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Math-taculous for math education

Vision

Math is a core subject in schools from the primary to postsecondary levels. It is in this position because it is useful for so many disciplines. Thus, it is an important subject for students to learn well. Unfortunately, the growth of computers as a teaching tool has not fundamentally improved on the way student learn math. Many math education products, such as WebAssign or the Math Blaster series, allow users to input answers electronically, but the problem solving process itself remains a mental or pencil-and-paper task.

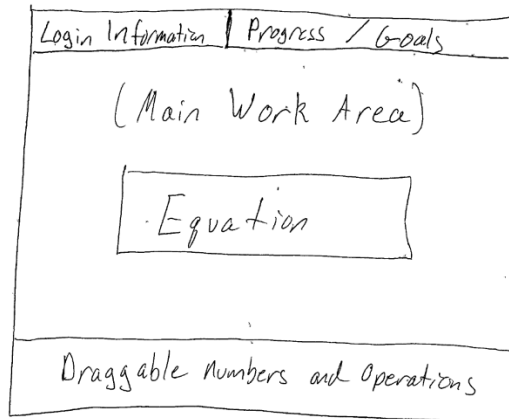
One particular challenge in math education is with algebra. Although arithmetic operations such as addition and subtraction are easily illustrated with real world examples, equations that students encounter in algebra are often more abstract. Students would benefit from a tool that associates a more tangible experience to these abstract concepts. Algebra is an integral part of higher mathematics, and failing to master it will cause more frustration later.

Math-taculous helps students learn math in a new way by allowing them to manipulate algebraic equations. Users are presented with an interface for building expressions and then modifying them by dragging, dropping, and combining items. With these operations, users can perform tasks such as solving for "x" or simplifying terms in a way that is more tactile-focused than the alternative of simply inputting an answer. With this tactile approach, the experience is centered on the process rather than the answer. Students can now receive feedback on their approach to a problem, so as to understand the all aspects of a problem.

$$\begin{array}{ccc} \frac{6}{x} + 4 = 9 & \Rightarrow & \frac{6}{x} = 5 \\ \frac{6}{x} = 5 & \Rightarrow & 6 = 5x \\ 6 = 5x & \Rightarrow & \frac{6}{5} = x \end{array}$$

In order to facilitate classroom use, Math-taculous will also provide a user sign-in system for individuals to track their progress, as well as for instructors to assign exercises. Instead of just a list of answers, instructors will be able to see the thought processes behind a student's work, quickly identifying common sources of misunderstanding. This additional information will allow instructors to tailor the curriculum more specifically towards the progress of his or her students.

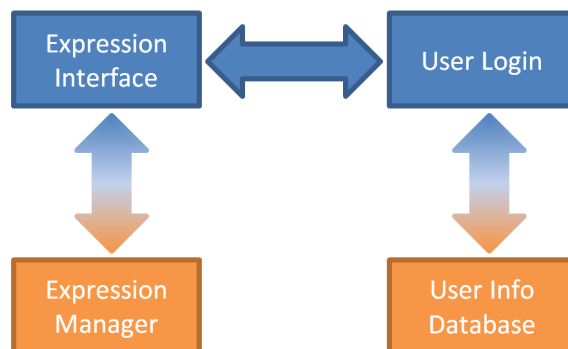
Example Interface



Architecture

In order to provide a high level of accessibility, Math-taculous will be a web application. Because of the heavy emphasis on the graphical interface, much of the development will take place in HTML, CSS, and especially Javascript. The graphical interface will depend on a separate module that keeps track of the mathematical correctness of expressions onscreen. The drag-and-drop paradigm expressed by the user's manipulations can be implemented with the help of the scriptaculous library, from which the name Math-taculous is inspired. PHP and SQL will be used for the user login module.

Blue components are visible to the user, and **orange** are not:



Challenges

The user interface is the central focus of this application. Ensuring that users can make arbitrary manipulations that are represented correctly both on screen and internally presents the biggest challenge. In order to minimize the challenge, during the design and testing phases we will emphasize the logical separation of the user interface and the internal logic.

Additionally, the most frequent complaint from users of mathematical teaching software is that correct answers are often marked incorrect. If we are not careful, these issues could be magnified by graphical integration. Once again, these issues will be mitigated through careful separation of the user interface and the internal logic.