Using Differentiated Physics Homework to Create Self-Regulated Learners

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Background

- Payson High School, located in rural Arizona, has 762 students.
- Students enrolled in physics range from 10th-12th grade (*N*=27).
- It was noted, in years prior to the implementation of this study, that few students completed their physics homework. Those that completed the homework often did so carelessly.

Goals

The main goal of this study was to:

- Determine how differentiated homework impacts students' mindset about learning.

Additional goals of this study include:

- Determine if differentiated homework promotes self-regulated learning.
- Determine if students can use the Question Formulation Technique (QFT) to identify their area of greatest need, the focus of their homework.

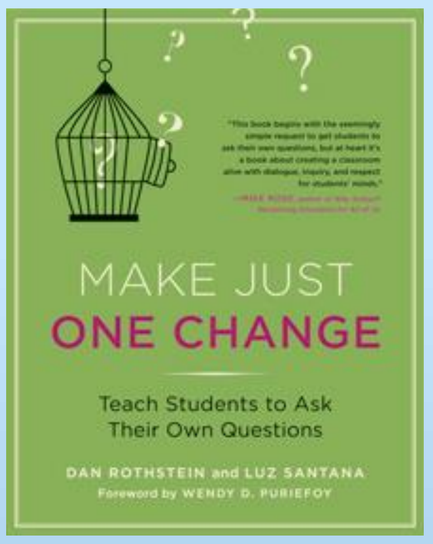
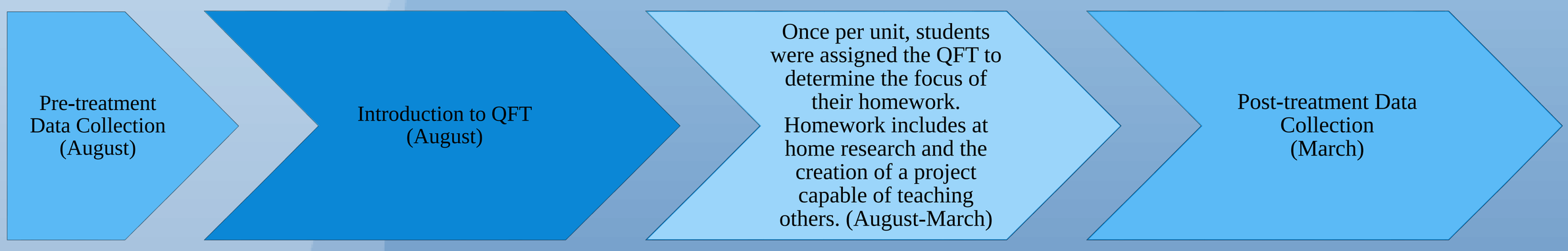


Figure 1. The QFT, introduced in the book *Make Just One Change*, is a step-by-step process that empowers students to ask their own questions. The process includes:

1. A Question Focus
2. The Rules for Producing Questions
3. Producing a Minimum of 10 Questions
4. Categorizing Questions as Open or Closed-Ended
5. Prioritizing Questions
6. Creating a Project to Demonstrate Gained Understanding
7. Reflecting on the Learning Process

Methodology



Data Analysis

- The pre and post-treatment data from the Science Motivation Questionnaire and the Colorado Learning Attitudes about Science Survey were analyzed by using diverging stacked bar charts.
- Survey data was coupled with interview responses and evaluated for common themes.
- The number of students who felt that they could solve a problem on their own, even after an initial struggle, increased following the implementation of this study.
- A subset of students, representing 29.62% overall, demonstrated the ability to complete differentiated homework in its entirety for each unit of study. This suggests that students are capable of becoming self-regulated learners.
- When asked of his thoughts as they relate to differentiated science homework, one student said:

"I'm excited to learn about the stuff that I need help with…"

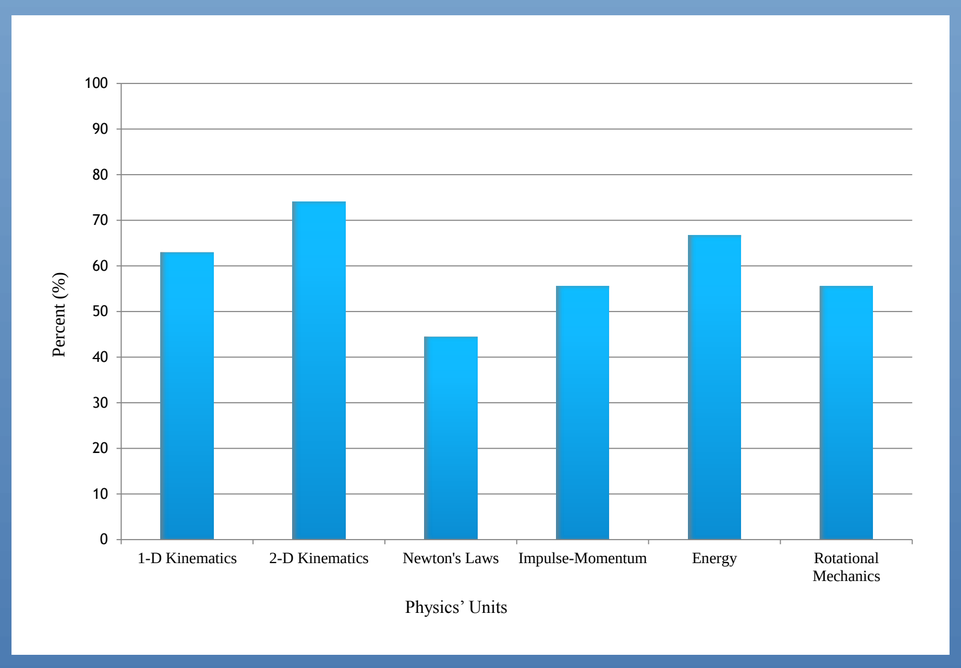


Figure 2. Homework Submission Rates by Unit, (*N*=27). The data sets are shown in the order in which the units were completed.

Values and Claims Reflections

- The use of differentiated homework in the science classroom is a work in progress. For those that embraced the idea of working on weaker skillsets, challenges became accomplishments.
- Differentiated homework, with refinement, may offer a method towards consistent attainment of the science and engineering practices in the Next Generation Science Standards.

- Questions for future research:
  1. Can differentiated homework be successfully implemented amongst adult learners, like in a college setting?
  2. As students are all starting and performing at different levels, how should differentiated homework be graded, so as to provide equality?

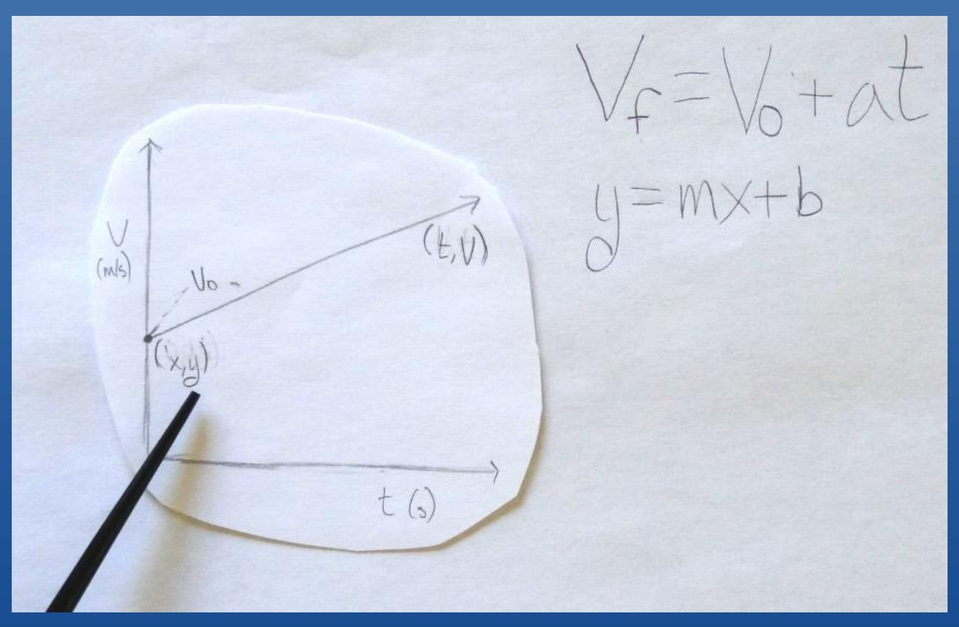


Figure 3. The student that created this stop-animation film, during our second unit of study, did so because she was uncomfortable with the idea of deriving formulas based on graphical relationships.

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