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Let's Talk Physics: Utilizing Language to Improve Understanding

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Let's Talk Physics: Utilizing Language to Improve Understanding

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Abstract

Einstein once stated that "If you can't explain it simply, you don't understand it well enough." This idea can be useful in the context of a physics classroom where students often struggle with conceptual and mathematical understanding. The purpose of this study is to analyze strategies to improve student comprehension using language based instruction and assessment techniques. This research was conducted in a public high school physics classroom consisting primarily of junior and senior level students. Students were provided with instruction that focused on discussion and conceptual understanding before any introduction to formulae. Furthermore, students were also asked to construct their own definitions of concepts during class and on assignments. Data showed that students who developed a linguistic explanation of concepts demonstrated a higher level of understanding. This result is also reflected on students' homework, assessment, and participation in general discussion of physics concepts.

Research Questions

- How can language be incorporated into a high school physics classroom?
- What are the benefits of incorporating more written and spoken language in a physics classroom?
- What are the trade-offs of having a language based learning and assessment?

Methodology

- Data was collected in a high school honors physics classroom.
- Students were instructed using discussion and inquiry. Additional discussions of definitions and hands on activities were prevalent in each class period.
- Students were provided with prompts on homework and in class that required them to discuss phenomenon in their own words.

Sample Work

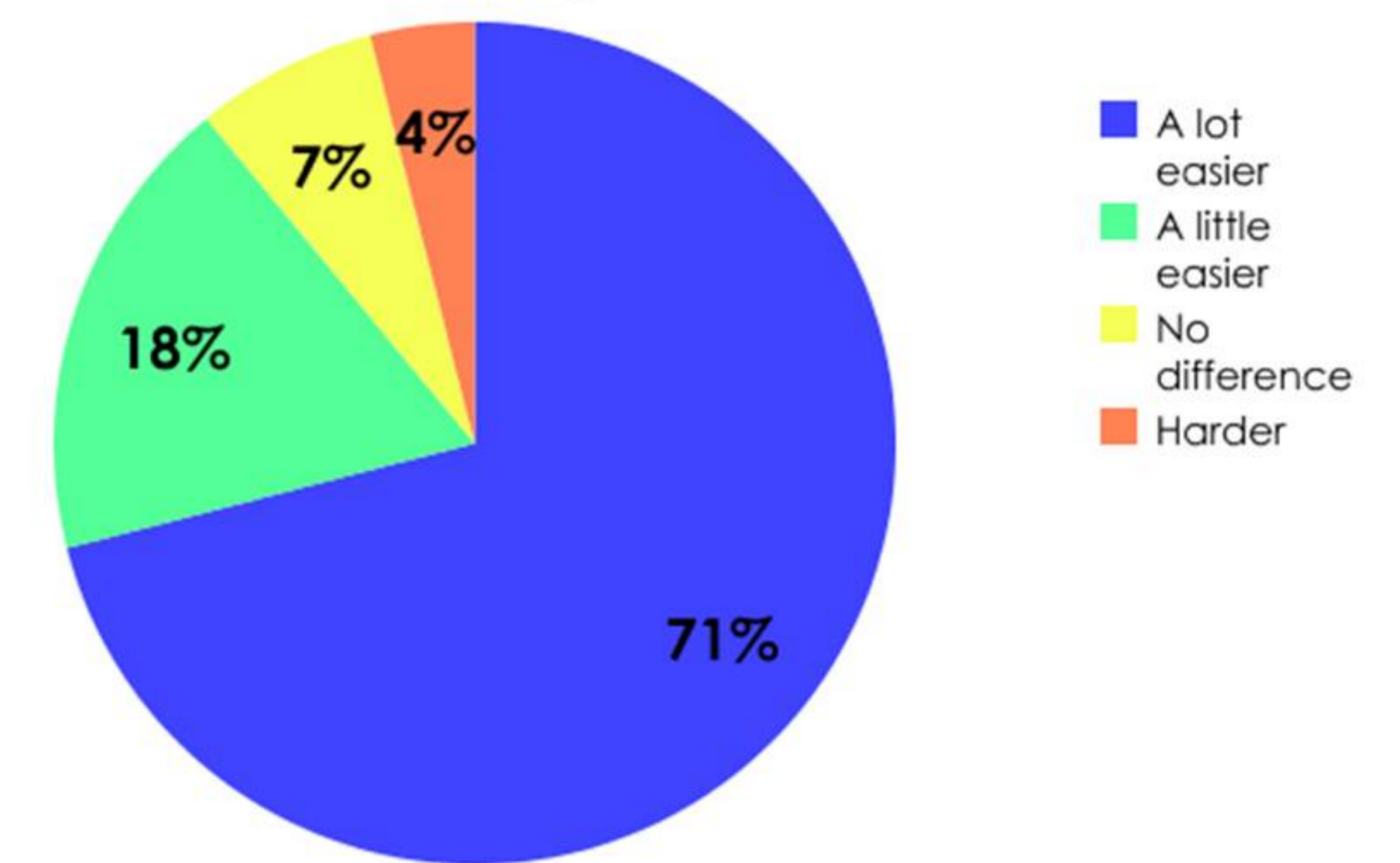
Define what a magnet is in your own words

- "...something that produces a field that makes a force on magnetic fields."
- "An object that has a field that is like an electric field."

Describe your series circuit in terms of voltage. What would happen if your light bulbs were placed in parallel?

- "Nine volts come out of the battery and go to the light bulbs, which are in a line. Each bulb has to share small portions of the 9 volts. If there are more bulbs, each one uses less voltage and they are dimmer. Parallel bulbs can all have the same amount of voltage because they get it at the same time."

Ease of Homework after Discussions and Written Responses



Conclusions

- Teachers can increase language usage in their classroom by promoting in-class group discussions (i.e. why is this happening?)
- Written language can be implemented in assignments, in-class activities, and on tests (especially using definitions).
- Using Inquiry, students are able to take responsibility for their learning.
- Added discussion increases student understanding and motivation.
- Written response questions promote critical thinking and better tests student progress.
- Students tend to enjoy it! (See Figure)

"I learned very early the difference between knowing the name of something and knowing something."

-Richard Feynman