Lessons from Dyslexia, etc.

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Learning Differences and Physics Teaching - some take-aways

1. There is not one approach that will work for all students.
2. Patience is essential. You may be shocked at how many times you repeat yourselves. It doesn't matter - if they ask you a question, gently and patiently answer it again. Processing speeds vary greatly. The point is - they were brave enough to (eventually) ask. Don't pull the "if you were paying attention in the first place" attitude. You'll seem like a jerk. (See also: avoid sarcasm)
3. Metric vs. English. Use metric. If you have meter tapes or meter sticks, cross out the non-metric side.
4. You are teaching children, not physics - the material is obvious to you because you learned it several times and have already done the problems and derivations. The steps in a derivation, and indeed, the rationale for doing a derivation in the first place is obvious to you. For that matter, most of your students may not be motivated to learn physics in the first place, especially if school (or science) has historically been difficult for them.
5. George Evans quote: "Every student can learn, just not on the same day, or the same way."
6. A. Huxley: "It is no good knowing about the taste of strawberries out of a book."
7. Require your students to have a note-taking scheme - introduce a variety of techniques.
8. Place equations in boxes; have highlighters handy.
9. Allow students to use their notes (or sheets, notecards) on a test. With short-term memory and executive function issues, they will need the support. Check student cards pre-test.
10. Use variables that make sense, wherever possible: d for distance/displacement.
11. Pre-lab explanatory videos can help, if they watch them.
12. Distance measures in room or hall; scale objects in room (Earth and Moon, for example)
13. You may have to teach kids how to study and take notes.
14. Scientific notation is baffling to many students - the TI calculators use of 2ND , as a scheme for inputting numbers is horrible for kids
15. In general, use of calculators can be hard for such kids - remembering how to divide ("what do I put in the calculator first?", etc.). Even entering an entire calculation at once can be hard.
16. Post mini video tutorials of calculations (screencast)
17. Build up lab report competence: give data table (with units) for first couple of labs, then build up sophistication
18. I have found that regular (2-3 per week) informal labs are way more effective than long formal labs; as a result, I rarely assign long lab reports - mostly for 2nd year kids.
19. Students often have trouble with trying to do "obvious" calculations: subtracting 2 location distances to get the net distance between 2 things (such as in the lens lab).
20. Post mini video tutorials (screencast)
21. Be prepared that students sometimes have an inability to get started - wasting an entire period, taking no data (getting distracted or never starting). Gently steer them into the lab. ADD is real.
22. Students can be surprisingly clueless about little things - picking up a lens and not knowing what to do with it. Never embarrass a student over this. (Yes, that's obvious.)
23. "Should we write this down?" "Yes, please" goes a lot further than anything else. One way to help is to put the important information in **bold**, including equations (and a legend to explain them). That is my standard practice: the most important content in my slide sets are in bold. It is also worthwhile to post references to the relevant slides for the day.

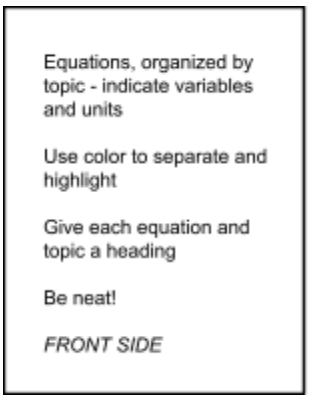
24. Triangle form of equations is not as obvious to students as it is to you. If someone is dysgraphic, they may still be a mystery.
25. Students can read directions and still not understand them. Again, pre-lab videos help.
26. No matter how many times you say something (what is g, what is c), kids will ask you again: short-term memory issues and/or attention problems. A large equation board may help.
27. You have to model good note-taking skills; same with studying, in general. Give time in class to review/update notes and create note-cards for tests.
28. Students often add units in each column of a data table or spreadsheet; it may seem "more complete" to them. The correct method (units at top) has to be reinforced.
29. Google sharing: Students forgetting to submit/share things - this is a regular occurrence. You can have students share their folders, but then you have to search through their folders each time. I have my students share labs after completing them, so that an email immediately comes to me - easier for grading large amounts of things.
30. Google calculator is better than phones for calculations, but do not allow students to simply copy and paste the problem into the search bar - yes, that works often, and students learn nothing.
31. Taking notes vs. copying and pasting: many students think of c/p as the same thing as note-taking
32. Expect some students to take huge amounts of time between trials - SLOW processing speed or memory issues.
33. You will hear "I'm so confused" over and over again, no matter how simple you want to think something is - it's not really about the science, it's about the sequence of steps
34. Wide variety of processing speeds - some kids may be nearly done with a lab and another student may be still creating a data table. Assigning data tables in advance works for some kids, but not if they forget to create it
35. Keep in mind that you will often have classes of similar (weak/compromised) background students, but mixed in with achieving students - due to scheduling issues, especially in small schools
36. Order of operations issues (not using parentheses), exacerbated by use of phone for calculators
37. Expect that some of your students will have NO number sense: "Is $1000 a lot to fill up a gas tank?" Also, having 2 numbers very far apart (experimental and theoretical) and not realizing how bad their comparison is, nor seeing that there must be some problem there.
38. When students see units in a table heading, they sometimes think that the units are an additional thing to multiply by: "So, the speed is distance/time multiplied by the meters per second?"
39. Students want things to be linear, so they may try to see a linear relationship when there isn't one.
40. Meter tape vertically on the wall (to reinforce what a typical height in meters is)
41. Expect that some students in their own time zone - interrupting class to ask a question from 20 minutes ago; not following along at anywhere close to regular class speed. Live with it and don't complain.
42. ADD x 3 kids feels like ADD^{10}. Gently teach them to be patient too, in waiting for help.
43. Students have big confusion with imperial systems and time conversions: 5' 2" is NOT 5.2'. 3.45 hours is NOT 3 hours 45 minutes. You will have to reinforce this.
44. No matter how many times you will demonstrate the right way to take data (and what to write down), students will make mistakes and write down things that make no sense.
45. Some students can only pay minimal attention to detail and writing; they may put words down that seem like gibberish to you, but they mean something in the kid's head; spelling may be an extreme problem and/or it may be very phonetic.
46. Making tables and graphs - lots of uncertainty and mistakes
47. Division or multiplication by 10 or 100, etc. - not obvious to many students

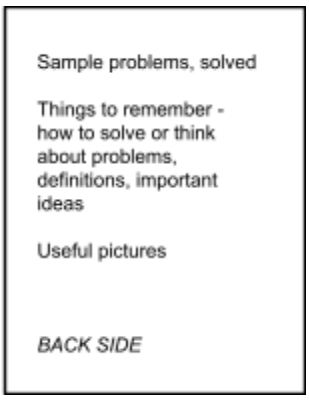
48. Digital notes have become the norm. You will have to teach students how to incorporate drawings and equations into them: in a Google doc, “Insert Drawing” helps. You don’t want students to spend much time searching for relevant images or equations. Yes, the evidence suggests that handwritten notes are better, but they are a nonstarter for dyslexic kids.
49. Test-taking is VERY tough for some students, even if you give copies of the questions in advance (on Kahoot or Quizlet, etc.). There will be impulsive answering on multiple-choice questions, and students sometimes miss key descriptive words in a sentence - “currently,” “greatest”.
50. Chunk out problem solving - for example, on a basic test question consider grading like this:

- 1 point (at least) for identifying variables
- 1 point for listing the relevant equation
- 1 point for plugging in numbers
- 1 point for the math
- 1 point for the answer
- 1 point for the units

51. No number sense example: a student subtracting 2 identical numbers and being surprised at 0
52. Expect that a paragraph may mean only 1-2 sentences for some kids.
53. Tech trouble is pretty regular - forgetting passwords, chargers, etc.
54. Students often confuse basic math functions, orders, etc. Never assume that they actually remember basic algebra or arithmetic, even if they are in trig.
55. Reading circuit diagrams is very tough for dysgraphic kids.
56. Some students will have zero confidence and/or need constant reassurance. “I just shared the lab with you. What should I do next? I got 4 - is that right? Can you check my work?” etc.
57. Graphs made with Google sheets are nice and free, but Graphical Analysis is intuitive.
58. Your students are probably using symbolab etc.
59. Many of your students will be “twice exceptional” or “thrice exceptional” - dyslexia, dysgraphia, and ADD, for example
60. You will have students on the autism spectrum - this is a whole other discussion. Remember patience. They may miss social cues in the classroom. Some things can present as anger.
61. Many of your students will have minimal executive function - notes, deadlines, organization, etc. will not be obvious to them. They will need scaffolding and significant support, especially for multi-part things with extended deadlines. Break it into chunks and use checklists.
62. Do not let your students leave blank/omitted questions on a test. Gently tell them to try their best and write down anything they can. Just a little kindness will help many of them do more.
63. I can’t stress this enough - some students will just not hear you the first, second, third, or fourth time.
64. Some of your most compromised students will also be 2-3 grade levels lower in maturity - academic and emotional.
65. Encourage executive function. Here are some useful items for an “organization checklist”:
    a. Are there loose papers in your backpack?
    b. Is your binder color-coded?
    c. Is your Google drive color-coded?
    d. Do you regularly check your school email?
    e. Do you understand your class schedule?
    f. Do you feel comfortable asking questions?
    g. Do you know how to send appropriate teacher emails?
    h. Do you have healthy ways to de-stress?
    i. Do you know how to find your homework?
    j. Do you get enough sleep and exercise?
    k. Do you have a good, quiet place (and scheduled time) to finish work?

66. Most important take-aways from my note-taking strategies:
    a. Use a bound notebook - a separate one for each class
    b. New page for each new class and topic; use dates and headings
    c. Write on one side of page only
    d. Draw and label pictures, use color, leave space
    e. Avoid laptops for note-taking, if possible. If you need to use a laptop, ideally use a tablet where you handwrite equations; if that is not an option, write out equations, take a picture, and include it. Don't waste time in class searching for images or equations.
    f. Label equations (and box them) - give names of variables and list units
    g. Leave space for omitted notes; spread your notes out - don't cram
    h. If you want to ask questions (but are shy about it and/or the class has moved on) - write your question in the margins
    i. Usually, if it is on the board (and/or bolded in the slides), it should be written down
    j. Sometimes it is better to pay attention, make brief notes at first, and take full notes later.
    k. Copying and pasting my notes is not note-taking.
67. You may need to teach kids how to make equation sheets ("cheat sheets"):





68. Some students will routinely test VERY poorly, missing questions that you even view as "freebies" - for example: "If something has more electrons than protons, we say that it is _____ charged." Similarly, I've asked questions like: "What question do you wish I had asked (and what is the answer)?" Sometimes, students will just write "IDK" or say nothing.
69. Students often miss the questions that are asked on a lab.
70. Allowing students to take tests as open-notes, etc. is not the advantage you might expect it to be. Remember that most of your students do not have the physical/mathematical intuitions that you have (or have developed). With my most compromised students, they can see something over and over again ("electrons are negatively charged," "opposites attract") and STILL forget it when test-time arrives.
71. Many students will need constant affirmation. Others will take nothing you do seriously, since it really does not mean much to them.
72. Students often confuse words like graph and chart/table.
73. Students will often forget their medications, and this shows up in behavior.
74. Students will ask you to explain something, right after you have explained it - all the time.
75. If tests are critical to your class, use test-prep games that mimic the actual test: Kahoot, Blooket, Quizlet (for vocab), etc. Again, you will find that some students simply cannot test successfully, regardless of (your perceived) ease of questions.