"The errors were the results of errors": Promoting Good Writing by Bad Example

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We learn best by example—this adage is probably as old as teaching itself. In my own classroom, I have found that very often the students learn best from the "negative" examples. Perhaps, this shouldn't come as a surprise at all. After all, we don't react strongly to the norm—but an obvious deviation from the norm may attract our attention and make for a great teachable moment. And, if the deviation happens to be either scary or funny, the added emotional impact can create a truly powerful and lasting memory in the minds of the students.

I must confess that, due to some unfortunate legal restrictions existing in the state of Massachusetts, I am not at liberty to make my classes really scary[1]—but I do enjoy making them funny. Not only does humor help us all deal with stress and fatigue, it can also be an effective teaching tool. In this article, I would like to describe one semi-serious classroom activity that I tried recently with great success.

I teach three sections of Honors Physics to ninth-graders.[2] One of the issues that I work very hard on is developing the students' writing skills.[3] The need for that is especially evident when I grade the lab reports. Unlike most tests and quizzes, they provide the students with ample opportunities to create their own narrative, to be truly creative, and to torture the English language mercilessly along the way. Some of the errors are purely stylistic or grammatical, some reveal existing misconceptions, some show the pitfalls of the spell-checking software—but the vast majority of them are the testament to the lack of thoughtfulness, care, and proofreading. For years, I have been collecting the most shocking examples of student writing for my own pleasure, but this year,[4] I decided to share some fun with my students and, maybe, shame them into trying a little harder.

As I was grading a recent lab report, I collected as many verbal gaffes as I could find—and then I made a slide show out of them. I wanted to see what the students themselves would think when the samples of their writing are shown on a big screen in front of everybody. No names were attached to the quotes, so as not to embarrass anyone, but I found that the suppliers of the funniest bits readily announced their authorship in full accord with the notion that there is no such thing as bad publicity. We had a lot of laughs (always a good thing), but the laughs led to a very serious discussion afterward.

The lab report described the experiment that involved finding the acceleration due to gravity on Earth (g) by analyzing the motion of a glider accelerating down a slanted air track.[5] The students were asked to use the law of conservation of energy to calculate the experimental value of g, compare it with the standard value and determine the relative percent error (RPE). In their reports, they were asked to discuss the experimental procedure, describe their findings and make reasonable conclusions. Of course, "reasonable" is in the eyes of the beholder...

I must say that, at least from their own perspective, the students did take their work quite seriously; after all, "*gravity is a major part of physics—it affects acceleration*."[6] They also knew that I meant business: "*[Y]ou are physically instructed to find the percentage*." It seemed clear to them that "*[t]he results should conclude with the real answer*" and they set fairly high standards for themselves: "*I hypnotized that gravity would be 10.2*."

They then described the experimental set-up. It turned out that not everyone was sure about the terminology: I learned that "*the hair track was slanted levelly*" and that the "*materials included the air track and the triangular thing*." However, others knew exactly what they were doing and noted that "*the air track was fattened out*"[7]— after all, "*a slight tilt in the original pitch could mean drastically different results than when properly done.*" Meanwhile, "*the glider was poised at the top.*" Oh well...at least, they realized that "*the important procedures were to know how to use the air track*" and that "*[t]his lab may be a teaching tool to other uses*." As one student noted philosophically, "*the purpose of this lab is to get used to the new things that we will be using and doing*."

The students then described their measurements ("*the experiment was performed by timing the length it took the glider to accelerate*") and calculations. Some went to great pains to describe what they did, as in "$0.5t^2$ *was calculated by squaring the time and multiplying by 0.5*." According to one report, "*the original data was then misinterpreted onto a graph*." Some students claimed great success: "*the results were similar to those of expected results*"; "*the data seems to be under the relative percent error*", "*our conclusion was close to 9.8*" and used highly scientific language, as in "*the result... supports the proposed hypothesis that the evidence would support the formula...*" Meanwhile, others stated flatly that "*the results did not support the experiment" and that "the RPE was not an especially good number to be in*"—but optimism reigned: "*This value is not great but the first time it was horrible*."

I always ask my students to pay attention to the potential sources of error in their experiments—and they are always happy to oblige. Hey, "*there are many possible places for error in all experiments*", right? One student seemed to blame fear: "*The main source of error was that people were shaking,*" while another noted, somewhat cryptically, that "*people had troubles*

dealing with Newtons and angels." As they say, the devil is in the details... At least one group "*suffered from systematic error*" that, according to some, "*could have occurred in miss measurement.*" Another report lamented that the "*systematic errors included friction, air resistance, and my partners.*" But, hey, "*the positive side of a systematic error is that it is proportional to its true value.*"[8]

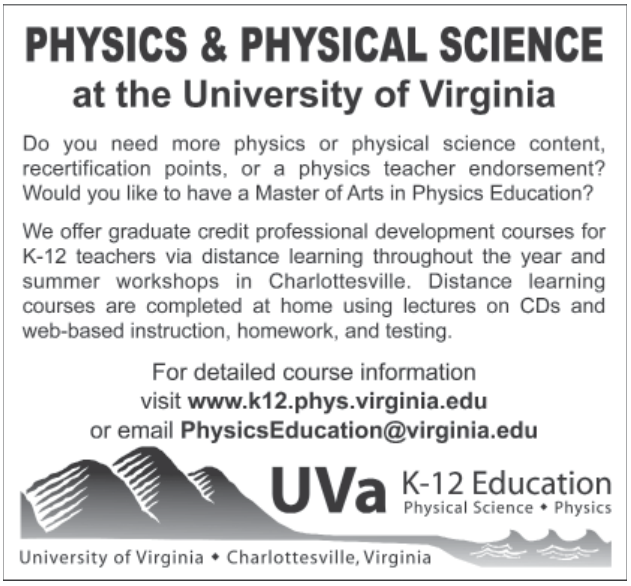
Being true 21st-century creatures, my students seem to think that technology is a cure-all. "*Computers are the best calculators and recorders in all of time,*" they said, and, naturally, "*the inaccuracy occurred because the operators of the air track were not computers.*" Some students don't even consider their own species to be of any use: "*The fact that we are all human is an error*" and ominously suggest a radical solution: "*the... error can be fixed by creating a mechanism that would eliminate the human[s]...*" Others were more diplomatic, simply stating that "*a source of error is that better equipment is not available*" and that "*faulty machine calculation can be fixed with stronger equipment.*" Many students echoed the idea: "*To reach good results, it would require expensive machines in space with infinite control.*" In particular, "*robots could run the experiments, so they wouldn't hesitate before letting go.*" Finally, many blamed the very air they were breathing: "*the air tracks are supposed to create a frictional environment. The only way to eliminate the air resistance is to create a vacuum.*"

I, personally, am not sure how the air track can work without the air but the students were insistent that in "*a vacuum sutch*[9] *as one at nasa would be a good way to do tests.*"

After the show was over, leaving my students thoroughly exhausted from laughing at themselves, it was easier to discuss and "sell" some serious ideas about academic writing:

- Writing is a primary method of academic communication; acquiring good writing skills is important;
- Once released to the public, the written piece takes on a life of its own;
- A writer must respect the readers by proofreading and revising the work before it is released to the public;
- As indicators of quality, clarity and coherence take precedence over length and fancy language;
- The lack of thoughtfulness, care and revisions may cause major embarrassments.

I found that having a serious classroom discussion about writing was a lot easier and more productive when it followed a light-hearted presentation. The students were engaged and enthusiastic; since I mentioned no names, everybody felt safe and comfortable. Since then, I made it a point to bring up occasional (anonymous, of course) examples of "student bloopers" each time we discussed a paper or a lab report in class—and I did notice the difference. Some students began to ask me to look at their drafts; others followed my advice to edit each other's drafts; many of them simply began to put a lot more effort, care, and pride in their writing. While I wouldn't claim that every single student improved, the overall positive effect, on both the students' mood and the quality of their writing, was clear. I would encourage my colleagues to use the same technique in their own classes every once in a while. After all, to quote one of my students, "*This lab can be used to show the imperfection in lab reports, which is an escential thing to know about...*" Indeed.



References

1. Some of my students may disagree...
2. For more details about Weston High School and its freshman physics program, see B. Korsunsky and O. Agar, "Physics First? Survey first!" *Phys. Teach.* **46,** 15 (Jan. 2008)
3. I could write a few paragraphs about the importance of teaching writing across the curriculum, etc. etc.—but why beat the dead horse with a thesaurus?
4. The article was written during the 2008/2009 academic year.
5. Gliders and air tracks are available, for example, from PASCO: http://store.pasco.com.
6. Most student quotes, mentioned in this paper, can be found in B. Korsunsky, *Trophy Wives Don't Need Advanced Physics: Dubious Words of Wisdom from Physics Students* (Pi Press, New Orleans, LA, 2009).
7. It's kind of like "*slanted levelly*"...
8. I couldn't have phrased it better myself.
9. Students are *sutch* bad spellers...

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