**Collaborative Student Lab Manual**

Todays academic science labs rely heavily on pen and paper exercises which are carried out by students in individual lab manuals. This approach towards completing science labs has two distinct problems. The first issue with a pen and paper approach is that students have very little control over the data they are collecting. Students are required to transfer their data to a computer or graphing calculator in order to perform routine analysis which could have been completed upon intake. The second inherent problem with old fashioned lab manuals is that modern students find science labs to be the only class in which they need folders and paperwork, as opposed to all other classes where they can take notes from their laptops. The goal of this proposal is to transition the cataloguing and analysis of data in a science lab towards an application based virtual lab manual. The virtual lab manual will enable students to collaborate while completing the given lab as well as providing students with powerful mathematical tools to analyze their datasets. Students will be able to access their work from any internet enabled computer with the necessary software installed and datasets can be saved for reference in future classes where the same lab is completed.

The application will consist of three distinct user stories. The admin user will be limited to the creation of student and teacher users as well as basic database administration functions. The teacher user will have the capability to create a science lab form and assign the form to specific students to complete. The form itself will consist of numerous modules including text boxes, charts, and multiple choice selectors. The student user will have access to the form once permission has been granted by the teacher. Students will also have access to data including how far off they are from the class average and how far off they are from a teacher guideline after they complete a given module. Important data such as this will allow the students to correct mistakes before they become irreparable. Students will have access to their completed labs for the duration of the science course.

**Intellectual Merit**

Updating the class averages for given datasets based on which students have completed the module will be a technical challenge. The large amount of communication between the database and the application will need to be handled by a dedicated query engine hosted locally within the application. An algorithm will determine how many students have previously completed the lab section that the student is currently working on and provide data from the completed labs based on this information. Additionally, a flexible database schema will be required to deliver adequate performance in this application. The act of a teacher creating an interactive form consisting of predefined modules presents a degree of technical difficulty. A content creation algorithm is required in order to build the module for the student to fill out as well as create the corresponding documents in the database according to an intelligent naming convention.

**Broader Impact**

The Collaborative Student Lab Manual has a great deal of potential to change the way that the academic world handles science labs. This application provides the opportunity for these science classes to join the 21st century and offer students every advantage possible for a higher degree of learning and retention. Particularly, this application provides the unique ability to notify a student that they have made an error at the time that the error is made rather than waiting until the student analyzes their data at home. The use of helpful technology in the science lab will increase the appeal of such classes and continue to grow the pool of successful STEM field graduates.