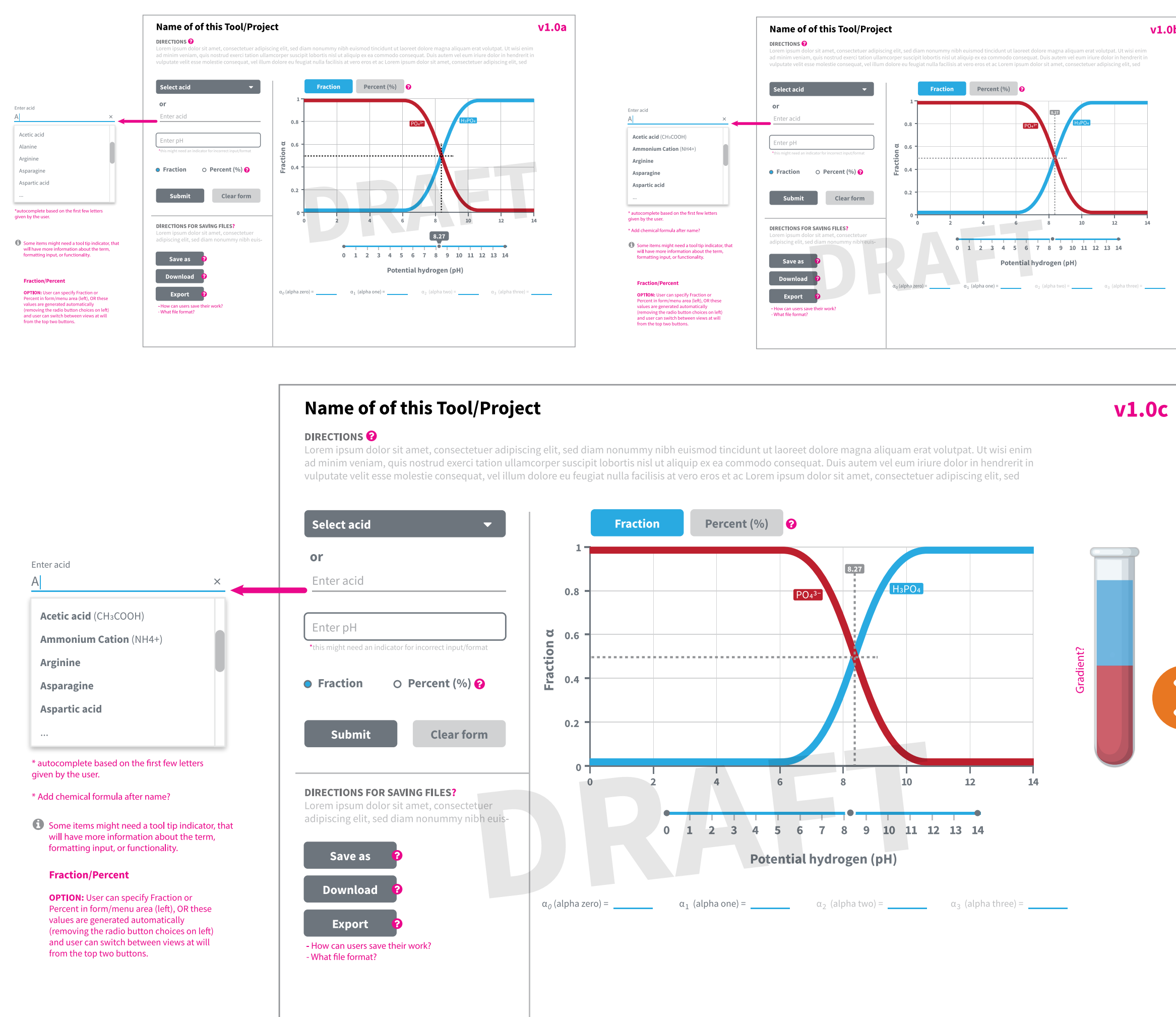
NOTES FROM KICKOFF TEAM MEETING



Comments, questions, and scribbles from the first team meeting to discuss division of work, benchmarks, and goals. You can also see some thoughts on HOW users will interact with these defined input fields, and how this layout would change when adding extra elements to aid in overcoming accessibility issues.

WIREFRAMES

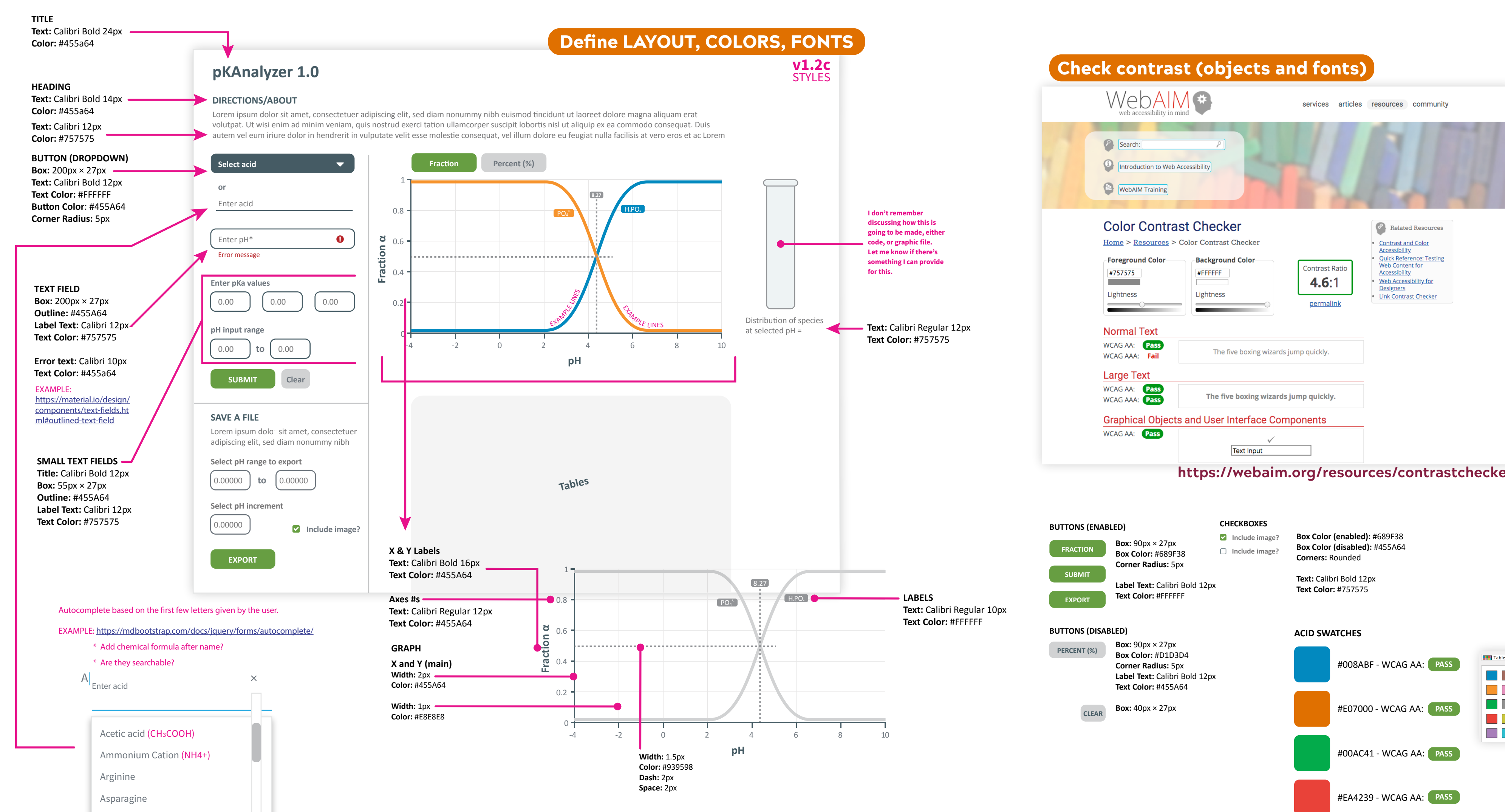
Here, the interface is starting to take shape. There are design decisions still to be made on look and feel, functionality (sliders, drop downs, search fields, etc.), that will need to be made during the next meeting, hence THREE mockups, with slight modifications from screen to screen. This gives stakeholders limited options for further refinement of these mockups, elements to discuss (further refining requirements for the MVP) the ability to cherry-pick elements that should be incorporated into another wireframe, or simply choosing one and sending it off to a developer. Design notes, references, examples of functionality, and version numbers are in hot pink, so they are not mistaken as part of the design for discussion.



THE "FINAL" DESIGN?

Not in the least! But, for this part of our three-month grant for this project, this is the final wireframe, where MOST of the interaction has been defined and layout confirmed.

NEXT STEPS



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This poster was created for the 2019 Gordon Research Conference, Visualization in Science and Education – Educating Skillful Visualizers. Held at Bates College, Maine on July 14 - 19, 2019

Michael J. Stamper is the Data Visualization Designer and Consultant for the Digital Arts at University Libraries at Virginia Tech. He has extensive experience working in data visualization, information design, and experience engineering for academic institutions, private companies, and the Federal government. Before coming to Virginia Tech, he was the Design Lead at the NIEHS National Toxicology Program (NTP). At Virginia Tech, he advises and supports administrators, faculty, and students with their data and information visualization and design needs, helps to define and refine requirements for projects, performs user research, specializes in user interface/experience design, and integrating the arts, design, and sciences into effective, meaningful, and insightful visualizations and presentations. He is also a member of Virginia Tech's Fralin Life Science Institute's Faculty Activity Support Team (VT-FAST).