

Describe the problem, issue, or area of interest and the context.

I teach about ten different courses at or beyond Intermediate Algebra, and in every class a *majority* of my students cannot complete basic algebraic tasks. I have gathered data on what kinds of algebraic mistakes they make and sought to discover why they made them. I then designed an Intermediate Algebra course around making my students more “fluent” in algebraic tasks.

Define your desired goals, or “outcomes.”

1. I wanted my students’ algebraic skills to be more flexible, portable, and context-free. I wanted them not to just know *how* to do something, but *when* to do it as well.
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3. I wanted my students to be able to express themselves in writing, justifying steps, documenting solutions and thought processes, and reflecting on what’s been done.
4. I wanted students to understand the *underpinnings* of algebra, to be able to understand why things like the distributive law are true, and to be able to complete tasks without traditional shortcuts such as “canceling,” “F.O.I.L.,” “cross-multiplying,” and equation-solving steps without regard to associativity and commutativity.

Describe your “indicators” of success.

My only indicator of success was whether students could correctly solve problems posed on exams, quizzes, and homework—the most important indicator being performance on the final exam, which was cumulative, with questions being asked in no particular order, and with many questions tying in skills from multiple areas.

Describe your project.

My project had two phases: research and implementation. First, several hundred final exams from 8 different courses were scanned for algebraic errors. The errors were collected, categorized, and studied. Reasons for why the errors were made were postulated, and plans were made to develop algebraic instructional materials to address these errors.

Then, lecture notes (available to the students) were developed for the entire semester and were used in place of a textbook to deliver the course content. The lecture notes sought to teach algebra with certain unique rules and themes in mind, with an emphasis on rigor, thoroughness, writing, reflection, and correction. Unique exercise sets were developed as well as unique on-line quizzes.

Describe your results.

Sixty percent of the students who began the course finished with a C or better (slightly lower than departmental average). Of those who withdrew from the course, some seemed dissatisfied and annoyed. Fifteen percent of the students received an “A” and seemed to have a strong grasp of the material. These students all received higher than 95% on a difficult final exam and I felt better about their algebraic skills than I have felt about any students I’ve had in the past. The instructor evaluation forms at the end of the course were more positive than usual. One student said, “I learned more math in this course than in all my previous math courses combined.” Another student said, “No one ever asked me ‘why?’ in a math course before.”

I learned two major lessons (and lots of minor ones) during the project. First, all of my students had some bad mathematical habits that were hard to break. Second, when I started requiring more of my students than I usually do, then some students begin to show their unwillingness to learn (they can’t be bothered with the “why” or even “how”; they just want the answer).

My project was more than just a project. It is the beginning of the way I will always teach algebra, and I plan many revisions in the future, and hopefully even a book will be written.

Describe your evaluation methods.

My evaluation method was simple: Did my students learn algebra? Are their skills portable and long-term? Beyond a final exam, I can only guess.

The project was revised several times as I went along. Often the lecture notes were revised the day before they were used in class. Changes in further implementation are a necessity.