Learning How To Learn Tip Sheet - By Students, For Students
By Simo Pajovic and Michelle DiMarco

How to Develop an Engineers Learning Toolbox

Concept 1: Adjust as needed to your professor's teaching style

Question: Do you ever have difficulty understanding a professors expectations?

Tips/ Response

- Sometimes, you can do everything right and still get bad marks on tests. In that case, you may need to reflect on your professor's teaching style. Is it different from other professors' teaching styles, and if so, in what ways? (e.g., working through lots of examples vs. explaining course concepts in great detail).
- What does your professor expect from you and your peers as students? Sometimes their expectations aren't clear until after the first assessment, whether it's a problem set or test. Once they are clearer, use them to guide your studying (e.g., if their test questions are more difficult than the assigned practice problems, search for more challenging questions in the textbook if possible).
- There's no one way to adjust to different teaching styles. You have to observe and understand the discrepancies between their teaching style and your learning style. It might even be good to open up a dialogue with them and ask what they think you can do to improve your grade or what their expectations are. Professors are people too, and they do want to improve their teaching—your feedback is valuable to them!

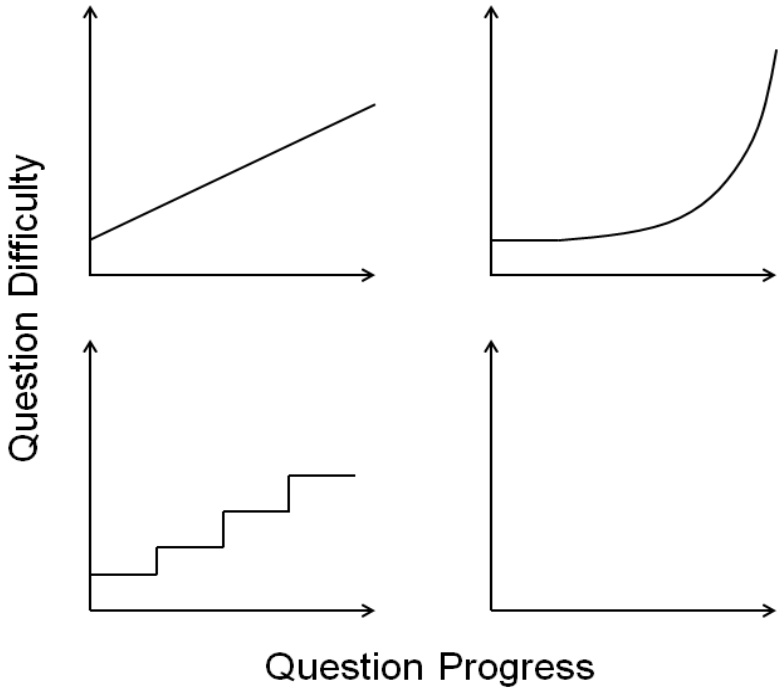
Concept 2: Identify what kind of problem you are being asked to answer

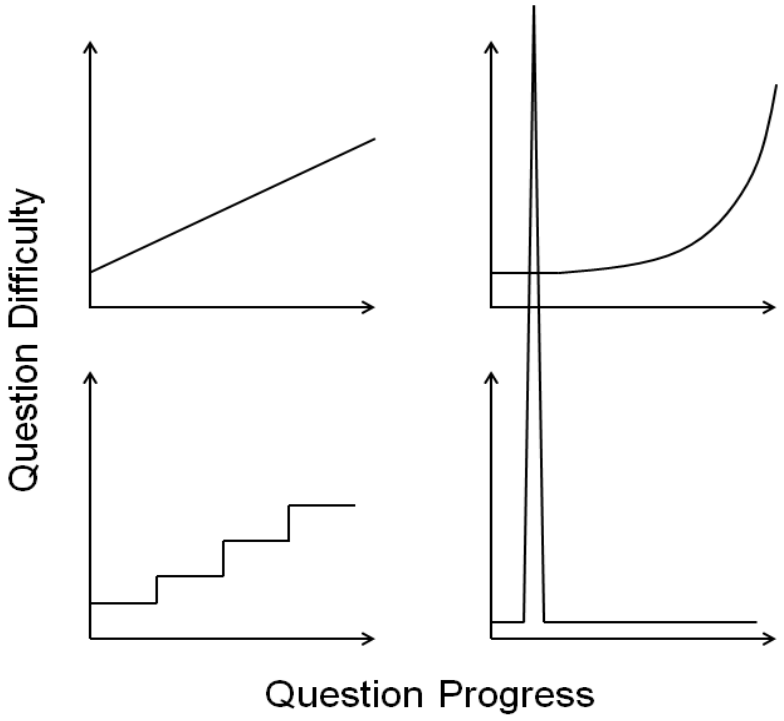
Question: How do you approach test taking and problem solving?

Tips/ Response

- Four question types we all know and love (in Simo's opinion):
    - Questions that linearly increase in difficulty
    - Questions that sharply increase in difficulty toward the end
    - "Hand-holding questions": when the professor walks you through a difficult question step-by-step
    - The worst kind of question: easy except for one key assumption

- How to get over questions that are of the last type? How do you climb over the barrier presented by the key assumption(s) you need to make in order to solve the problem?
    - You need to have a deep understanding of the course material and how it relates to the other tools in your engineering toolbox
    - Often, you need to have mastered certain basic skills—for example, you may need to rearrange an equation into a form where you can substitute expressions in to simplify the equation or reveal a hidden relationship between two variables
    - You need to have some vision for what you are really being asked; instead of staring at what's given in the problem and trying to remember what equations piece all the information together, think about what's not given or implied in the problem
        - Don't be afraid to raise your hand during a test to ask questions—the worst the professor can do is tell you they can't answer your question, and if enough people are confused by something on the test, the professor might end up addressing it
        - If it's an open book exam or the professor has given you an equation sheet, review it carefully; often everything you need is there, though you may have to practice accessing that information before the exam
            - Personal example: in my heat and mass transfer course, the equation needed to solve a difficult problem on the final exam was in a large table that many students didn't know existed because they didn't review the equation sheets attached to the exam! Some students who found that particular table didn't know how to use it because they didn't practice!
    - Think about the other tools in your engineering toolbox, such as fundamental concepts from earlier courses. The professor expects you to know those things! Just because the course is about *x* doesn't mean it's fully compartmentalized. Everything is connected, and if you try to memorize solutions to practice problems because you "expect" to see them on tests, you'll always struggle with questions that truly test your understanding of the course materials





Concept 3: Recognize connections between subjects

Question: How do you utilize your past knowledge and engineering toolbox most effectively?

Tips/ Response:

- It may not always be obvious, but learning from previous years can impact your learning in future years—as previously mentioned, concepts from one subject may be come up again in another subject
- We are fortunate that mathematics models nature so well, and a lot of the same models pop up over and over again (a good example is the analogy between electrical and mechanical systems, which first years will learn in winter semester)
- Reusing the same neural pathways can be a really great way to learn new things because, in a sense, you won't see them as new
- Look for patterns in things you've seen before, even as far back as high school—again, your education is holistic, not compartmental based on course
    - Personal example: in the PDEs course I'm currently taking (in 4th year!), I realized certain types of PDEs were named after the conic sections (which I learned all the way back in high school!) because the equations had the same forms!

Concept 4: Demonstrating understanding is not regurgitating information

Question: Do you ever get frustrated when a question on a test seems like it is unrelated to what you have studied or learned in class?

Tips/ Response

- During a test, you may be asked to apply a course concept to a new situation, which may seem extremely difficult if you do not fully understand the material
- In these cases, you can learn a lot from a difficult test
- If you do not do well on a test, reflect on your performance. Were you on top of your game? Was your physical and mental health good? How did your peers find the test? (Don't ask this question until you've exhausted all other options—you should strive to better yourself rather than beat your classmates. The point of this question is to figure out if it was a difficult test for everyone, in which case, don't be too hard on yourself!)
- For some courses, practicing a particular set of problems over and over again may be a good way to study because you are expected to be able to solve those problems. However, that doesn't mean you can get away with memorizing everything—a lack of true understanding will catch up to you eventually! Try to understand *why* that solution

works and what you are actually doing. If you don't have that understanding, then what you're doing isn't really engineering—it's just calculating, which computers can do.

Concept 5: Approach something you do not understand with curiosity

Question: How do you approach course concepts you're struggling to understand?

Tips / Response

- You can have epiphanies when you least expect them—on the bus, in the shower, while walking down the street... The way something is explained by the professor or in the textbook may put pressure on you to understand it in those words exactly. Casually thinking about something you don't understand without that pressure can be a good way to help you see things differently.
- Have a growth-oriented mindset instead of being mad about not getting something. Don't tell yourself you're stupid or get angry at yourself or others— it's not conducive to your learning!
    - This is not to say it's not okay to get upset every once in a while— it's perfectly normal. Just find a good outlet for it and don't allow it to negatively affect your learning.
- If a difficult concept or problem has some subtlety or a clever solution, accept that it is clever and try to understand what you didn't see. Think of it as a game or brain teaser in the moment you're developing your understanding of it.
- View difficult things as an opportunity to learn something new and unique that others who weren't faced with that challenge won't and better yourself as a person.

How to Develop a Personal Learning Toolbox

Concept 1: Let go of control

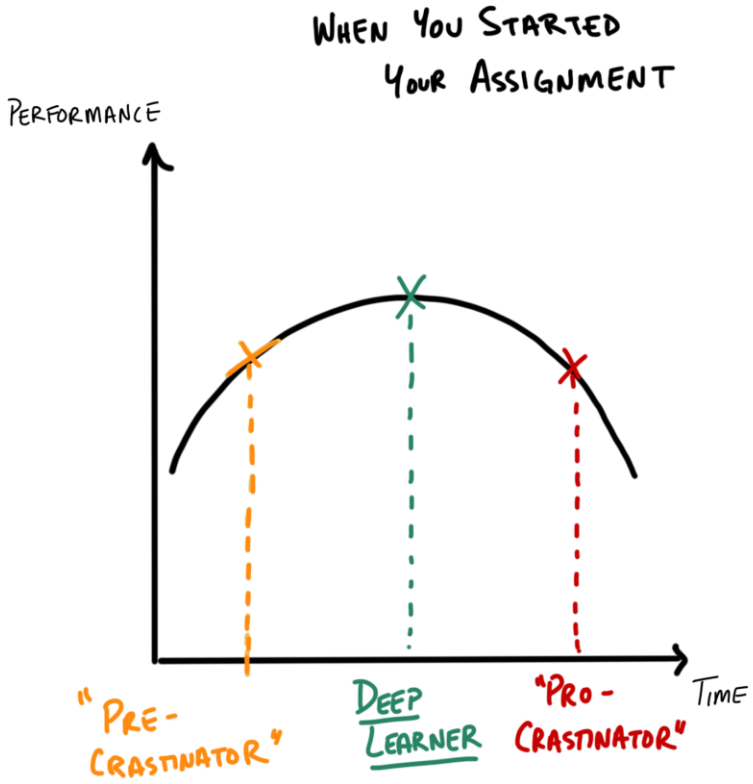
Question: Do you try to control your study outcomes?

Tips/ Response

- We always hear that an effective time management plan is key to productivity. And often times we will even go so far as to make one. But like any habit, your ability to maintain this plan is dependent not only on sheer willpower, but on how sustainable it is
- Making yourself a plan that micromanages every task you have to accomplish- for example, giving yourself 3 hours on a lab and then scheduling other work directly after, is an example of an unsustainable one.

- It is easy for us to fall into our "bad habits". But we need to make the good ones trivially easy to start, so that they can start to compete with the bad ones.
    - Catch the trigger of the bad cycle. What causes the trigger to go off?
- The issue is that, especially when we first start planning out our schedules, we underestimate the time things take to be properly completed. And the moment we exceed the limit we set for ourselves, we feel dejected and abandon our plan altogether. But a change in attitude alone can truly lead you to the productivity goals you desire!
- *Step 1: Embrace when things don't go as planned.*
    - This will take time to master, but if you start now, you will
        - Learn to stay focussed, calm, and logical in strenuous situations
        - You'll be kinder to yourself, and have more confidence in interacting with your weaknesses in order to make them stronger
- *Step 2: Let go of control. How?*
    - Gratitude.
        - A good rule of thumb is that whenever you feel irritated or upset, especially if it involves blaming your lack of productivity on external factors, stop yourself. Focus on the positives, focus and inner peace are intertwined.
        - The more you do this, the easier it gets. Fewer things will distract you, because you'll be at ease with yourself in your present moment.
- This may all sound splendid, but you know have a lab in 2 days that you haven't started yet and you know it will take you at minimum 8 hours. You don't have that time
    - Don't you, though? The next step might help you reassess this preconception:
- *Step 3: Learn to prioritize. (See Concept 7)*
    - Steps 1 and 2 are to ease you into the frame of mind for each block of time you allot to some task. But prioritizing is quintessential to how you block out the 24 hours you have in a day
    - Here are some questions to consider
        - 1) Why are you taking these courses? Do you genuinely wish to learn this material in the long run?
        - 2) What course is giving you the hardest time? Usually the one you like the least takes most time. That's okay, we'll get there :-)
        - 3) Take out your calendar and look at the next two weeks. Write every single deliverable you have. Which are worth the highest?
        - 4) Which tasks require the least energy to complete while still achieving satisfactory results?

- When you determine the most pressing, break it into mini tasks. Overshoot your estimate of how long these mini tasks will take.
    - You will improve on this estimate. But the moment you start to force yourself into time constraints that are unreasonable, you will a) resent what you're doing b) be unhealthily negative towards yourself c) panic and not focus and perform poorly
    - If you start panicking again, go to step 1.
- Summary: Your workload is not meant to scare you. It's meant to give you many chances to make mistakes. Because the more of them you make and learn from will determine ultimately your performance on major assessments. Make this an inviting process. Don't leave tasks to the last minute and gain nothing. Equally, don't start too early for the sake of finishing, doing the bare minimum. Start early, but give yourself enough time to go back, do a second draft, change your first answer, rethink and digest the problem you need to solve. This image is a summary:



Takeaway: Breathe. Understand that ***good things take time, but they always come.*** :-)

Concept 2: Identify and understand your strengths as a learner

Question: Do you ever try to copy other people's studying style and find it does not work for you?

Tips / Response

- Do not compare yourself to others—you are you, and you have your own unique ways of learning and understanding things. Instead of trying to copy someone else's studying style outright, borrow elements of it that you think will work for you.
- Understand yourself and your own studying style—when you reflect on tests, think critically about how you studied and why or why not it worked for you. Knowing yourself and your strengths and weaknesses is key.
- Adapt your studying style to different courses—you are all required to take a certain number of CS/HSS electives, and you'll probably find that you'll need to change your approach to studying for those courses! How does the course expect you to demonstrate your knowledge? Essays? Definitions? The general way in which you learn course concepts may be similar, but the way you practice will probably have to change.
- You don't need to justify how you learn!

Concept 3: Learn how to identify your questions and ask for help

Question: Do you find it hard to ask for help because you do not know what your question is?

Tips / Response

- Review lecture material after class
- Identify concepts you did not understand
- Write your questions down in the margins during lecture and ask them later. Sometimes, the professor might answer them later on in the lecture, or you may realize that you had the wrong question, in which case you can refine what you wrote earlier to pinpoint your misunderstanding.
- Classifying your questions using something like Bloom's taxonomy might help your narrow down what you're struggling with. You can also try referencing your question to a specific sentence or paragraph in the textbook or your notes—anything to make your question as clear as possible to both you and the professor.

Concept 4: Take ownership of your own learning

Question: Do you find yourself blaming other people or external circumstances for why you may not be meeting your goals?

Tips / Response

- Recognize what is not working for you—think about all the other things we've talked about so far in this workshop. A lot of points have been about understanding yourself, your learning toolbox, and your engineering toolbox. Take a look at each tool you have and ask yourself how long it's been since you've last used it or if it's been doing its job.
- Accept when a failure is your own fault. Don't allow yourself to think that everything is your fault—it's really not! But when you didn't study for something and you got a bad mark, accept that you probably should have studied. Take ownership of your mistakes and identify specific ways in which you can prevent yourself from making the same mistake again.
- Direct your energy in a positive way! Find good outlets for your negative emotions, and ride on your positivity to even greater heights! When you feel good, do productive things to make you feel even better, and when you don't, take a break and relax for a moment. Again, if you're mad at yourself for failing something, channel your energy towards an honest self-reflection and make a plan to change things.
    - "A journey of 1,000 miles begins with a single step." - Lao Tzu

Concept 5: Learn from failure - be flexible and adaptable

Question: Do you criticize yourself for not doing well and feel unmotivated to keep trying?

Tips / Response

- Link to college info geek video
- You can always start anew, you are not behind
- Embrace your frustration and use it to be creative
- Distinguish between a lack of motivation and a lack of discipline. Discipline is about doing things even when you don't want to do them because it's a part of your training regimen or something you have to do. Discipline takes time to develop!

Concept 6: Develop a time management plan

Question: Do you find you struggle to find time to complete your work?

Tips / Response

- Do not pack your schedule too tightly!
- Analogy with “tolerancing” in mechanical engineering
    - In mechanical engineering (and other types of engineering), we rarely if ever design mating parts to fit perfectly together. For example, we never make the hole for a peg exactly the same diameter as the peg itself because we know there is error in the fabrication process. We tolerance the parts and define an acceptable range of error for the diameter of the hole AND the peg so that they’ll still fit together snugly even if the one of the parts happens to be a bit larger or smaller than expected.
    - The same goes for time management—you’ll always be behind schedule if you overplan. Give yourself breaks and buffer time, and don’t stress if something you plan for goes a little over or under time.
- Along the same lines as before, reflect on your time management plan and try to figure out what works for you. You may prefer to have a priority list of things you need to do without planning each hour of your day out, or you may prefer to make a colourful schedule using Google Calendar that you follow and adjust when needed
- Interweave your studying, take turns working on different subject, whether you know it or not, when you switch focus, the last thing you worked on is still simmering in your head!

Concept 7: Move forward and take action when you freeze

Question: Do you ever find an assignment so hard that you start to procrastinate starting the assignment?

Tips / Response

- Breathe, try positive self-talk
- Write down your feelings, be aware that it is fear driven
- Try to recognize if you are feeling imposter syndrome
- More concrete tips:
    - Look at the assignment the day it’s assigned so you know what you’re up against and casually think about it when you have time. Try to develop a plan of attack.
    - Use Google to look for similar problems and find inspiration to start.
    - Force yourself to do something—anything! Draw a schematic of the problem, write down the information you’re given, write down the related equations you learned in lecture, but start! Try to do this as soon as possible!