Using Learning Styles to Improve Student Learning

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Learning styles are preferences that each of us (faculty and students) have for processing, understanding and organizing content. There are no right or wrong learning styles and you can't change your learning style preferences. Students with fairly balanced learning style preferences often survive okay no matter how you teach, but if a student has a strong preference in a particular area, he/she will have a real strength when information is presented in concert with that preference, and, potentially, problems when it is not. Not only do learning styles affect how you learn, but they also have a huge influence on how you teach. Simply put, unless you make a conscious effort to do otherwise, you tend to teach the same way that you learn. As a student, it is important to understand your learning style preferences so that you can maximize the effort you put into studying. Why struggle for a week to learn something that you can learn quickly and easily in one evening? (Yes, factoring in learning style preferences can make a dramatic difference in a student's ability and motivation to learn). As a teacher, it is important to understand your own learning style, as well as the range of student learning style preferences, so that you can be sure to teach in ways that reach the spectrum of students you teach, versus only those whose learning style preferences are similar to you own. Here, we will give a brief overview of learning styles (following Richard M. Felder and Linda K. Silverman – see [1] and [2] for a more thorough treatment; also available at: http://www.ncsu.edu/felder-public/Learning_Styles.html), followed by some simple tips on using this information to reach more students, no matter what course you are teaching and which students are in your class!

Felder and Silverman identify five different learning style dimensions: processing, perception, input, understanding, and organization. They give two preferences for each dimension: for processing – active or reflective; for perception – sensory or intuitive; for input – visual or verbal; for understanding – sequential or global; and for organization – inductive or deductive. Students can have a balanced preference for a particular dimension, which means they learn equally well either way. Students may have a moderate preference for one or the other type, or even a strong preference. Below, we will list each dimension and give brief descriptions of the two types of preferences. For additional information, see [3].

	Active Learners	Reflective Learners
Processing:	• Process actively • Think out loud • "Let's try it out." • Jump in prematurely • Like to work in groups	• Process introspectively • Work quietly • "Let's think about it." • Delay starting • Like solo or pair work

	Sensory Learners	Intuitive Learners
Perception:	• Focus on sensory input • Practical • Observant • Concrete: like facts and figures • Like repetition	• Focus on subconscious • Imaginative • Look for meanings • Abstract: like theory and models • Like variety

Input:	Visual Learner • "Show me." (respond best to pictures, diagrams, sketches, schematics, flow charts, plots)	Verbal Learner • "Explain it to me." (respond best to spoken words, written words)
Understanding:	Sequential Learners • Can function with partial understanding • Make steady progress • Explain easily • Focus on analysis, details (the trees)	Global Learners • Need the big picture to function • Initially slow, then major leaps • Can't explain easily • Focus on synthesis, systems thinking (the forest)
Organization:	Inductive Learners • Start with observations • Infer, explain (natural human learning style)	Deductive Learners • Start with principles • Deduce, derive (natural college teaching style)

To determine your own learning style preferences, you can access an online Inventory of Learning Styles, developed by Barbara A. Solomon and Richard M. Felder at [4]. There is also a host of other information on the site relating to learning styles, including validation studies, other learning style instruments, etc. I would encourage you to take the inventory so that you will have a better understanding of your own preferences, since they do exert considerable influence on your teaching.

Once you have some feel for learning style preferences in general, as well as your own learning style, you can use this understanding to implement some simple strategies to help you reach more students, increase their conceptual understanding and make a real difference in student performance, attitude and self-confidence. I have characterized some strategies, below. I don't pretend to have an exhaustive list here – these are strategies that I have adopted from other people – Felder's material, students, my own children – or discovered myself by sheer accident while trying to reach a student(s). Don't overlook your own students – they will have, many times unconsciously, developed a variety of strategies on their own. Remember, students with the strongest preferences have the most to gain here (and perhaps the greatest needs) – a class full of balanced learners aren't likely to notice a dramatic difference in your teaching because of these strategies.

To assist the active learners in your class, have students work in groups (remember active learners need to *move* to process – sitting still and being quiet doesn't work for them). Consider having your students get up and exercise once

during class. According to Mittendorf and Kalish [5], research shows that the adult attention span for a passive activity, such as standard lecture, is only about 15-20 minutes. After that point in time, students are retaining little of what you are saying. If you have them get up exercise - do 5 jumping jacks, toe touches or "jump rope", you will be amazed at the different it makes in class. The degree of attention and engagement increases noticeably after they exercise. The students (after they recover from their initial shock at being asked to exercise in math class) also quickly pick up on the benefits of exercising. If for some reason I skip exercising on a particular day, I can guarantee that I will get complaints from my students at the end of class! You'd be surprised at the strategies that a successful active learner develops to meet their need to move – writing, walking around, jumping rope, eating candy or chewing gum, drawing, going through a set of flash cards. Moreover, they may develop ways to move in a classroom environment (so they can think) without violating the unwritten social codes.

For reflective learners (I'm reflective – I *can't* think with all that moving going on), again have students work problems in groups. Lest this sound funny (after all, it was the same strategy I listed under active learners), notice that I didn't say *force* your students to work in groups. The active and reflective learners in your class will approach group work differently. The active learners will try to find another (active) learner near them with whom to start talking and working. The reflective learners will sit quietly and work the problem by themselves until they get stuck or finish it – then, they will be more open to talking with either the instructor or the others in the group. It's important to explain this to your students – once they realize that they have different, but equally valid, approaches to group work, they are all more tolerant of the other person's needs (i.e., the reflective learners won't complain so much when the active people start talking and making all that noise and the active learners won't take offense at the reflective learner who doesn't want to talk or be bothered). In addition to group work, at the end of every class I use a writing activity called a Minute Paper. It can be an effective tool in reaching your reflective learners. Developed by Thomas Angelo and Patricia Cross [6], the instrument requires your students to answer two questions at the end of the class: 1) From your point of view, what was the most important thing we discussed today; and 2) What question(s) remain uppermost in your mind at the end of class? I collect these, read and individually answer the questions, and return the papers to the students at the beginning of the next class period. I also make a list of the most frequent and important student questions and spend 10 – 15 minutes answering and reviewing the related information at the beginning of the next class period (which, according to my students, is repeatedly, class after class, term after term, listed as the most helpful thing we do all class period). Why is this helpful for reflective learners? It gives them an opportunity to think (quietly) and discreetly ask you a question(s). If you actively promote a questioning environment in your classroom, students will respond.

For sensory learners, it is important for them to know why they need to learn this material – and telling them they need it for the next section or the next course isn't they type of answer they are looking for. (I'm sensory and I specifically remember asking this very question as a student and getting this exact response.)

They want to know how or why this could be used in the real world, why they need to know this information, how they or someone in their future profession would use this information. Formulas (anything with a letter in it) can throw some of your strongly sensory learners for a loop. When you introduce a new formula, work a quick example, plugging numbers in for the variables. It will make a huge difference for those students. Sensory learners need examples, examples, examples.

Speaking of examples, intuitive learners HATE working lots of examples in class. They will always complain that you assign too many homework problems, irregardless of how many you assign. I always point this out in class, along with the fact that the sensory learners in the class NEED the examples and homework problems to function. Again, it's amazing how tolerant the intuitive learners become when they understand that others learn differently than they do and that you are trying to help everyone. So what do you do for the intuitive learners? Briefly discuss or mention interesting conceptual links or applications of the content. You don't have to go into too much detail here – the sensory learners will be bewildered by your comments and promptly forget them; the intuitive learners in your class will entertain themselves by figuring out the details while you're working the next three boring examples…

For the visual learners, probably the most important thing you can do is to use colored chalk or markers. Color can make a dramatic difference for a strongly visual learner. I once had such a student who was unable to look at a black-and-white three dimensional graph and read off the coordinates of the (what I thought was an obvious) maximum point. However, when presented with the same graph in color, it took him all of 5 seconds to answer the question. That's when I realized how important color was. There is so much you can do with color – color-code different parts of a long problem (this will also help your sequential learners, too, as I will discuss below); or different elements of your lecture (definitions, theorems, examples, etc.). Be creative here – good use of color can be a real goldmine (but don't go overboard or you will negate its value). Visual learners also respond well to graphs, charts, concept maps, etc. I strongly emphasize graphing in my classes – not with graphing calculators, but learning some basic hand graphing skills and techniques. With this information, you can quickly answer many seemingly "algebraic" questions by mentally picturing the general shape of the graph and its behavior. Since algebraic manipulations are a verbal skill, this approach can be of great assistance to the visual learner who struggles with all that algebra in the first place.

For Sequential Learners, details are important. Put in some of the details – when you leave out steps or skip over work, it can confuse your strongly sequential learners, who tend to think very linearly. Break up a long or complicated problem by inserting some key steps – this provides some structure which helps organize the problem in a way that they can grasp and remember later. Also, be careful about how you lay out a problem on the board – skipping around in a non-linear fashion will likely drive these students crazy – you may lose them completely. If you have a problem where you must stop in the middle to work a sub-problem,

color code the original and sub-problems differently. Place the sub-problem clearly in another section of the board and indicate where you left the original problem and where you re-enter it and with what information. All of this helps them think about it in a linear fashion. For Global Learners, it is crucial that they "get the big picture". For this reason, you can start each new topic by putting it in context. What have you been talking about? Where are you going with this new material? How does it relate to the topics before and after? Encourage your global learners to read a lot, too. This helps them put all the pieces together. Strongly global learners can sometimes get discouraged. For example, at first, they may not be able work the simple two-step problems that their equally baffled sequential classmates can. So be sure to encourage your global learners if they are struggling - about the only bad thing a global learner can do is quit. I always remind my global learners that CEO's and other leaders tend to be global learners, because they can see the big picture, how it all fits together. You can also help these students by not insisting that they work problems sequentially. Realize that they may not put down much written work and that it may be difficult for you to (linearly) follow their work. They may not be able to tell you how they got their answer, either. Consequently, they are sometimes wrongly accused of cheating.

In summary, understanding both your own learning style preferences, as well as the spectrum of preferences that your students bring into your classroom, can be of tremendous value in helping you reach more of your students. There are many simple strategies you can employ to make a marked difference in your students' ability to grasp the material, many of which require little or no "preparation" on your part. It has been my experience that the more I think about learning styles, the more I understand the issues with which my students struggle and the better job I do of reaching them. I am confident that I still have much to discover about learning styles and how they impact teaching and learning – and I am counting on my students (and my children) to teach me.

Biographical Sketch

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