Letter to a Young Undergrad*

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Dear Reader: This is what I *might* have read if someone I trust were to give me suggestions about how I should think about my undergrad education back when I was an undergrad. Please take them with a grain of salt but remember that I have tried to make these suggestions *objective*. This is *not* an advice for I truly believe in the maxim, "No advice is as bad as advice". I have a Master's degree in Computer Science and I have worked in the software industry for a couple of decades, but that alone does not qualify anyone to give sensible suggestions to young people. I will keep this short (900 words or less from here onward) and will stick to my thoughts about how one should approach one's graduation and career. Since this is a personal opinion it is clearly not generally applicable. Perhaps it is about an education is science and engineering and not arts. But you know, some people say that artistic pursuit of anything can be rewarding in the end too. If you need some *masterly advice*, especially from a seasoned scientist (or naturalist), take a look at a book like Edward O. Wilson's "Letters to a Young Scientist" [1]. To limit this narrative to actionable items, I have used bullet points:

1. Know thyself. Although this feels like a cliche, it is useful to have a realistic view of oneself at any point in time. In early career, this can translate to knowing what you *truly* like to do. Nothing else really matters. It is like what Einstein is said to have once said, "That is the way to learn the most; when you are doing something with such enjoyment that you don't notice that the time passes". This means that you should ask hard questions about what you would like to *do* the most. Is it mechanical engineering with all its physical grandeur of

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well-designed systems (for example, did you carefully observe the construction of a nearby flyover or the massive metro work?), computer science with its application of discrete mathematical concepts to solve real-world problems (for example, how much do you like to *program your computer*?), or biotechnology with its promise to use technology to understand and enhance human life (for example, would you like to get your DNA sequenced and then would you analyze it yourself?), or something else. I agree, this is not an easy decision. Psychology plays an important role. Knowing what (for example, winning a competition, artistic pursuit, recognition, awards) motivates you is tricky. A mix of the intrinsic motivation (doing something *for the sake of it*) and exstinsic motivation (doing something for the other things like fame (even a fickle fame on social media) or money it may bring) seems to work for most of us. I have a simple trick that may help decide what you like to do. Let us say you are procrastinating while you have some task at hand. Then observe what you do when you actually procrastinate (well, of course something other than chatting on a smartphone). Maybe you should be doing that. But I warn you – having a *realistic* understanding of our (changing) self is difficult.

2. Our work defines us. If you fall in love with what you do, sooner or later, it will pay off. You see, it is a feedback loop. On the one hand, you must have fun doing whatever you do, on the other, you get better at that craft since you simply keep doing it. For an undergrad student this means solving problems. You should have the zeal to solve every problem posed to you, say, by your professor or by anyone. Your allegiance is to the problem. You shouldn't care if you are spending an inordinate amount of time on solving given problems. There are many anecdotes where students tenaciously solved problems posed to them and the payoff was huge. I know that not all of us will be able to solve unsolved problems, but why do you care? If someone posed a problem not known to us before and we solved it, for all practical purposes, we solved a previously unsolved problem! This requires a sense of wonder and tenacity.

3. Research shows the direction; industrial engineering implements it. People say that to do research, one needs a "research mindset". That may be true. A famous scientist-mathematician [3] once said, "You are

doing research if you *don't* know what you are doing. You are *not* doing engineering if you don't know what you are doing". The essence of this is, of course, that there are a lot of unknowns in research whereas the main challenge in engineering is soundly *building* things with an adhoc design. Indeed, we say that something is "production quality" when it is *built* right and keeps working. It is about applying the best practices tenaciously. Of course even well-engineered things may fail, but the reasons of their failure often point to a faulty design or faulty procedures. It is generally accepted that doing research is finding a problem that you are prepared to solve for the rest of your life. It is possible that you might just keep searching for a long time, but don't let that frustrate you. It is a marathon, not a 100-meter dash. In time, you will choose whether to do research in an academic setting, research in an industrial setting, or product development in an engineering company[1]. Third choice is what most of us do as a career and that is okay!

4. Believe in yourself. This sounds vacuous, but it is true. Many a time we just disregard our abilities. Whereas confidence can be misleading, a lack of it is unfortunate. Everyone has a potential to succeed (and you know, success has a "personal" definition) and fulfillment of that potential is meaningful.

5. Skills trump university degrees. Although Elon Musk said this recently (Nov 2020), I believe we knew this all along. However, we shouldn't misconstrue this suggestion to mean "drop out of college" even though Steve Jobs and Bill Gates did that. As an undergrad, and as a lifelong learner, we must spend a majority of time learning new skills and honing existing skills. Remember, luck happens when preparation meets opportunity.

6. Use the Internet wisely and read. Read a lot. The Internet is a treasure trove and unless you use it wisely, you will have a lot to miss. Recent knowledge enhancement and educational experiments like Wikipedia, Coursera, edX, OpenStax, Khan Academy, YouTube, Reddit, Stack Overflow, GitHub etc. have a lot to offer although they are not a substitute for formal education yet.

[1] Although we need good managers to manage projects, I hope you defer that decision for now

These are my suggestions. Thank you for reading. I have quoted other successful people not to intimidate you, but for us to learn from them. Remember that those people have failed too. For a more authoritative (and expensive) account, see [4]. Good luck!

References

[1] Edward O. Wilson. Letters to a Young Scientist. Liveright; 1st edition, 2013. Amazon Link.

[2] Wikipedia. Know Thyself.

[3] Richard Hamming. You and Your Research.

[4] Ken Bain. What the Best College Students Do. Harvard University Press, July 2012. Amazon Link.