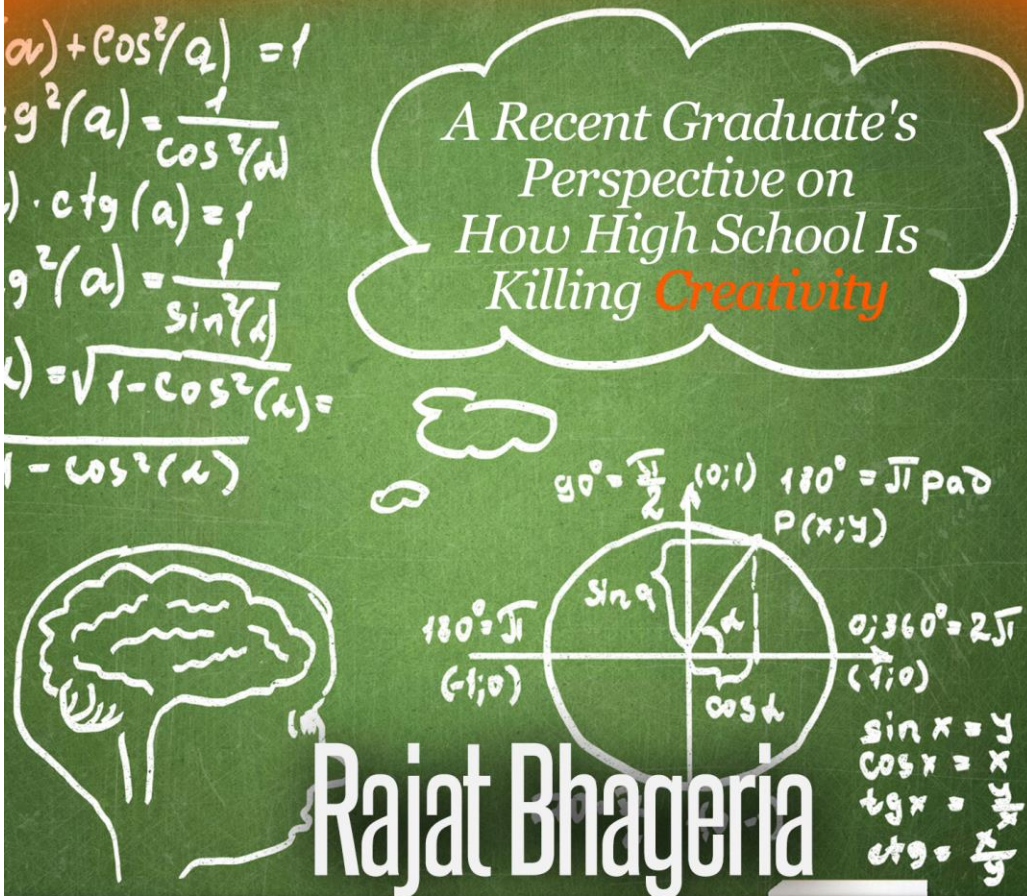
WHAT HIGH SCHOOL DIDN'T TEACH ME

A Recent Graduate's Perspective on How High School Is Killing Creativity



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Introduction:

Extrinsic vs. Intrinsic Motivation:

Let me introduce you to one of my high school friends, who I will henceforth refer to as Jamie to protect his identity. As a student in my accelerated (read as "honors") English class freshman year, Jamie was one of those students who absolutely devoured books. He was a zealot. While the teacher was arranging her notes for the day and all the other students were curiously scrutinizing their phones for text messages with their backs bent, Jamie would start reading his DK *Big Book of Planes.* And he didn't stop. When the teacher started talking, he just continued to read. When he didn't have anything to read—or the teacher told him to "put his book away"—he would retrieve his composition notebook and start writing dystopian sci-fi stories. They were spectacular—almost professional in my eyes. He loved reading and writing, but argued that sitting in class, memorizing a play didn't seem worth it in his eyes.

This trend continued throughout high school, and by the time we were seniors in AP Literature and Composition—arguably one of the hardest high school courses because of it's subjective nature—Jamie really didn't care much about the class. He didn't listen to any discussions (let alone participate), and didn't even read the vast majority of the assigned material. And yet, when he sat down to take the English aptitude tests, he consistently scored almost perfectly, whereas students who followed the teacher's departmental plans and were equally intelligent, struggled to score higher than a measly C (keep in mind that this is a test which only requires around a 58% to pass).

Something's not right is it? Students who actively participate in school are "supposed" to do well, right? Right? Wrong.

Students who are intrinsically motivated to do something, whatever subject it may be, will do the best. Truly, people will input the most effort and will make the most innovative leaps while partaking in something they are fundamentally interested in, not while working for grades, money, or even college acceptances. Indeed, in Jamie's case, while everybody else was working away to earn that A or B, Jamie was reading and writing because he loved reading and writing, not because he was forced to do something to fulfill the teacher's requirement. So why don't we mold our classes to that standard?

Quite frankly, why don't we create an education system in which every student is intrinsically motivated just like Jamie was? Not only would students achieve the true goal of English and school—to debate literature and actively discuss the human condition—but students would also gain something more meaningful from the study of our past

literary than a measly A on their transcript. They might have to actually *think* rather than simply memorize the plot of a book, take a test, and then forget everything—as many currently do.

Purpose:

This concept—intrinsic motivation—is the basis of this book. Indeed, all students are innately creative. They love to draw, read, and write. However, schools force them to memorize impractical factoids they cannot relate to, and instill the idea that grades govern every aspect of their academic lives from a very early age. By the time these students are in high school, they focus the vast majority of their resources into maximizing their grades, and not into developing their passions. So while these students *can* sit down and memorize facts and then do well on tests, they have very little practical problem solving skills, not enough creative drive, and a knack *not* take risks; rather they have an aptitude to take the path that leads to the greatest Pavlovian reward (i.e. the dopamine rush they earn when they score a "good" grade). Moreover, because grades are external motivators and because students will not reuse many of the impractical skills they learn in high school, they don't *care* much about the information they learn in the schoolhouse.

We need change. The American education system is building robots in a factory—almost all of whom can memorize, but very few that can divergently think and focus on what they intrinsically love to do. My purpose in this book is to write about the faults that I see with the current education system (from a recent high school graduate's perspective) and to address how educators can address these problems.

But more importantly, I hope to tell *my* story to future students. Truly, I endeavor to prevent any future students from falling into the well that I fell into by focusing on the extrinsic motivators that schools told me to endear—grades, exams, and college admission—in the early years of *my* high school career.

Chapter 1: ENGLISH

1.1: Why do we force our students to read Shakespeare?

English teachers seem to adore Shakespeare…. Students seem to chug through it…. Everyone else in society sits questioning why our English teachers force our students to read literature by a guy who lived 500 years ago, who writes in barely recognizable English, and whose plays are painfully predictable? Now don't get me wrong: I enjoyed many Shakespeare plays throughout high school (unlike the vast majority of my peers), but it seems counterproductive not to spend more time studying modern authors, modern advertising/print-making, and contemporary journalism. Not only would this latter scenario help students in this age more able to grasp the seemingly abstract culture of today, but it would also assist them in more technical fields such as business and engineering…. Truly, whereas Shakespeare may assist students pursuing an English/Literature based field in the future, it won't be as assistive as more contemporary works for a student in a non-Literature based career.

But nevertheless, Shakespeare aside, some of the books that are taught in our modern English classes are in fact *vital* to the growth and development of scholars; specifically, novels such as **A FEW GOOD MEN** and **THE GREAT GATSBY** are modern enough that students will be able to appreciate the "slang" (i.e. contemporary language), contain enough complex & meaningful literature to be worthwhile, and on the fundamental level contain plot lines that students can directly relate to (after all, which occurs more often in our modern culture: an evil brother pouring poison into his brother's ear to seize the throne, or a woman being arrested for prostitution and heroin accounts?).

1.1.1: Better Alternatives to Shakespeare Exist:

In the former case (that of Shakespeare), the ROI (return on investment) seems to be significantly smaller than the ROI of reading modern literature. In other words, it seems that the only reason we are reading Shakespeare is because some person in some governmental institution 400 miles away decided that we should. And every one listened. With very little reason.

Why? The governmental officer may argue that Shakespeare is essential to understanding the literary influences of modern English, or that reading *Hamlet* helps students truly appreciate literary devices, or even something more absurd along the lines of "we've always done it, and it *seems* to work, so why not continue?" But what evidence

is there that reading Shakespeare helps students in the modern age survive in the work place, live without government aid, and achieve familial goals? Very little…. We have been teaching Shakespeare for decades, and sure it *works*, but unless we try something different, who's to say the new system won't work better? Truly, we cannot expect different results with the same kind of thinking that we've always used.

Now one argue that most people who are in the level of classes that read Shakespeare in high school (i.e. AP/Honors students), probably won't be on the brink of barely surviving (as previously proposed). But, it is precisely those students who are will be on that brink that will *also* probably read Sparknotes / Cliffnotes (websites that provide chapter summaries, detailed character development summaries, and thematic statements for the vast majority of books in literature), and perhaps not read the play at all, therefore gaining little to nothing—outside perhaps the ability to "get away with a BS essay"….

Truly, forcing students to do something in which they have so little interest will most probably result in students not reading or contemplating—the main goal of English—the books at all. On the other hand, reading more of the modern equivalent of Shakespeare (e.g. **THE GREAT GATSBY**) will not only acclimate students to the literature that they will be immersed in *every single day of their lives*, but it will also be more relatable (and hence, students are more likely to fully read and contemplate the book).

Why is this phenomenon valid? Humans will innately do what they are most interested in with the most fervor, will reason/debate the most, and will input the most available resources. On the other hand, they will most probably input little to no work or innovative thinking doing something that they really don't care about. And as shocking as it may be, since video-games/video/news of our modern age seem to stress the high amounts of violence/crime, students (even those in higher level classes) will be more likely to sit up and listen if a love-torn couple ram a yellow wagon into a woman and kill her (as occurs in **THE GREAT GATSBY**), than they will be if for some unseen reason a love-torn woman just happens to fall into a river, drowns, and no one sees (as occurs in **HAMLET**).

Why? The latter scenario doesn't happen very often today, but car accidents—especially those involving drunk couples—are not uncommon. The former is more relatable, interesting, and contemporary. Indeed, contemporary novels like Let the Great World Spin contain just as much literary benefits as **A COMEDY OF ERRORS** does, but the fact that students simply won't care about the latter as much as they will about the former seems to reject the hypothesis that Shakespeare is absolutely vital to our English curriculum. Why spend time doing something that students will simply not spend time doing?

1.1.2: Replacing Shakespeare with Modern Newspapers:

So we've hit a wall: sure there may be more benefits to reading modern literature than there are to reading Shakespeare, but how many teachers will actually change their course? Probably very few…. Why? They've done it all their lives; it would require them to input vast loads of work to design a new curriculum; and the modern institution seems to "work." So why change? Here's a proposal: teach Shakespeare to the extent that all students are working to understand the material, but decrease the total amount. Simultaneously, increase focus on modern advertising, difficult economic/scientific/opinion articles in New York Times/Wall Street Journal/The New Yorker, and modern novels such as **LET THE GREAT WORLD SPIN**.

And as time goes on, even the CollegeBoard will realize that perhaps they should focus more on modern applications than classical ones, and perhaps one day more of the novels high school students read can be similar to contemporary novels such as **LET THE GREAT WORLD SPIN.**

1.2: Problem—The Letter Grade that Takes Dominion:

Another major problem with our current English system—and education system on the whole as you will later see in the *Mathematics* *and* *Social Studies* *Chapters*—is grades. Grades—an external motivator—run everything, and so schools really never give students a chance to develop intrinsic motivation. As such, they never develop interest in the material or input creative effort.

Consider, if you will, the same class freshman English class I introduced in the introduction of this book. In this class, we often read novels to "enhance" our critical reading skills. But that enhancement rarely occurred.

For example, while reading **ROMEO AND JULIET**, we discussed plot summary of every chapter in class (including very little discussion about the textual meaning), took a multiple-choice test on the plot, and then moved on to the next book. I didn't remember anything by the time I had to re-memorize the plot for the final. And this more or less occurred throughout every year of high school.

Everything was grade-oriented. So even if the homework for the night was to go online and memorize an act of the play, I had to do it. Did I learn anything from it? No. It was completely busy work. But my teacher and my peers were pushing me for one reason: to "earn" an A. So I did. I chugged though. Still, the more busy work I had to do, the more interest I lost in the actual material. After some time, I frankly didn't care to analyze the effects of the family feud in the plot since I was too busy memorizing the name of the Friar that Romeo sees.

And as such, my reading comprehension skills didn't really improve. I was truly so worried about my grade that I didn't care about my writing—the true matter I should have focused on since I would be using the skill for the rest of my life.

1.2.1: Solution—Increasing the Probability of Intrinsic Motivation:

So what's the solution? In theory it's simple: develop intrinsic motivation for English in every student's mind.

Now you may think this is a utopian dream that's never achievable… How could we ever create an English system in which grades don't matter and everyone has intrinsic motivation for the material like Jamie? After all, many students simply don't listen or "try" for the sake of not listening….

Perhaps the foremost method is relating all the required readings and assignments to the students' lives. Truly, if they can relate to the assignments, thematic problems, and ideas, they are significantly more likely to develop intrinsic interest for the subject, and hence understand it better.

Secondly, ensure that students have choice in the books they read. So when choosing a required reading book, let the majority of students pick which of five books they want to read. Indeed, currently, not many people are interested in a book that they didn't pick; however, if we move closer to the ideal of a "book someone reads for fun," by letting students pick it, a higher percentage of the class will demonstrate intrinsic interest for the book (See *A Revamp of the High School Experience* for more information about "requirements with choice" and the Arts chapter for more information about a case-study on silent reading).

Chapter 2: SOCIAL-STUDIES

2.1: The Basic Problem with History:

Imagine a *high school* class with seven textbooks—contributing to around 30 pages of daily reading—a 20-page historical research paper, and check-up quizzes almost every day. Seems like the average college class, right? I thought so to. I naively told myself at the very beginning of AP United States History that I would have to deal with this everyday in college. *Better learn to cope with it now.*

But quite honestly, I really didn't really learn much at all. Sure I did well on the quizzes, tests, and the final AP test, but quite frankly, who cares? The grade really means nothing; if you think about it, it's only a number that you have to battle with for one year. I knew that. Nevertheless, the intense schedule—comprised mostly of busy work—had instilled the impression in my mind that nothing but my final grade and my AP exam score mattered. *The A at the end of the line was going to be worth it,* I told myself.

The same was true about the class in general. The excess of information deemed necessary by the AP curriculum more or less required that we—the whole class, even the teacher—*"learn"* at a pace that would allow us to cover everything by the AP exam. As long as we had "covered" everything, we had accomplished our goal.

But it wasn't quite "learning…." Everyday we had to cover a set amount of information. And if we didn't cover 10 minutes one day, we were behind the next. It was a governmental manner of *claiming* to have learned something, without truly understanding it. How did it help me two years later? Not much. Nowadays, I remember almost none of the information we "learned." All I do remember is how much busy work the class had and how a measly AP exam score was the only motivator.

The only skill I did develop was the ability to process large amounts of information in a limited time. Now there is no doubt this is uniquely important skill in the work force. But this was merely a side effect of the intense schedule. The history itself helped in no way.

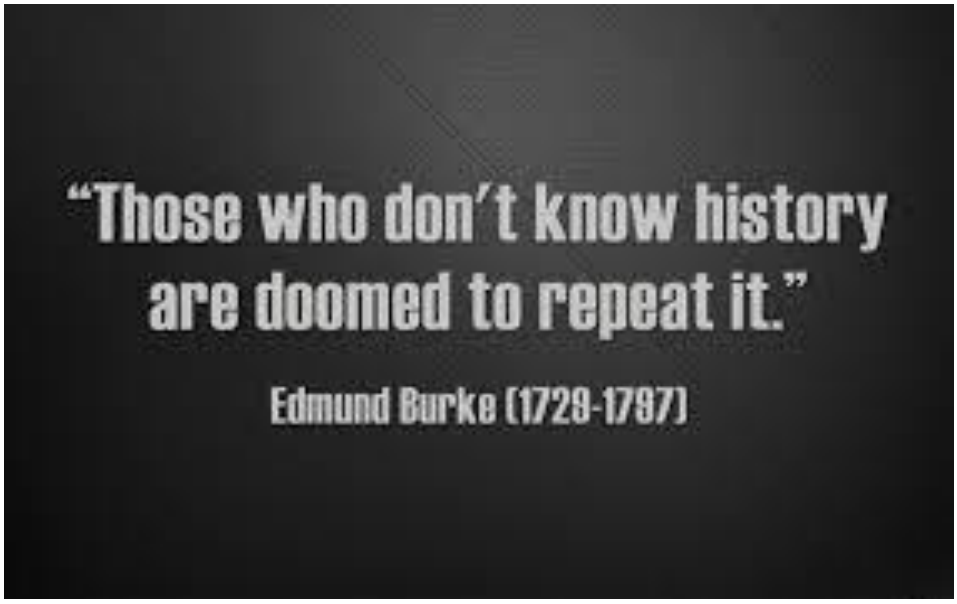
The basis of the problem? History fundamentally entails memorization. Sure you can argue that *"converting the events into a story"* will help a student understand the history. But at the heart, he must still memorize factoids that he'll almost never need again for the sake of fulfilling the state's requirements.

Just because some self-proclaimed expert said that it would be a "good" idea to have students memorize history, everyone agreed. The other problem: repetition. I've

learned about the civil war to some extent *every…single…year* of my 12-year education. I *completely* understand that it was an incredibly important and brutal turning point in American history, but still, 12 years of the exact same information? By the last year, almost no one—even the people who absolutely love history—cared about the material. *Schools are killing students' intrinsic passion for history by forcing them to memorize it and then take comprehension tests, even though the students are way more likely to truly even try to understand the history if they have intrinsic motivation.* Indeed, many of my friends all over the US who love history tell me that they really don't care too much about it after taking high school history classes. This is a telltale sign we need change.

Truly, sitting in class, listening to the teacher talking at two times her normal pace, and rapidly writing down facts *I would never use again* became more of a chore than the gift of knowledge it should have been. Shouldn't I learn a little more about practical skills that I would use on an everyday basis?

Now don't mistake me: history is no doubt important. As Edmund Burke so eloquently says it, *"those who don't know history are doomed to repeat it,"* but learning the about the same one topic every single year of their secondary school really isn't helping anyone. More than anything, it's hurting those who already loved history.



2.2: A More Economical Approach at the Social Studies

Wouldn't it be more productive and efficient to teach more practical social studies today? Indeed, by learning more about economics, psychology, political science, sociology, & geography and less about history, students would not only be more practically prepared for life after high school, but they would also have more necessary

skills should they choose not to pursue college. I'll focus on two main social studies: economics and psychology.

2.2.1: Psychology:

Psychology is the study of the brain and human behavior. And as such, every phenomenon taught in a psych course will relate directly to a student's life. And hence, high school psychology puts meaning behind everyday life phenomena. Truly, a student can take almost every topic she learns about in a psych class and apply it to her everyday life. Whether this is in regard to dreaming or deindividuation, a basic psychology background allows the student to explain even the simplest and most trivial ideas in life.

Things that seem human nature have a reason behind them. For example, why do people remember items in the beginning and end of a list better than items in the body of the list? Try the serial position effect. Or: Why do we only remember dreams (with great detail) that happened very close to the morning? Try REM sleep. Do humans attribute the successes and failures of a person more often to personality than to the situation? Yes, and we call it the Fundamental Attribution Error.

Regardless of whether someone is planning on pursuing a career psychology, or something even remotely related to medicine, having a *slight* psych background makes the everyday, pedestrian happenings of life meaningful.

Moreover, psychology is not an independent field; it can be applied to nearly every other field. Why? One must incorporate human behavior into everything—from computer science to journalism to business management. For example, a computer scientist must consider whether a customer will grasp a user-interface. A journalist has to ask herself the attention span of the average reader to decide whether to publish a long article. And business manager decides everyday how much pay to assign based on hours worked to maximize efficiency and profit.

2.2.2: Economics:

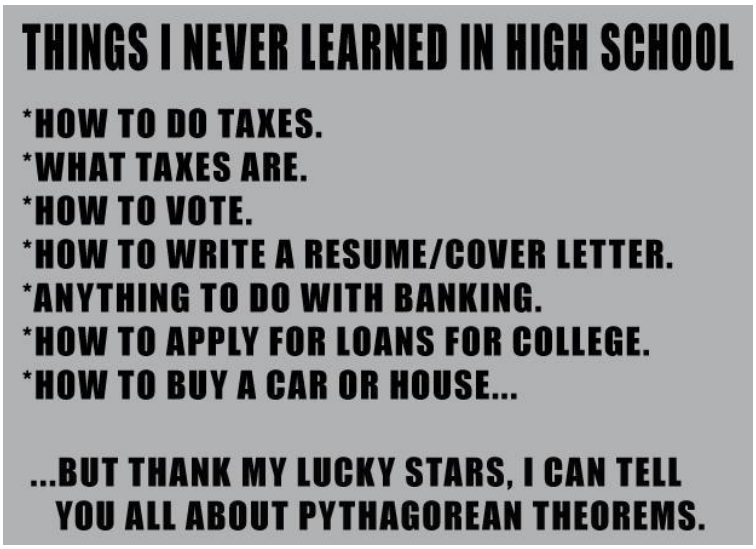
On the other hand, economics is the study of how people *"get what they want."* In other words, it's about what role incentives play when there is scarcity—or a lack of something. And economics teaches students (just like it taught me) how to think about money more effectively. But more so, I learned about the incentives that govern *everything in life* from the price that a real-estate agent sells a house to the amount of cheating that occurs in a classroom (read more about the incredible power of incentives in Stephen J. Dubner and Steven D. Levitt's **FREAKONOMICS**). Truly, understand incentives, and you understand the basis of the whole human condition.

Now you may argue that economics—just like history—entails memorization of large confronting terms such as fiscal policy, average variable cost, and the Lorenz curve. But nevertheless, the fundamentally topical nature of economics will help students to develop practical skills such as determining when to shut down a business or deriving the *actual* price of a house. Since these economic concepts are practical, just like psychological phenomena, I can use them on an everyday basis in my everyday life whether I'm a doctor, plumber, or a Wendy's cashier (and this simply cannot be said for history).

2.3: Solution:

2.3.1: Part 1—Social Studies over History:

It's quite apparent that we have a problem in the social-studies department of our American education system when students cannot ask for a loan, mortgage their house, make an informed decision for the next presidential election, or even fill out their taxes.



These are common complaints, but one idea that threads through each of them is they are practical, not theoretical—such as history. So here's a proposal: decrease the emphasis schools place on history—while still maintaining a elementary level of the subject—and significantly increase the emphasis on practical social studies such as economics and psychology.

In other words, rather than creating the standard that requires students to take 3-4 years of history, require them to take one year of world history, one year of economics,

one year of psychology, and one year of political science throughout their high school career.

The key however, is to ensure that students have some say in the courses they pick; in other words, create requirements, but create requirements with choice (find out more about this concept in A Revamp of the High School Experience). So even though there may be an economics requirement, let students take a business fundamentals course instead; this way, they can find something they are truly interested in and something that they will input intrinsic time and effort into.

Now this may seem a bit radical…. *No American History? We're not going to teach our students the basis of our country's founding?* But quite honestly, Elementary schools and middle schools do a fine job of informing our students about the fundamentals of our country's history. 8th graders know about the Civil Rights Movement. They know about the Boston Tea Party and the Boston Massacre. And they know the generalities of the industrial revolution. What most students don't learn in K-8, however, is history on ancient civilizations, European History, Asian history, and African history. This is what the "world history" course should cover; this will allow our students to have an overarching experience in some of the main cultures of human history, rather a very limited scope knowledge in only American history.

Then let the history courses already established in many schools—such as in-depth American History, military history, art history, European History, Hispanic studies, and Asian studies—as electives. This way, students who are truly intrinsically interested in history can take classes they enjoy, discuss with peers who enjoy the material just as much, and put in serious effort to learn a lot.

For example, I love art, and so accordingly I put aside my topical thinking and decided to take an Art History course; and I absolutely loved it. While most others struggled to do well and make connections between the arts of ages, my intrinsic interest in the subject allowed me to input genuine effort and take away a great ability to seek patterns in not only art works but also generally in life. (Read more about my Art History Experience in the Arts Chapter)

2.3.2: Part 2—Finance or Accounting Requirement:

One of the major complaints people seem to have about the current education system is that students don't learn practical skills such as requesting a loan, buying a house, or understanding mortgage. Then use the space that fewer history requirements created to add a finance/accounting requirement.

But again, let students have some say in what they choose; indeed, if there is only one choice, there is a very small probability that the students will develop intrinsic

interest, but if there are a few choices—such as *Intro to Accounting*, *Finance Basics*, *Intro to Banking*—then there is a better chance students will find something they are really interested in. (Read more about "requirements with choice" in the "Revamp of the High School Experience" chapter").

2.3.3: Part 3—Political Science:

High school graduates—as witnessed with the rage social-network post shown above—also seem to complain about the lack of knowledge they have about the political sciences. Specifically, many argue that even though they are eighteen when they graduate, they don't know what a political party is, they don't know the voting process, they don't have enough of a background to select a candidate to vote for, and they don't know how to involve themselves with political PACs and their local government.

The fix is simple: add a political science requirement—that once again has a few alternatives. However, rather than structuring this political science course like a traditional class—where students learn a concept and then take a test—a more *hands-on course* will help students develop the practical governmental skills they will need in their post-high-school careers. So for example, let students contact their local government and send complaints or compliments. Or let them try to associate with a local PAC. Real-time experience always trumps classroom studies.

Chapter 3: MATHEMATICS

3.1: The Current State of Mathematics:

"Alright scholars, this is a formula called the double angle formula and it is one of the trig identities you all have to memorize for the next test," one of my math teachers says.

"Can you derive it? Why does it work?" a student asks.

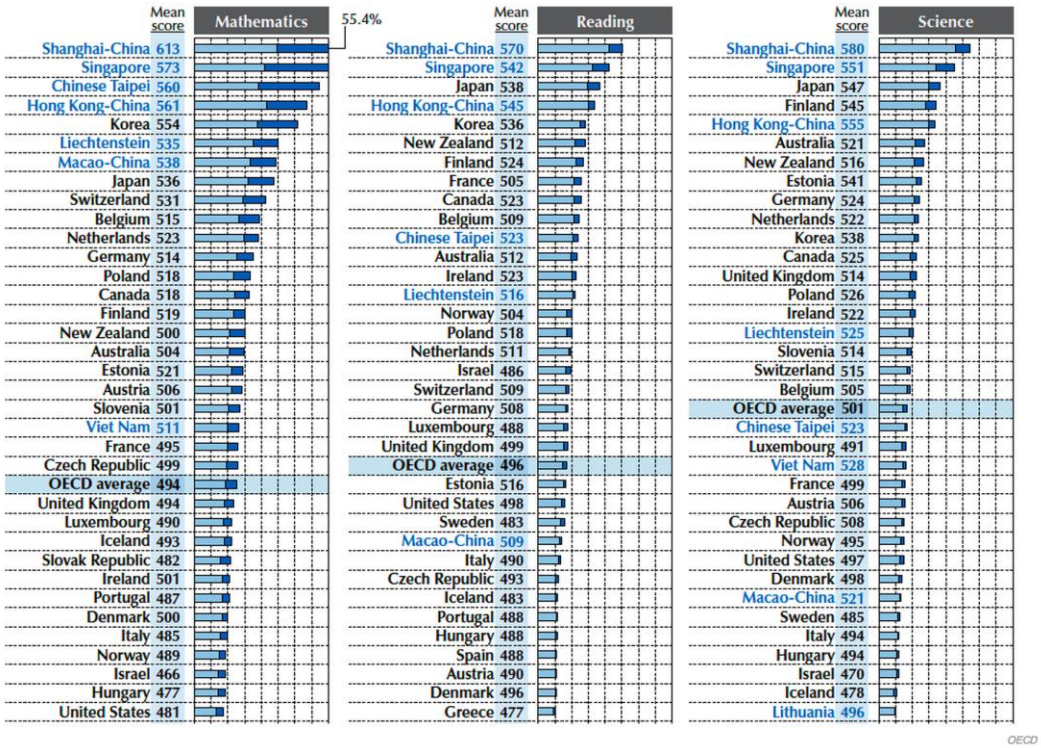
"You don't have to know that for the test. Just memorize the formula and you should be set!"

You've probably heard some variation of this from one of your math teachers. Nonetheless, you go ahead and read some examples in your book, and the next day, the test or quiz has more or less the same problems as the examples. There is no problem solving, simply memorization. You do well. Then after the test, you forget all the formulas and start to memorize the next topic—in my pre-calculus class that was graphing trigonometric functions. After chugging though the whole class, you sit down and *re-memorize* all the formulas for the final. Sometimes you may even struggle to remember reviewing the formulas in the first place. Still, you take the final and now can finally forget everything for good.

See the problem? Teachers are forcing students to memorize formulas—that can quite honestly be found online in a matter of seconds—when they should be learning problem solving and pattern recognition (for these are the skills that all students, future mathematicians or not can use.

And my allusions are not solely true of *my* high school. In fact, these complaints are quite common nationwide. If you ask most high school students all over the country, this is precisely how they describe their math classes. Of course, for the vast majority of them, the system is fine as is since they don't have to input much work, and can still slide away with a solid grade—the main motivating factor for most.

Nonetheless, for politicians in Washington, ranking *below* average—though the 2012 PISA results—in mathematics doesn't seem to suffice. We need change.



A graphic released with the 2012 PISA—Program for International Student Assessment—shows that US teenagers "slipped from 25th to 31st in math since 2009. Click here for more information and the source of this graphic.

3.2: AwesomeMath Camp:

One of my past experiences may offer an inspiration for change: "Holy f**k…how the f**k do you do this f**king problem? OMG. OMG. Dude what the 'f' is this? This is most trivial thing ever! OMG…." This was an everyday occurrence at AwesomeMath @ Cornell University—a summer camp I attended after sophomore year.

And honestly, as shocking as it may seem, this kind of sentimentality did not surprise me: e*xtremely* ambitious people—many of whom would participate in elite competitions such as International Mathematics Olympiad—surrounded me. "People here get high off of math," one of my friends said. And he wasn't overstating the fact. Most students at this program woke up at eight, went to class till noon, and then worked on the *Art of Problem Solving* Problems for the rest of the day. It seemed absolutely *crazy* to me. But they loved it. They didn't mind the schedule at all. It was truly heaven for them. It was for me to, but not for the most obvious reasons (see *A Revamp of the High School Experience*). But moreover, I learned more than I ever have in any traditional high school math class.

Why was AwesomeMath so effective in teaching? Every class was comprised of proofs. In other words, for the lecture portions of the number theory and combinatorics classes—the two classes I took—all the professor did was explain how a particular concept or formula was derived. He didn't go over any "examples." Those were reserved for the second portion of the class—the problem-solving session—where students would work in teams (hence developing team-collaboration skills) to solve extremely difficult problems though the proofs presented earlier in the class.

As such, there was no memorization. And there really didn't need to be. Indeed, in mathematics, the proof for a concept obsoletes the necessity for memorization; truly, if you forget a formula, you can derive it right on the spot. And since you know where the formula originates from, it will make significantly more sense. Even to this day—two years later—I still remember many of the proofs my professors presented, whereas many of the formulas from my high school multivariable calculus class would completely baffle me, since the class was focused on memorization rather than *understanding*.

And hence at AwesomeMath, while I did indeed learn many mathematical concepts that can be used to solve combinatorial and number-theory problems, the one major skill I learned that I could apply to any field was problem solving. Truly, writing, and even understanding a mathematical proof requires intense critical thinking, close reading, and abstract & nonrepresentational thinking—something that simply cannot be claimed of the memorization of seemingly useless formulas presented in the everyday high school class.

3.3: Solution:

3.3.1: Problem Solving Over Memorizing:

And that is precisely the solution to our problem of American mathematics: mold it towards the AwesomeMath ideal. Dramatically decrease the amount of memorization in the class and focus on problem-solving and pattern recognition since those skills can be applied in not only mathematics, but also in every other field.

Indeed, in the classroom setting, simply presenting students with a formula and then reviewing a few examples conditions students to only focus on the given steps to solve *specific* problems, rather than developing an ability problem solve though *all* similar problems. In other words, even though a student may be able to solve the kind of problems that the teacher presented in the past, he may not be able to generalize the ability to all analysis based problems that require the particular formula or concept.

In order to increase the chance that students are able to solve a variety of different analysis problems rather than simple variants of those presented in class, ensure that

students understand how to conceive the formula or concept. Prove the concept. Prove it a different way so that even if the first explanation didn't click, the second one may. If students understand the origin of a formula, it is way more likely to "click" and even more likely that the student may remember it.

And on assessments, perhaps even *give* students the formula and have them try to solve *difficult* problems—problems they have never seen before and problems that require more than the simple memorization of a formula to solve. Give them calculators (as cliché as it may sound, students will truly have access to all the formulas and calculators in their post-high-school years) but make sure they have to think about when to use the calculator, how to use it, and what function to use on it. Don't make it obvious that you must use the double angle formula. Cloud up the problem so that a different identity is the first bet, and then measure whether they can figure out a different method to solve. That will truly teach students how to problem-solve and recognize patterns, not only in mathematics, but also in other fields.

Now it may arise that "lower-level" students could not handle proof based classes. But this is simply not true. The topics covered in class don't have to be advanced mathematics, they can be simple algebra or geometry based. Indeed, there is reason that 1+1=2, or that three points define a plane, or that $a^2+b^2=c^2$. Truly, for the vast majority of students, that latter formula is just that, a formula they memorized. They call it the Pythagorean theorem and can plug numbers into their calculator to find a hypotenuse given two legs in a right triangle. But why is it true? Very few people—even advanced students—know the answer to this simple proof. Yet understanding it leads to a deeply greater understanding of basic geometry. Truly, even lower level classes can be proof based, and an early development of analysis skills needed to prove concepts will assist students deeply in higher-level classes (plus many countries on the PISA list above already have proof-based classes).

3.3.2: Increasing Intrinsic Motivation:

Now, you may think that the solutions proposed in this chapter are still quite radical and that the only reason that AwesomeMath camp was so effective at teaching mathematics is that it is, well, a camp where the whole point is to have fun…. Or you may think that the reason that students put in so much effort there was because mathematics intrinsically motivated them (something which is not true for the average student). And you'd be absolutely correct. People will do their best work when they want to, not when working for grades or money.

So why don't we do that? Why don't we strive to increase the average students' intrinsic motivation in the subject? Truly, while intrinsic interest for mathematics may

seem particularly utopian—after all, there seem to always be students who just don't listen for the sake of not listening—we can move closer to this ideal than we currently are.

The solution is to make mathematics problems relatable, contemporary, and most importantly, *practical*. Currently, students simply don't care about the vast majority of mathematical scenarios posed in high school because there is no story. They cannot relate to the problems. They are asked to find the area under a curve, the velocity of a ball, or the angle between two lines for *no apparent reason.* And as a result, students question why they will ever need the skills again, moving us away form the utopian ideal. Because students cannot relate to any of the problems—in their world of rap singers, the most fashionable shoe, or the latest gossip, nobody really cares if Bill is trying to install a fence in his yard.

However, if the problems posed directly relate to current events and the students' current life, they are more likely to care. So for example, if a Kardashian was married, have the students calculate the probability of a—a long marriage, b—a divorce, or c—cheating. As brutal and immature as this may sound to an education professional, there is no denying that this is a common topic of debate in the high school hallway. And as such, since students care about the topic, they are more likely to put effort into understanding the mathematics problem.

Moreover, rather than conceiving situations that are completely unfeasible for problems, using those that occur on a common basis—such as the exponential growth of interest in a bank account, or the expected drop in TV prices based on prior data—would be more relatable to students, and therefore more interesting. Plus, these skills are practical. These are the skills that students would continue to use for the rest of their lives (this simply cannot be said about many of the current topics high school mathematics instructors teach). And so, students will actually *want* to learn the information (after all, nobody wants to risk bankruptcy later in life).

Indeed, if teachers are able to create content that students will truly use in the future, while simultaneously—and more importantly—teach problems-solving, not only would students be more willing to put in the effort to learn the content (after all, they will *actually* be needing it in their professional lives), but they will also learn skills they can directly use whether they pursue mathematics or not. If we can do that, we can move close to the ideal than we or any other country ever has.

Chapter 4: ARTS

In his State of the Union address, Barack Obama said that in his term, he would strive to emphasize STEM in the education sector.

And instantly, there were hordes of online controversy about why the President said "STEM" rather than "STEAM." Indeed, people argued that "A" for "Arts" was just as important as any other field. And in many extents they are completely correct: after all, would Obama (someone who generally writes his own major speeches) be able to address the union as eloquently as he did with only a science, technology, engineering, & mathematics education? The simple answer is no.

4.1: The Opposition to Arts:

But the full answer is nowhere near as simple. Truly, people all over the globe are arguing that schools need to remove liberal subjects from high school and college curriculums, because there is a incredibly limited market for say art historians or academics in French Literature (read this Forbes article "Should We Abolish Liberal Arts Degrees? Quite Possibly, Yes" for more background).

And it seems to make sense: why focus on the past by *re*-studying 18th century English Literature, when we can focus on fields such as medicine—which may permit us to construct a fully functioning artificial heart and help save *millions* of lives in the future. Truly, there will almost never be a shortage of art historians, but we will always need more people to invent products, create medicine, and study our human life. After all, any day now, there may be a young doctor who just happens to look at cancer through a different, more innovative, eye and happens to cure a strand that has baffled scientists for decades. The same cannot be said about liberal subjects (and even if there is a major discovery in the works of a 18th century poet, since the discovery doesn't affect the everyday American, most people won't care).

Economically, Anthony P. Carnevale, Jeff Strohl, and Michelle Meltonan at Georgetown University did a study suggesting that every one of the ten *highest*-paid college majors (such as Petroleum Engineering, Mathematics and Computer science, and Mechanical Engineering) is in STEM. On the other hand, almost all of the top ten *lowest*-paid college majors (such as counseling psychology, studio arts, and drama and theater arts) are in liberal subjects. (Click here to see whole article on USAToday or view the list below). Why continue to teach a liberal subject if students who dedicate their life to it, and receive a college education, will struggle to make over $25,000 a year?

Top 10 highest-paid college majors

1. Petroleum Engineering: $120,000
2. Pharmacy Pharmaceutical Sciences and Administration: $105,000
3. Mathematics and Computer Science: $98,000
4. Aerospace Engineering: $87,000
5. Chemical Engineering: $86,000
6. Electrical Engineering: $85,000
7. Naval Architecture and Marine Engineering: $82,000
8. Mechanical Engineering: $80,000
9. Metallurgical Engineering: $80,000
10. Mining and Mineral Engineering: $80,000

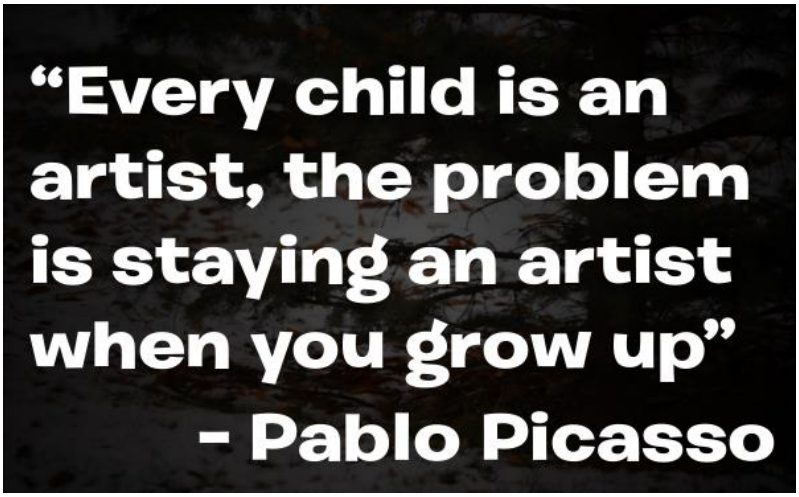
Top 10 lowest-paid college majors

1. Counseling Psychology: $29,000
2. Early Childhood Education: $36,000
3. Theology and Religious Vocations: $38,000
4. Human Services and Community Organization: $38,000
5. Social Work: $39,000
6. Drama and Theater Arts: $40,000
7. Studio Arts: $40,000
8. Communication Disorders Sciences and Service: $40,000
9. Visual and Performing Arts: $40,000
10. Health and Medical Preparatory Programs: $40,000

Thus, it seems to make practical/economic sense to remove these impractical subjects, and instead teach students STEM, subjects that will improve our technology and the lifestyle of people all over the world.

4.2: But here's the Catch-22:

Some kind of artsy *background* is incredibly important in thinking creatively. As Picasso says, "Every child is an artist, the problem is staying an artist when you grow up." (See A Revamp of the High School Experience for more).



Truly, being able to express your innate, gut expressions is what liberal subjects teach students. And these skills do not lose their value in more practical subjects (such as STEM, Medicine, or Business); they are truly important—and even practical when innovating.

The Massachusetts Institute of Technology (MIT) seems to be taking this idea to heart. any people worldwide consider this university as the forefront of engineering and technology (STEM) anywhere. And yet, Deborah K. Fitzgerald—the dean of the MIT School of Humanities, Arts, and Social Sciences—says, “At MIT, the humanities are just as important as STEM.”

She continues on to say that “we view the humanities, arts, and social sciences as essential, both for educating great engineers and scientists, and for sustaining our capacity for innovation.”

And indeed, success in many STEM fields almost requires some kind of background in humanities as well. A MIT medicine school alumnus said that to be successful in the clinic, not only did she require a background in medicine, “but also the ability to interpret her patients’ accounts and stories.” “Reading literature, studying the various forms of narrative, the many ways humans share vital information,” taught her this skill. She went onto say that “MIT biology prepared me for medicine, Literature prepared me to be a doctor.” (Read more about this article in the Boston Globe).

Truly, helping students have a basic liberal background (in addition to their general pursuits) seems to be working. MIT consistently ranks as the top engineering school in the country and has top programs in entrepreneurship, business, economics, and the humanities (along with countless alumni who are changing the world on a daily basis).

4.2.1: The Intersection of Arts and Technology—Apple:

But we don't just see this marriage of arts and technology in high tech institutions; we also see the concept in the business sector. Apple is a prime example. At this point, almost every person in the world over the age of eight has probably at least heard of the name Apple. But one of the main reasons that Apple's products are so simple to use, elegant, and famous is that Steve Jobs—the legendary co-founder and late CEO of Apple—possessed a strong inclination and esthetic ability.

One of his major learning points was studying calligraphy at Reed College. Indeed, in his 2005 Stanford Commencement speech: How to Live Before you Die, Jobs said, "Reed College at that time offered perhaps the best calligraphy instruction in the country…. Throughout the campus every poster, every label on every drawer, was beautifully hand calligraphed…I learned about serif and sans serif typefaces, about varying the amount of space between different letter combinations, about what makes great typography great. It was beautiful, historical, artistically subtle in a way that science can't capture." He continued: "when we were designing the first Macintosh computer, it all came back to me. And we designed it all into the Mac. It was the first computer with beautiful typography. If I had never dropped in on that single course in college, the Mac would have never had multiple typefaces or proportionally spaced fonts."

Truly, such a simple yet superficially *useless* course permits Jobs to change the face of technology forever. Apple is truly the epitome of the marriage between technology and the liberal arts. And this marriage is truly where the future of our country and the world lies.

Now you may argue that not everyone is Steve Jobs; after all, he was already a creative genius who had a knack for design. And you'd be right. But nevertheless, there is no doubt that liberal arts can instill creative, "right-brained" thinking into more "left-brained" subjects like medicine.

Think back to the example I presented earlier: a new-and-upcoming student just happens to cure a strand of cancer that scientists couldn't cure for decades. In this example, that innovative thinking could be either innate or developed. In the latter case, studying or even creating a piece of art or writing based on an earlier artist may give that particular student the insights to cure the strain of cancer.

4.3: My Experiences with Art History:

The concept of the *marriage of arts and technology* alone inspired me to take AP Art History in my senior year of high school. Now, most of my friends criticized me with comments such as "why in the world you take that class? It's absolutely useless. Nobody

cares about art." But nevertheless, I took a chance—I already had an inclination towards producing art—and dove in.

I loved it. Every second of it. And sure, most of the information presented in the class was absolutely useless. *I'm almost certain I'm not going to have to use characteristics of Renoir or Rodin's works in the future.* But still, I gained more from art history than I did from some more practical classes.

Truly, studying art history taught me a greater appreciation of patterns. For example, a common question in this particular subject is to analyze the evolution of a particular figure over a time period. And so I had to compare an Adam and Eve painting/sculpture from the pre-Christian era to the Roman era to the Renaissance era to the Neo-classical era. I learned how to deduce similarities and differences from very little detail. And thus, even though the content may not have been completely applicable to my life today, the skills I learned from studying it most definitely help me see patterns.

How? Nowadays, I am constantly comparing artwork with movies with articles with books; before taking the course, I would never have seen the connection between these completely diverging forms of expression, but today, it truly does seem that *everything* is connected, and that *everything* influences *everything* else. And so—for example—while writing, I'm able to reference these various forms of expressions.

4.4: Solution:

So teaching liberal arts are important; they help students develop a knack for creativity, and moreover, they intrinsically motivate many people. But are we making sure that we are taking advantage of the arts in our current system. And is it even economically worth studying an impractical subject for the rest of your life?

Probably not… but that does not mean that schools should absolutely banish the liberal arts from their curriculum. Rather, schools should require students take *some* kind of liberal arts class each year of their secondary school education. A background is what todays students need. But allow them to make the decision to which subject they choose to pursue: art or creative writing or French or band; after all, people will do their most innovative and creative works when they are innately interested in something. In other words, if someone really loves to draw, they will intrinsically put a lot of time and effort into drawing, not into playing clarinet.

But the above proposal isn't anything new—most schools all over the country have some kind of liberal arts requirement. That's completely true. But the current system doesn't take full advantage of liberal arts classes.

Indeed, most classes—though promoting creativity—require grades….And anytime there are grades, there cannot be creativity. Why? Once again, people put in

innovative effort when working for themselves, not when working for grades or money (see *Social Studies chapter*). Because of grades, many students don't put in the effort to do something creative, but rather just do the bare minimum (and commonplace), get an A, and then move on.

So instead, create creative classes that have no grades. Let students create something they really want to make. Let them make art based off of Van Gogh. Let them write a creative story. And let them compose electronic/techno music on their computer. This way, not only would students be doing something they are really interested in, but they can also craft their creative thinking. (See the Entrepreneurship chapter for more on how effective these projects are).

4.5: Why would such a System work?

Okay, this idea of a grade-less liberal-arts class seems to make sense, but it is just a theory…. Who's to say it will actually work?

Here's an application of this idea that has been tested all over the country: silent reading time.

During my junior year, my English teacher gave us a whole hour on Friday to simply read. Nothing else. No homework. No talking. No playing. Just reading. Now, this may seem limiting, but in reality, it was liberating. Truly, before these reading days, it simply seemed like I had no time whatsoever to read, even though I loved to do so. But every Friday, I would open a new book that I picked, start reading the first chapter, and be transported a brand new setting different from the drab schoolhouse one I am in everyday. And usually, I would enjoy the book so much that I would continue reading over the weekend and into the next week.

What started off as a Friday exercise in English class quickly evolved into everyone's favorite bell of the week. As soon as the class started, everyone instantly stopped talking, and independently started reading; the teacher didn't have to say anything—the students themselves wanted to read. People didn't *want* to text or play games or talk with friends. They *wanted* to read. That's intrinsic motivation. Truly, these reading days permit us (as a class and individually with friends) to have in-depth discussions about the texts that we simply couldn't have with required readings (such as **THE GREAT GATSBY**, **TO KILL A MOCKINGBIRD**, or **A TALE OF TWO CITIES**) because most people couldn't relate to the novels and weren't intrinsically motivated to read them. But on reading day, since the students themselves picked these books, they were intrinsically interested in the novels (and if they weren't, they could simply change the book).

This is precisely the reason that such a system works: choice. If there weren't a free choice in the book I read, I really would not have redeveloped my passion for reading. In this case, I would look at Friday reading days as a chore. I would look at it as a time to get ahead on my homework—which required reading is.

Chapter 5: RESEARCH/ENGINEERING

5.1: My Research Experience:

5.1.1: The Crude Beginning:

I was one of the few lucky ones who found an opportunity to do graduate level research at the local university *during* high school. So I drove 40-50 minutes every Friday starting sophomore year to a professor's lab and would simply sit and listen to Ph.D. students, professors, and general speakers give seminar talks about glass science—the field of interest for the professor I was working with.

The reason for my visits? I wanted to develop some real-time experience in the field I was considering to major in college, and I knew that lab experience was incredibly more effective than any school course was.

Initially though, I understood almost none of the information. Literally none. The large, esoteric words and advanced calculus rendered all my efforts useless. But after a few months of simply listening, I learned to circumlocute the scientifically technical words and comprehend the "gist" of the talk, just as student would understand the main point of a text while learning a foreign language.

And as I continuously gained more knowledge about glass science during the latter part of my sophomore and the whole of my junior year, the professor allowed me to assist his graduate students in the experiments they were running for their doctoral theses; this entailed helping them prepare glass samples, starting complex instruments needed to characterize samples, and creating graphs that accurately portray the data (click here to see a project that I helped a grad student on at my website).

5.1.2: The Spectacular Ending:

By the beginning of my junior year, glass science and research in general truly interested me. My professor noticed this curiosity and allowed me to independently research a topic that I didn't understand at all a couple of years ago.

As such, I designed a series of experiments, conducted most of them, and created the graphs & data tables for an experiment. The experiments were gave the team some terrific insights and as a result, at the end of the summer, my professor permit me to be

the first author paper on the published research paper (click here to see extended information about the project on my website).

basic solid state physics

Fragility and molar volumes of non-stoichiometric chalcogenides: The crucial role of melt/glass homogenization

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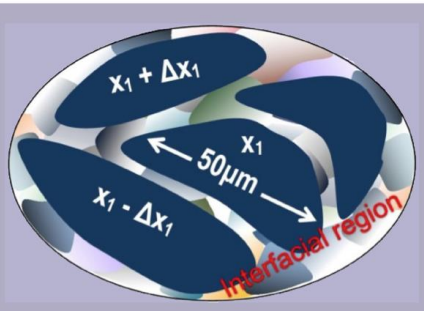
Melt-fragility index (m) and glass molar volumes (V_m) of binary Ge–Se melts/glasses are found to change reproducibly as they are homogenized. Variance of V_m decreases as glasses homogenize, and the mean value of V_m increases to saturate at values characteristic of homogeneous glasses. Variance in fragility index of melts also decreases as they are homogenized, and the mean value of m decreases to acquire values characteristic of homogeneous melts. Broad consequences of these observations on physical behavior of chalcogenides melts/glasses are commented upon. The intrinsically slow kinetics of melt homogenization derives from high viscosity of select super-strong melt compositions in the intermediate phase that serve to bottleneck atomic diffusion at high temperatures.



Schematic of a near homogeneous Ge_xSe_{100-x} melt composed of homogeneous (dark) regions separated by heterogeneous (light) interfacial ones.

(*Additionally my experience is a truly a fantastic case study on how motivation works. Initially, when I didn't know much about glass science, I was not able to do much work, but as I spent more time with the material, I became truly interested in the research; at this point, I looked forward to driving an hour to the university each day. I wanted to work and make contributions to science. This is the point at which I found my intrinsic motivation; this motivation allowed me to "make the most" of my experience.*)

5.1.3: What I learned:

Even though I most definitely learned a lot of factoids about glass science, I more importantly gained a realistic realization of what science and research entails: it's not a linear process as high schools propose, but rather is a cyclical process: one question leads

to another, and the second leads to the third (while experiments run all the while). This was incredibly frustrating. Most of the time, neither the graduate students/professor nor myself had any idea of why something was or was not working. We simply had to go along. Projects failed. Experiments failed on a daily basis. And yet, at the end of the day, I developed a great tenacity when it comes to project-work—something that I simply never would have been able to acquire in minor school projects.

But that mental determination wasn't the only skill I developed. I also obtained an ability to creatively use very limited materials—because of the huge price of equipment—to accomplish some specific task.

Moreover, to truly understand the experiments, I had to read long, scientific journal papers; and so today, after continuously persisting though the papers (just like the seminars I attended earlier), I am able to efficiently read difficult articles and books.

5.1.4: The Experience I Now Hold:

Furthermore, and perhaps more importantly, even *while in high school*, I gained direct experience in the field I was considering for my future studies. Although this may not seem particularly noteworthy, perhaps one of the major complaints of *college* students is that even after attending four years of college, they have to complete internships before they can work in a full-time job; after college, they simply don't have enough "experience." This seems counterintuitive doesn't it? If I major in electrical engineering in college, I should have enough "experience" that I should be able to score an EE job, right? But no… That's not how it currently works. Currently, it's a cycle: since I don't have experience in my respective field, I cannot get a job, but since I don't have a job, I cannot garner experience.

However, in my case, my internship gave me experience very early on. And as such, even if I weren't to attend college (I am), I would more easily be able to contract a job—probably *without* an additional internship.

So why not fully incorporate some kind of research into high school? That way, everyone would have experience in the field they are considering in college, and could work at a high-paying job right out of the university. And moreover, they would develop problem-solving skills, mental tenacity, ability to work with team-members, and a great appreciation of how independent projects work.

5.2: Solution—Fully Incorporate Research into Schools:

As you can see, the benefits for incorporating some kind of research into high school highly outweigh the costs. Now you may think that many students would not be

able to handle the intense time commitment and critical thinking that would go into research. But in reality, the research need not be incredibly high-level graduate studies. Students should be able to research anything—arts, literature, science, mathematics—they are truly interested in.

This is imperative. When a school chooses to incorporate research into its curriculums, individual students *must* be allowed to select the topic they want to research. Why? A particular student must truly have intrinsic interest in a particular topic if he wants to gain the most benefits (the saying "you get out what you put in" is true here more than ever). If he is not intrinsically motivated, the student will simply work for grades (and thus try to "get the project out of the way" than actually try to understand the material).

Truly, an incredibly intelligent student researching advanced biology to earn money for college will probably not make as many innovative gains as a mediocre student who absolutely loves to learn about, say, saltwater aquariums, and who puts all of his time into understanding and experimenting. Most definitely watch more about intrinsic vs. extrinsic motivation from Daniel Pink's TED talk: The Puzzle of Motivation.

And truly, for their research project, teachers should not force students to research obscure, detailed, and technical topics like advanced engineering. The student could try to prove why 1+1=2 (believe me, the answer is not as simple as you may think), write a paper on who or what principally influenced Van Gogh's creation of *The Starry Night*, or even research what motivates us to watch sports.

Indeed, no matter how simple or trivial these questions may seem, they are almost guaranteed to help students read dense text, pick out important information, find important media to help convey a message, learn how to use Google and other search engines efficiently (read here why Google is the most important learning tool ever invented), translate raw information into a well-thought-out paper, manage time, write eloquently, increase vocabulary, and most importantly, problem solve.

There is absolutely no way that students could develop these skills if they were to simply listen to teachers give advice on what they *may* do in the future. Things in the lab—or anywhere in the professional world for that matter—are never as simple as they seem in the classroom; something always goes wrong. The best way to learn is to do, not just go to a lecture hall or library. Research would allow students to do something innovative, something that they enjoy learning about, and something that will give them real-time experience in any future jobs.

5.2.1: Incorporating Research into Schools:

Now you may argue that it would be incredibly costly to transport and keep students in touch with professors. But in reality, for many of these disciples, students do not need to work with professors. Even independent research in the school building is possible for some liberal subjects (e.g., using primary documents to find out precisely how Thomas Edison changed the history of the world). Especially for underclassmen, this is a terrific way to gain the benefits of research without spending all of the school's cash flow.

However, if funding is available to create a class dedicated to research, many funding organizations (such as the *National Science Foundation*—NSF) generally require professors to demonstrate how they've helped secondary school students; as such, many professors willing—even hoping—to interact with students in high school. For example, the professor that I worked with in my glass science research was more thrilled than I was when I emailed him asking for an internship; he won an extra pair of hands and received extra research funding, and I received genuine experience in the career I was contemplating.

Moreover, to further reduce money required, schools could create an after school activity that allows students to preform research with any willing professor at the closest university. To further increase the fruits of the endeavor, have the students themselves contact and arrange with a professor to work with (that way, they can develop communications skills as well). A bus could then transport everyone right after school and return home at a specified time.

Another tool that is even simpler to implement and requires significantly less money is an "inquiry lab." In these kinds of labs, students completely design a procedure and carry out experiments (with only the equipment available) to answer a question they want to answer. They have complete control over all aspects of the project. Plus, neither the student nor the teacher knows the answer (hence, more accurately representing a research lab). As such, these inquiry labs come extremely close to the ideal of a research experience in high school and don't require any extra costs (Read more about Inquiry Labs and their effectiveness in the *Sciences Chapter*).

And truly, this "research" doesn't have to be every year. Even a little research for one semester in four years is better than anything.

It seems that even the College Board is following suit with the ideal incorporating research into high school by designing new courses this year—AP Seminar, AP Research, and AP Capstone—that the non-profit will beta test at select schools. (Click here to see more information about these future Advanced Placement courses). And the organization provides many of the same reasons I provided in this text for implementing these courses. Additionally, since these courses are "AP," even students who would rather have Pavlovian tests and rewards over creative/free courses can at least gain some of the benefits of research.

5.3: Teaching Practical Skills:

Another common complaint of high school students and college students is that even after completing four or eight years of education, they don't have practical engineering skills. So they cannot jump-start their car, wire their house, or change a tire…. Moreover, many don't know how to request a loan, buy a house, or even write a check (but I address these financial practicalities elsewhere: in *History/Social-Studies*). Why don't they possess these practical skills? School—the center of their teenager life—didn't teach them.

5.3.1: Solution:

This is a completely reasonable simple complaint. If someone chooses not to attend college, and rather joins the workforce right after high school, she will probably not have the skills to complete any of the tasks—though simple—listed above.

But the solution is equally simple. Create a class in which the first semester is all about research (as detailed in the first part of this chapter), and the second semester focuses on teaching practical engineering skills: basic plumbing, wiring, lighting, changing tires, etc.

There is almost no reason *not* to implement this kind of class. Many schools already have a basics "engineering" class in which topics such as woodworks are covered. This same instructor could decrease the emphasis the woodworking, and increase the emphasis on other *engineering* skills necessary to have a home, keep a car, and maintain a family.

Chapter 6: SCIENCES

6.0: Introduction:

Science for centuries has remained one of the only school subjects that directly relates to problem solving and helps students think and make sense of the world. It is by nature topical. But there are nonetheless a few changes that could greatly enhance the skills students take away from their high school science classes.

6.1: Biology—the Problem with Memorization:

Consider if you will the average high school introductory biology class. Students have to learn the parts of a cell. *Seems important, right? After all, one cannot learn microbiology without learning the basics of a cell.* And so students go on memorizing the definition of the cell parts, take a test, and then forget everything. Then the teacher moves onto the next chapter—say genetics—and the previous chapter's knowledge is never reincorporated. Then, when exam time comes around at the end of the year, students re-learn—re-memorize is perhaps the more proper term—all the terms and cycle starts again.

As a result of this process, most students have a very small understanding of the actual information. Sure they can repeat the exact textbook definition of the rough Endoplasmic Reticulum, but ask them to *explain* how the ER interacts with the rest of the cell in process of synthesizing proteins, and they are absolutely helpless.

And additionally, most students really don't *care* about the rough endoplasmic reticulum. Requirements say that they must take the class, and they have no say the issue; moreover, there is no choice in classes that students can take to fulfill the particular requirement and so there is a very small chance that many develop intrinsic motivation for the subject. In other words, almost every student in the classroom is working for a particular grade—whether that is an A, a B, or a C—and as such, no one really cares to actually understand the material. (See *A Revamp of the High School Experience* for further detail about the necessity of choice).

Now you may be saying, sure you've identified a problem—however severe. But how do we correct the error? What's the ideal that we should be working towards? Unfortunately biology is perhaps the most difficult scientific class to address since it requires the most memorization of factoids. Indeed, in this regard, biology is almost a brother to mathematics (*see* *Mathematics chapter*). And since all of the factoids students

learn about don't directly relate to them, and they cannot see the facts being *directly* applied to their lives, they generally don't put in intrinsic effort. But still, there are still a few things educators can do to help reform the biology classroom.

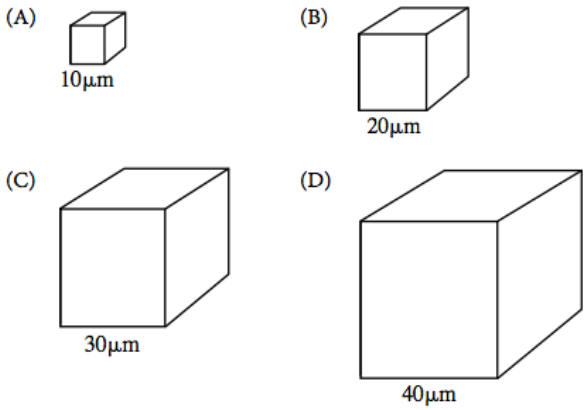
6.1.1: Biology Solution:

Currently, the College Board (creator of Advanced Placement or AP) has created a "revised AP Biology exam" that directly answers to this problem. Truly, rather than having students memorize specific information, factoids, and processes, the test writers give students all the background information and formulas needed to solve a particular problem right on the test.

Consider this sample problem:

2. Simple cuboidal epithelial cells line the ducts of certain human exocrine glands. Various materials are transported into or out of the cells by diffusion. (The formula for the surface area of a cube is $6 \times S^2$, and the formula for the volume of a cube is S^3, where S = the length of a side of the cube.)

Which of the following cube-shaped cells would be most efficient in removing waste by diffusion?



To solve this problem, a test-taker truly doesn't have to know any formulas or background information; all she must know is how to read, analyze the information given, use specific pieces of data to propose a hypothesis (in this question, does a smaller or larger surface area result in a more efficient waste-removing cell?) and then problem solve thought the question (the answer is *A* if you're wondering).

Now, this is true problem solving, and it more accurately represents the real world. Truly, in the lab or in the work place, students will have all information readily available; what they have to do is use the information to solve a particular problem. Memorization doesn't help in any way. This is how teachers should structure all classroom tests—including the rest of the AP exams.

This method would not only force students to actually understand—memorization doesn't help you at all in these kinds of tests—but it would also increase the probability that students develop intrinsic motivation (if they actually appreciate how something works, rather than that it "just does," they may become truly curious in investigating the answer).

6.2: Chemistry and Physics—Not Enough Labs:

Physics is the polar opposite of biology; a physicist truly does not need to memorize any formulas or concepts, since he can derive almost all physical formulae on the spot. As such, high school physics classes are laden with problem-solving that helps students not only in the realm of physics & science, but also in their everyday problems.

Chemistry fundamentally stands between the intense memorization that biology requires and the intense problem solving that physics merits. Indeed, chemistry is truly the perfect balance between memorization and problem solving.

These classes move towards the ideal of problem-solving more than any other. However, in many schools, teachers only focus on the theoretical aspects of the problems. So while students may calculate how much torque an object requires to rotate in a certain manner, or calculate how much of an ionic salt will dissolve in a particular liquid given a solubility constant, they very rarely do real experiments.

6.3: Experimentation:

But quite frankly, biology needs as much of an upgrade in the lab category as physics and chemistry do.

Why? On paper, a student can understand a concept until he can answer every problem in the textbook, but in real-life, something always goes wrong, or a material is missing, or something unexpected occurs (See *Research/Engineering Chapter* for more). This unpredictability teaches problem-solving skills and develops mental-tenacity that a paper and pencil simply cannot teach.

But the few labs that teachers are currently using don't meet this ideal. Truly, thousands of students have already done the vast majority of the labs that most teachers currently require their students to do; these labs were developed long ago and are quite mundane: the teacher knows what's going to happen, there is no question about the result, and there is a prescribed set of instructions. If a student has a question, he can ask the teacher, and the teacher generally knows the answer (because she has done the lab over and over again). This approach is not realistic or representative of the real world.

However, if the teacher didn't know the answer—if the lab was innovative and had never been done before—then the student is significantly more likely to go home, and actually research the answer. In other words, he might actually develop curiosity (aka intrinsic motivation) to find the answer.

Indeed, the labs that teach the most problem-solving skills and are most representative of the professional research lab are "inquiry labs." In these labs, students themselves pick the question they would like to investigate (this choice is once again vital so that students can work on something they are truly interested in, increasing the likelihood of intrinsic motivation), and then use any materials/equipment in the school's possession to carry out their experiment. The students develop the procedure, they find the materials (and problem-solve when something is not available), they form all hypotheses, they preform the experiment, they re structure their tests when their first experiment fails (something that is almost inevitable in the professional lab), they formulate all data tables, and they analyze the data and make conclusions.

Truly, these inquiry labs are wonderfully ideal since students have complete control over everything, including the problems that arise. So they are very representative of what happens in a graduate-level lab. Additionally, the fact that students have to completely start the experiment from scratch and stay with it until it either fails or succeeds helps develop mental tenacity, persistence, a curious desire to know an answer, and the ability to follow though with projects. These are the kinds of labs every high school science classroom should adapt; moreover, if the university research opportunity I proposed in the Research/Engineering Chapter is not feasible, these inquiry labs come close to providing the same benefits.

Chapter 7: COMPUTER SCIENCE

Computer science…. Most of us don't even know what it is…. It seems distant and even a bit confronting. What does it mean? How is it used? Indeed, most students—and even more adults—don't know anything about computer science, and there are so many misconceptions about CS that people are afraid to even *try* it.

And since computer science is a relatively recent field—compared to chemistry, English, or history at least—educators high in the schooling hierarchy are not willing to substitute it for a subject that has existed for some time and *works.* But it is precisely because we live on this modern world that this recent a subject is so incredibly important.

7.1: Code is Almost Required Today:

Code.org—a website that encourages students to learn code for an hour—created a promotional video called "What Most Schools Don't Teach" that has gained viral status today. I highly recommend watching Bill Gates, Mark Zuckerburg, Will.i.am, and other leaders/founders in today's world provide reasons to support teaching programming to students.

Truly, we live in a technologically driven world. Everyday, we cannot even think about *not* taking our iPhones, laptops, and Android-devices everywhere we go. Stephan Hawking says that robots may one day take over the world. And yet most of us cannot even write a simple program to calculate how much gas we spend in a year…. Now more than ever, coding is incredibly important. Many colleges have even required their liberal arts students to take at least a semester of a computer science class. But since it is their first CS class ever and they have other classes related to their major that they would rather take, these college students don't reap many benefits.

Some high schools are moving towards the ideal of requiring a year of CS in their curriculum. But not enough are….

7.2: My Experiences with Coding:

Quite honestly, computer science taught me more than any other subject how to problem solve? Truly, computer programming is all about finding the easiest way to do something—the method that requires the least lines of code.

So, lets say I want to create a program for my theoretical t-shirt business that keeps track of sales by automatically adding the price of the shirt to the total sales I've made, and then subtracting the costs of production for the shirt from the total sales to find revenue. This example should highlight the practicality of programming—this is a very basic example of the magical powers of CS in the real world. But something you may not have realized is how many unique routes a programmer may take to create a program that accomplishes this given task. Truly, unlike a paper-and-pencil logbook, programs are dynamic in that they constantly need revising and there are always many different ways of accomplishing the same thing.

Nevertheless, some methods are more practical and easier to implement than others. This is the programmer's job. He must figure out the easiest method to implement a particular assignment. And thus, programming is "difficult" mainly because it entails thinking about how to do a particular task, and ensuring that it is the most economical approach. Once the programmer has this "algorithm"—just a fancy term for a series of instructions the computer follows to do something, kind of like a recipe—in mind, actually typing the code into the computer is usually not very difficult.

The second reason CS involves problem solving arises after the program has already been *written*. It occurs when the program doesn't "compile"—in other words, there is a coding error. This is such a common dilemma, that there have been countless "meme" jokes constructed about it.

And while it may not be particularly entertaining to debug code—that is, finding an error, fixing the problem, seeing another error caused by fixing the first error, and then resolving the second one—it teaches more critical thinking than even the most advanced mathematics and applied physics courses.

7.3: Students can Apply CS to Any Field:

Plus, unlike those math and physics courses, computer science is truly a versatile tool. Indeed, you can use programming to enhance your lifestyle in almost any case. Want to create a business? You need a website. Want to do college research (*see Research chapter*)? Many labs around the world use MATLAB or Mathematica to assist in creating accurate data-tables and graphs. Want to create Halo, Call of Duty, or Mario? Programming is a must.

7.4: Programming is Actually "Fun":

Furthermore, contrary to common misconceptions, CS is on the whole quite pleasing. Most people that program something for the very first time say that they loved the experience. Why? Perhaps the main reason is that the compiler—or the software "playing" your program—provides you with *immediate* feedback. So if you make a syntax error, you instantly know. Then you can instantly fix the error, and see what happens. After a few minutes of fiddling around, you can instantly use your creation. This *instant* feedback loop and *instant* gratification is what makes all the difference in the human psychology (read more about Instant Gratification at Entrepreneur.com).

Additionally, there is a certain joy to creating something—whether it be a wooden bed, a metal chassis, a written book, or a coded program. Indeed, programming allows you to create something new while sitting on your bed in pajamas. And with the widespread influence of the Internet, you can spread your own creation with people around the whole world. It is truly a dopamine rush like no other to see someone using something you created with your own hands.

7.5: CS Pays Off:

In terms of numbers, computer science majors make on average $60,000 right out of college. That's second only to engineering (and even that by only $3,000) and is significantly higher than business (at $54,000), communications (at $43,000), math and sciences (at $42,000), education (at $40,000), and humanities & social sciences (at $37,000). Read the entire study at done by the National Association of Colleges and Employers (NACE) at Forbes.

Truly, not enough students even know what computer science is because their schools don't teach it. And thus, schools are discarding tremendous opportunities for their students.

7.6: Connection with Entrepreneurship:

Finally, as you will see later in the entrepreneurship chapter, today more than ever, the most successful individuals are entrepreneurs who can build relationships, spread their ideas, and create new, innovative products. And CS and entrepreneurship are *deeply* connected. Indeed, the vast majority of startups around the world are Internet ones.

More and more, the ability to independently run a business (or anything really: a club, a organization, a non-profit, or a team) is significantly more important than having a formal education (in terms of earning and then succeeding in a job). And in any of these cases, having a website is almost necessary in the world we live in today. After all, if I'm interested in joining a book club that someone advertised for in my local library, the first thing I'll do is open Google Chrome, and Google the name of the book club. If what I'm looking for doesn't show up within the first few results, I'm probably going to give up on the Book club (statistically speaking, the top result on Google for a particular keyword receives 36.4% of the clicks, whereas the seventh result only receives 3.8% of clicks. Read the entire study by Danny Goodwin here).

So learning how to program—even on the most basic level, with some HTML and CSS skills—is imperative to anyone and everyone in our technologically advanced world.

7.7: Solution:

The basic response after weighing the enormous number of positives over the small number of negatives of CS is to give the green light: go ahead, add some CS classes and lets see where they go.

But here's the problem: computer science requires that the instructor have a very specific background, that he be able to problem-solve well to create difficult problems, and that he have access to modern computers. Now, access to computers isn't hard: the vast majority of American schools have at least one computer lab. However, finding a qualified instructor willing to work in the school is a different challenge (after all, many computer scientists don't even consider education as their career, since they are more set on creating software, websites, and applications in an entrepreneurial fashion).

7.7.1: But there is a Simpler Way:

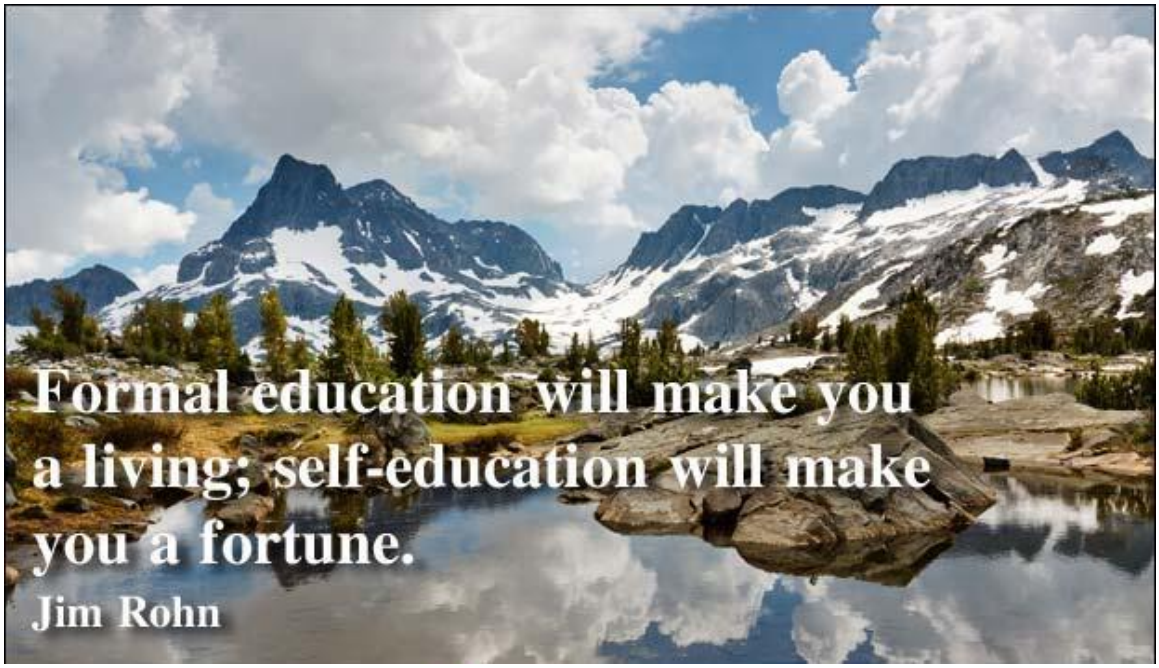
Still, there is a simple solution to this problem too. Indeed, precisely because of computer science and the Internet revolution, there is a plethora of online resources that teach computer programming—many of which are free. These websites (e.g., CodeAcademy.com, Code.org, and Codingbat.com) generally speaking teach you a few programming concepts, test them with quick exercises, and then ask that you apply a group of them to create a particular program.

These websites also allow you to learn all of the major languages: Java, Python, Android, & iOS for general programs/applications; and HTML, CSS, JavaScript, PHP, & Ruby on Rails for web development. As such, each student can learn what he feels he or she's most interested in.

Truly, these online classes only require a computer, most of them are free, and a teacher with programming experience is not necessary. In fact, only an instructor that ensures that students are actually physically doing the work is necessary; the website takes care of the rest. Once the student starts working, he is usually enticed to work more (because of the fundamentally "fun" nature that instant feedback in CS provides). Indeed, there is almost no reason not to teach students how to program with so little negatives to bear.

Additionally, students who develop an interest in programming after completing this online course could also apply their skills to doing an independent research project (as suggested in the *Research/Engineering chapter*).

Chapter 8: ENTREPRENEURSHIP



8.1: My Entrepreneurial Projects:

Throughout my high school career, I always been a bit doubtful of the formal education we receive. Truly, sitting in a classroom and memorizing formulas didn't really seem as important to me as going out, starting a project, and spreading the project for the world to see. And as such, I involved myself with independent projects from a very early age.

You'll soon learn that even though entrepreneurship may seem like a full-time endeavor, teachers can easily incorporate it into their classrooms by providing students the opportunity to "sell" or market their products to the world.

8.1.1: CafeMocha:

8.1.1.1: The Ideas Behind CafeMocha:

One of the fundamental ideas I pushed throughout this book is that people will do their best work when they are truly intrinsically motivated, not while working for grades or money. And if you think about it, the concept makes a lot of sense (View Daniel Pink's TED talk—The Puzzle of Motivation—for a little more evidence).

And yet, this exact opposite of this idea governs one of the largest—and perhaps the most important—institutions in our modern society: education. How? In school—particularly high school—students are forced to memorize factoids they will probably never use again simply to achieve a particular grade (for more details on the abundant memorization and lack of understanding that occurs in the average high school classroom, see *the Sciences, Social Studies, and Mathematics chapters*). And as a result of this memorization, schools do not let students explore their creative potential, and are thereby killing creativity (make sure you watch Sir Ken Robinson's TED talk for a different perspective as well).

Indeed, every student is initially innately creative (see the *Arts chapter* for more). But as school progresses, students who are terrifically innovative writers and poets and abstract-minded mathematicians are forced to "learn" formula, after definition, after historical event. Because of all the mundane work these students do, they lose their passion and risk-taking abilities for some of the activities they enjoy doing most: writing, poetry, and research.

8.1.1.2: The Basics of CafeMocha:

As a result of this concept, I founded CafeMocha.org—a fully engaged social-network that allows students to publish and then share innovative works of creative writing with worldwide friends. It is kind of like flickr for creative writing.

Truly, if I'm a young photographer, I can post my photos onto flickr and people all over the world can see my work, and if I'm a high school musician I can establish my name on Soundclound. But what do I do if I'm a writer? That's what CafeMocha is for.

How does it work? The online writing community allows users to establish their name in the online world, receive commentary on their writing, and read other new-and-upcoming writers' works.

Additionally, by publishing to CafeMocha, professionals and publishers can contact students and can recruit them for professional publishing. Ultimately, CafeMocha pushes students to maintain passion for activities they have intrinsic motivation for, and truly enjoy. (By the way, make sure you and your students publish your creative writings to CafeMocha.org to help spread creativity around the world *and* help reform our broken education system!).

8.1.1.3: How I Started and Run CafeMocha:

Once I had established the basic idea behind CafeMocha and decided that it was a valid project to pursue, I began the coding process. After competing the layout and code for the website, the most important step became creating a user base; after all, creating a website doesn't mean anything unless people use it and can benefit from it. Indeed, I started publishing press releases (click here to view CafeMocha's PR), doing search engine optimization (including website speed/optimization, off-page SEO, on-page SEO), blogging (click here to view my CafeMocha blog), posting articles (on sites like Quora, Yahoo Answers, & Wiki-Answers), marketing on social media sites (such as Twitter, Facebook, & Google+, LinkedIn, YouTube, & Vimeo), marketing on social bookmarking (on reddit, Stumbleupon, digg, and delicious), and making promotional/example/explainer videos on YouTube to spread the word.

Since 2013 when I started, I have been publishing regularly on CafeMocha, sending out newsletters regarding CafeMocha's progress, and spreading word about the website though word of mouth. When it was launched, CafeMocha received around 30,000-page views/month of traffic. (Read about my successes and my daily experiences about CafeMocha on my website).

8.1.2: Modular Sofa Integrated with Entertainment Center:

Early on though, I didn't really know what I wanted to pursue. I knew I liked to make things and then market them, but what *exactly* did I like to make? Websites? Machines? Furniture? As such, I tried to pursue vastly different—though all entrepreneurially based—projects, and ultimately the "Smart Sofa" arose. On the very basic level, this "Smart Sofa" contains all electronics—such as DVD/Blu-Ray/Surround-sound speakers/gaming system/AV receiver all *inside* the couch—rather than cluttered in the front of the room with the TV.

Then the couch is wirelessly connected to the television. As such, if a consumer wants to create a home theater system, all she must do is buy Smart Sofa and a TV, and the process is done; there is no need to research what equipment to buy. Additionally, the sofa significantly decreases bulk in the front of the TV room and removes the necessity for multiple remotes—everything is internally connected with only *one* detachable remote on the sofa armrest (rather than the hordes of remotes that multiple machines requires in the status quo).

For this project, I initially researched all of the similar products that have been released worldwide, and then wrote out a detailed description for a provisional patent. After it went pending, I continuously tried to license the sofa to willing companies. (Read more information about this project on my website).

8.2: The Fruit of My Entrepreneurial Endeavors:

Truly, I have learned more though these two projects than I have in any classroom setting. For example, CafeMocha didn't just teach me about social-networks, marketing, and website coding, it also taught me about practicality. It taught me how to make accurate cost-benefit analyses: is it better to invest time writing a blog post or to try to find a potential journalist?

Additionally, it greatly increased my public speaking skills, and as Tim Westergren—founder of Pandora radio—says, "of all the skills that an entrepreneur can have, I think the ability to convey an idea or opportunity, with confidence, eloquence and passion is the most universally useful skill," Indeed, I have developed an ability like never before to express an idea passionately, persuasively, and confidently though my experiences pitching CafeMocha to possible investors and to writing societies.

Similarly, my "Smart Sofa" invention gave me real time experience pitching a product to large companies. Moreover, writing the patent detailed descriptions gave me insight on how to insure patent safety (so that some one doesn't come, change one small aspect of the product, and claim the idea as their own).

But perhaps the greatest thrill of entrepreneurship is seeing people all over the world use a previously nonexistent product, website, or service because of your work. Indeed, as an entrepreneur, one must truly become a jack-of-all-trades to manage everything about a particular product: the development, the marketing, the production, and the finance. Completely managing something—no matter how simple it may be—teaches practicality and time-management skills like no other. Starting a project from nothing and then building it up teaches more practical skills than any classroom ever could.

Still, not everyday is a walk in the park. The one ability that CafeMocha and Smart Sofa drilled into me over and over was mental tenacity. I had to continuously ask myself why I was inputting so much time into these projects, when there were giants such as Google, Facebook, and Yahoo—who had significantly more experience and connections than myself—that could be working on similar projects. Whereas I needed to start everything from scratch, they had all the foundations already established.

Indeed, on an everyday basis, failure surrounds the new entrepreneur. Mistakes are inevitable. For example, I had to incessantly experiment with different methods to call users to my website: social-media, content marketing, and advertising. Some times users came. But most of the time, they didn't. Some times people saw and upvoted a post on reddit, but most times they didn't. And yet, the lure of a successful website was too strong: after one failed attempt, I tried something different, hoping for more rewarding

results. I still have high-expectations, but a simple failure doesn't upset me nearly as much as it did before I involved myself with these entrepreneurial projects.

Additionally, I now have a variety of experience in not only website designing, and patent filing, but also in finance, content marketing, social media marketing, website coding, and prototyping. As such, these entrepreneurial give me the "experience" to earn high-level jobs (that so many college students enlist in internships for).

8.3: Incorporating Entrepreneurship into School:

And so you see, there are a plethora of benefits to entrepreneurship that simply sitting in a classroom cannot teach. Now, you may be thinking that the only reason I was able to begin and follow though with these entrepreneurial endeavors was because I was interested in creating and spreading products. And you'd be right, however, entrepreneurship *can* indeed be implemented into high school and students *can* indeed reap many of the same benefits that full-time entrepreneurs see.

First and foremost, the projects that students pursue need not be huge products, services, or websites. They could be as simple as creating a new recycling program at school and then convincing the majority of the school to sign on. This project alone would teach students to persuade a higher-up individual to an idea, raise money to buy recycle bins (whether though a fundraiser, crowd-funding, or grant writing), research what the optimal number of bins is, buy all the bins, plant the bins in the correct places throughout the school, spread the word about the new program, and convince individuals to recycle. These are skills that students will use every…day...of…their…lives and are significantly more practical than those that students sitting in a classroom would learn. Moreover, the student would commence a terrific new program that could last for years.

But truly, any completely independent project in which the student has complete control of his choices will teach more practical skills than any semester of classroom studies. To add to the mix, many schools already have a "Senior Capstone" where students enlist in a project of their choosing. Simply taking these already established capstone projects and making them more entrepreneurial could significantly increase the gains. And taking study halls—in which students generally are not very productive—and transforming them into "entrepreneurial study halls" could have the same affect.

In either case, students could create a product, make a website, implement a new program, plan out a new club, contact an organization to have speakers come and talk at the school, and then follow through with the plan. For example, in the already established senior capstone, a student who created wooden desk could try to sell the project and would inevitably reap many entrepreneurial benefits I listed above.

Moreover, for many of these types of classes, new instructors are not necessary (hence decreasing money the schools would require to implement these programs). Since students would have complete control over what entrepreneurial project they choose—whether it be selling pottery on eBay, fixing the school's computers, building websites, blogging, writing eBooks, designing apps, or selling crafts—they should have at least some kind of intrinsic motivation to pursue it fully. In other words, they should *want* to work on the project and complete it intrinsically. Nonetheless, the instructor could simply ask for weekly checks to ensure that work is being done.

And although the change necessary to incorporate entrepreneurship into school curriculum may seem challenging, there is truly no other experience that could give students financial/persuasive/management skills, work-like experience, & money; and that could greatly enhance the school's programs.

Chapter 9: COLLEGE PROCESS

9.1: My Experience:

I won't lie to you: as an underclassman, a burning desire to impress the college admissions counselors at top name brand schools mainly motivated me. Truly, my middle school and junior year school experiences instilled into me the idea that college acceptance was the true goal of high school, and so early on in my high school career, acceptance was all I focused on.

In my freshman and even sophomore year, I read all about the process on College Confidential—the ambitious high school student's Facebook. It housed everything. But I spent most of my time browsing through college decisions of former "CCers," and forums filled with current ones striving just like me to "get accepted" into Ivy schools, earn prestigious scholarships, and thoroughly build up their resume. And let me tell you: I loved it. It was a game for me. I woke up in the morning before school and would read though the stats—ACT, GPA, scores, extracurricular activities, work experience—saw their decision (accept or reject), and contemplated about how I compared to them, and what I would have to do to improve my application based on their results. Most of the time, I convinced myself that my "app" was better. Other times, it was depressing to see how some of my peers all over the globe had "done more than me."

I knew I was comparing myself to others, and I also knew that that wasn't the best self-esteem booster. But I didn't care. I had to beat all those valedictorians and perfect SAT/ACT kids. I was addicted. Addicted to understanding a fundamentally capricious process that is inexplicable. I told myself—convinced myself—that all the work I'm putting in would at the end of the day be worth it. *It'll all pay off when you're accepted.*

And so I wasn't really able to enjoy high school. Why? I was too busy trying to impress people who lived 400 miles away and I don't even know. *Is this going to look "good?"* I frequently asked myself. *What could I do*—should *I do—to improve my chances of receiving that "fat-envelope?"* ("fat" signifying good news, while a simple "thin" envelope usually means a simple "sorry, we cannot take you.")

Moreover, throughout the whole four years, I felt as if some mystical force was pushing me to take courses that I really didn't even want to take. Case and point: AP American History (*See Social Studies Chapter*). I had the option to take either the dreaded AP class or the measly academic class, but one or other was required. Now, I loved European history, but after learning about the American side of the story almost every year of secondary school career, I was trying to avoid the class as much as possible.

But then my college process instincts popped in. *I can't take academic right? That'll look "really bad." MIT probably won't accept me if I take academic…. And anyways, an A in AP gives an extra GPA boost, whereas an A in academic will probably decrease my >4.5 GPA…. Better take AP….*

I *hated* the class. I was extrinsically motivated and worked for nothing but maintaining my GPA. But I chugged though. The end of junior year came quick. And in the short-term, it truly was worth it—I was valedictorian of my school after my junior year. It was a great day. I treated myself for working so hard throughout the last three years.

Still, I wasn't the only one stressing about the upcoming applications. Everyone was. Every…single…junior in the school was cramming SAT vocabulary terms that she would instantly forget after the exam, signing up to do as much volunteering as possible over the summer, and memorizing definitions to pull of "good grades" in the final quarter of school. It was completely counterproductive, but everyone did it, and so no one really doubted the system. I myself prided myself on the fact that while some students are now figuring out about College Confidential, I already knew about it, and had read articles on the website for years. By the end of 11th grade, I thought I knew everything about the process.

Then the worry of most significant part of the process arose. Almost three whole years led up to the moment—the essays. It was the bane of every senior's existence—dreaded essay after essay after essay. It sucked. And yet, the essay was truly the only part of the application though which the admissions officers can see the true you—your words and your ideals, not your accomplishments. It was an opportunity that the cunning ones would seize by showcasing their creativity and innovation. I considered myself a member of that in-group. I started chugging though.

9.1.1: Then the Epiphany:

The first few essays were easy. Force "creativity," "passion," and throw around a few keywords like "state-of-the-art research facilities" and "world-class professors."

But then I realized those terms just made my essays trite and trivial. I started over. *The essays have to be perfect,* I told myself. This time, I added a little more me. A little more about who I am and who I hope to become. But even those seemed all based on my achievements, not based on who *I* am.

I started over once more. This time around, while answering an question around the lines of "what do you want most in life," a question arose in my head: why the hell did I spend the last for years doing *that.* Why did I spend the last four years of my life trying to do something as *stupid* as getting accepted into college?

I contemplated the thought over night, and the next morning I knew. (By this point, I had already submitted all of the essays, and it seemed as if that mystic being that had earlier pushed me to take APUSH had blessed me by removing a giant boulder from my shoulders.) *My life could end at any point. On an everyday basis, I should do things I enjoy doing, not do things that I am forced to do.*

I wanted to change the broken system so that students didn't fall to the college process like I did at the beginning of my high school career. During the heat of the process during senior year, I didn't think that anything was wrong with it. But now, a few months later, the whole thing seems childish….

This moment is truly what motivated me to start CafeMocha (and write this book!) in the first place. It became my full-time project. And the concept seemed ideal: I would inspire students to focus on doing things they really loved doing—like creative writing—rather than things the system is forcing them to do—things that had initially enticed me. That's the true purpose to this book: to motivate students to not fall down the well of admissions, and do something they love to do from the very beginning.

9.2: Solution:

Truly, the college admissions process has always been criticized, and always will be criticized. Perhaps the overlying solution though is to mold the process to encourage creative requirements rather than test scores and numbers. My goal in this section, however, is to prevent any future student from repeating my high school experiences.

9.2.1: Fundamentally Change the Standardized Tests:

A number, whether that number is GPA or SAT scores, should define no one; yet too many high school students think that the only thing that matters in their life is scoring a 33+ on ACT or 2250+ on SAT. And so they spend countless hours trying to boost their arbitrary self-confidence by correctly answering one more question. The result? They score one point higher. But does that one point really mean much in the long run?

Laszlo Bock—senior vice president for people operations at Google—claims that "G.P.A.'s are worthless as a criteria for hiring, and test scores are worthless — no correlation [to job performance] at all." He continues on to say that after a few years, your performance at Google was completely "completely unrelated to how you performed when you were in school, because the skills you required in college are very different." And the environments that most schools possess—one where test scores and GPA govern everything—are "artificial environments. People who succeed there are sort of finely trained, they're conditioned to succeed in that environment."

So by studying for all these tests, Bock says that students are conditioned into "looking for a certain answer." He says that new students start scrutinizing a problem for dents in the syntax where they may make insight into how to solve a problem, kind of like they are always taking a standardized test (click here to read the rest of the interview on the New York Times). The problem is that this methodology pushes students to stop thinking about concepts divergently, and that kills innovation and creativity like no other.

So standardized tests and GPA don't do really mean much when applying to jobs and internships. Then why do high schools and colleges emphasize them so much? And why do companies like the CollgeBoard even exist? People who can sit down, memorize facts, and then take a test—such as in high school—won't provide many skills to the workforce. In fact, test-taking skills are rather *unimportant* in the professional world. Rather, people who can creatively think about solutions to abstract problems while also being able to effectively communicate will run the future.

The solution? Perhaps the main idea worth pursuing is to replace standardized tests with more creative emotional intelligence and creative thinking skills. So rather than asking students to find the hypotenuse of the third side of a triangle with a simple formula (which they will never be asked to do in the future), have them to solve spatial reasoning puzzles. Instead of forcing them to memorize vocabulary, ask students discuss how they would solve a smoking problem in a city. Or question them how they would organize and spread the word about a new organization they are starting.

Why? Because rather than creating tests that ask students to answer questions about concepts they will never experience in their professional life, an essay based test that tests students leadership skills, communication skills, and creative-thinking skills is not only more useful for future employers, but it also helps the students develop skills that they will need in their daily lives. Moreover, students cannot spend time memorizing methods and formulas for these tests—they are truly about your innate abilities—so students can spend more time doing creative work in school and won't even have the opportunity to squander their time in school trying to impress admissions officers.

9.2.2: Maintain Status Quo for Essays/Interview:

The essays and interview are truly the only part of the college admissions process that "work" as is. Indeed, while writing essays, students are truly finding their true selves (their self-concept and identity in the words of psychosocial psychologist Erik Erikson). I couldn't agree more with what my Princeton interviewer told me: "while writing essay and talking to interviewers, you truly discover more about yourself than any admissions officer does."

Moreover, essay-writing (or writing in general) is a skill that students will need over and over again in the future—whether that be for drafting a resume, writing a cover letter, or contacting a friend. Interviewing is perhaps even more important since it helps build up confidence in speaking. This simply cannot be said for the vocabulary that students memorize (only a selected few will even need the vocabulary), the high level mathematics (students can find every formula they will ever need at their fingertips with the evolution of the internet), or the critical reading (the level of writing on most standardized tests is much higher than the skills that most students will need to read the news, communicate, and read contemporary novels).

9.2.3: Decrease Emphasis on Grades/GPA:

But the main reason the college process doesn't work is GPA. Truly, the amount of time students try simply to score a higher GPA—rather than understanding the concepts—is a *major* flaw with the current system.

Now one of the points I have emphasized many times throughout this book is that people will do their best work when working on something they are truly interested in, not while working for grades. And unfortunately grades are the basis of today's education system. And I understand: teachers need a unit to compare one student's progress to another.

But simultaneously, too many students today work for nothing more than an A on an assignment. Quite honestly, most high school students care about nothing more than grades. Truly, when the teacher is presenting new material, rather than asking questions about "why this concept is true," too many students consistently ask whether there will "be a question like this on the test?"

Furthermore, when only working for grades, students are likely to choose the path of least resistance—the path that offers them the highest grade with the least cost associated with it. So they might resort to Sparknotes and Cliffnotes instead of reading books; even with an essay style test, these summary platforms offer enough content—summaries, themes, motifs, in-depth characterizations—that allow students to score high grades.

So what's the point? By focusing on grades, teachers are indirectly creating a gateway for cheating.

Moreover, grades are extremely discouraging for students (once more killing self-confidence, reducing their chance of taking risks, and thoroughly laying creativity in dust). Consider if you will, the general students' work ethic in a difficult class. They start off the year with the attitude that they will learn a lot, make friends, and hopefully pull of an A. Then, the first test turns around and they don't do well. They tell themselves *that's*

okay; I'll do better next time. And maybe they do, but if they don't, most times, they develop a condition of low-expectations. It becomes cyclical: they score low because they don't expect high scores, and they don't expect high scores because they have scored low so often. In other words, they score low so many times that they don't expect high scores; by this point, they start worrying about their grade, and then all their future work in the class is motivated externally by a desire to save their GPA…. They really don't care about the practical applications of calculus, or the usefulness of physics, or the critical reading skills that reading literature can teach. And so they are willing to do anything—including copy friends' answers and sometimes even sabotaging their friends' work—so they have an upper hand and can earn an A.

And why do they care about earning an A? Most times, it has something to do with college admissions.

9.2.3.1: Give Positive Feedback:

What should be happening is that students receive positive feedback (not a red "F" mark on their essay) if they don't score well. Behance's Gregory Ciotti—author of "Sparring Mind"—in his article "The 5 Most Dangerous Creativity Killers" says it's "tough to continue working on novel ideas when you haven't received any positive feedback backs this. This feeling is backed by psychological research that shows people who've started a new undertaking are most likely to give up the first time things come crashing down, also known at the "what the hell!" effect. Creative people thrive on having others impacted by their ideas."

But grades prevent students from really impacting anyone. Students work to "impress" teachers. Truly, the only time a teacher gives students feedback is when the student is failing, and by then, they have fallen into the cycle of despair and there is no way for them to recover.

9.2.3.2: Compare Students to Themselves:

The reason grades were made in the first place was so teachers would have a means to compare students and track their progress over the year. But with the evolution of grades, students are comparing themselves to others a bit too much. On an every day basis, students want to know "what you got" on that last test, or essay, or homework assignment. Why? It gives them context for how well they did. Does that 97% really mean much if the average score was 92%? How "bad" is that 67% compared to the lowest scores in the class?

See the problem: by comparing themselves to others, students are only hurting their own self-confidence. Indeed, Huffington Post psychotherapist Daniela Tempesta, LCSW claims that by comparing yourself to others, "you will always be losing. In this game of life you will never reach a point where you are better than others in every way and why would you want to be." Moreover, "being hard on ourselves actually zaps motivation and decreases goal completion."

But just like I could sense my self-confidence dropping when I was reading some of those genius students' profiles on College Confidential, some school students compare themselves to other students because of grades almost intrinsically. It's like an addition: they cannot control it.

And the purpose of a formal education is to *help* the student. So instead of keeping grades to compare students to each other, teachers should make an individualized plan to help students improve their performance individually. More and more, technology and the Internet are making individualized education pathways possible.

Until they make a breakthrough however, setting up a grading system where students cannot compare themselves to others with grades is the best option. Currently, teachers measure how many questions each individual student correctly answered on a particular test, and then assigns them a grade that reflects this number; as such, it is incredibly easy to compare oneself to another. But the standard of comparison should not be the same for each student.

A student should receive an A if he improves his performance throughout the year, not if he answers more questions than everybody else in the class. This way, rather than comparing himself to everybody else, he is comparing himself to himself (and this kind of comparisons can actually be healthy). Furthermore, the student can set goals and see complete them.

Now you may argue that this method will motivate students to set low expectations at the beginning of the year so they can beat themselves by the end. And although this *may* occur, because students won't be motivated by grades all day, any improvement will be because of genuine interest in improving their *own* skills.

Chapter 10: A REVAMP OF THE HIGH SCHOOL EXPERIENCE

Consider your elementary school years…. There was fun: recess with friends, art class, and kickball in gym. Students loved elementary school. Creativity thrived. You could do anything. It was great. You actually *wanted* to go to school. Why? You were able to do anything they wanted. You could paint anything; and the teacher would actually appreciate their work for what it was—art—and not just hand you a report card with a grade on it. The teacher would even allow you to show their work to the principal. There was freedom. You came home on the bus smiling, waiting anxiously for the next day.

Then slowly, school drifted away from the creative, friendly environment to an academically oriented one. Indeed, today most high school students would do anything to get *away* from school, not beg their moms to take them to school early so they can paint a picture in art class. And the most important thing on students' minds is not learning and being creative, but rather it is grades; even in art and gym class, there is a set limitation to what a student can paint or do. More than a creativity-encouraging complex, high schools seem to have evolved into a factory that is building robots that can memorize facts.

10.1: The Solution?

10.1.1: Creative Open Environment:

Many of the most successful corporations (such as Facebook, Dropbox, Google, and Pixar) have an extremely open, creative environment. So, employees can do basically anything during the day as long as they complete their work by a certain time; for example, at Google, employees can ride their scooters in the building, play Ping-Pong whenever they want, watch a movie, or even take a siesta during the day. Then they can complete their work at night or even at home if they wish. And since the building layout is open, there are lots of "casual collisions" between people who would generally never meet that lead to fascinating and innovative conversations. Indeed, much creative thought and deep discussions (both about and unrelated to academic topics) arise not in classrooms, but rather in casual, everyday environments and in casual, everyday conversations (rather than a intense fishbowl conversation in the schoolhouse where the teacher is ensuring that every student say at least five things).

So why not make school a casual, everyday environment? Kind of like home? (Don't be alarmed: Google New York's headquarters conference rooms are structured like NYC apartments). Why not create an education system that actually encourages creativity? Indeed, why not increase the likelihood of "casual collisions" between people who would normally never see each other: students and executive staff, science teachers and woodshop ones, freshman with seniors—in other words, collisions between people of completely different backgrounds.

Now you may think that the reason that these open, creative spaces can work with these corporations is simply because the employees are all adults, and much more mature than the average high school student; so even if students were allowed to socialize & relax throughout the day, they would probably never spend time doing academic work. That logic is impeccable, but nevertheless, there are a few improvements that the next generation of schools should have to foster creative thinking.

First and foremost, they should have an open plan, not enclosed, and high traffic areas where casual collisions are common. They should have a lot of open space—like cafeterias and common areas—that students have the time to go to interact with students and faculty. And rather than lining students up in rows facing an instructor, arrange desks in a circular manner so everyone is facing everyone else; this creates a casual workspace where creative thinking flourishes. (Find out more about creative office/schooling spaces on 99U).

10.1.2: Create an Awesome Atmosphere:

Following on with creative environments, give students more freedom (although in a controlled manner) to let their creativity blossom. In *Chapter 3: Mathematics*, I introduced you to a mathematics camp I attended after my sophomore year of school. And while many of the attendees loved this program for the intense mathematical aura, I loved this camp for an entirely different reason: the great freedom. Indeed, I was allowed to do basically anything before and after my two three hour classes (that I picked). This freedom was uniquely energizing to me, and gave me even more motivation….

10.1.3: Reassess "Recess":

Remember recess? You could go out and play on the swing set. You could throw a football. You could collect rocks. Or you could just talk to friends. Everybody loved recess, just like everybody loved elementary school. Then slowly, as you progressed though middle school and then high school, there was no more recess.

Truly, recess led the way for casual conversations like no other. Students met new people. There was no stress, just a free thinking time to make connections with each other and with the world—connections that are not possible sitting in a classroom, rapidly jotting down the teacher's lecture notes.

Bringing back recess into the everyday high school day would not only result in more creative conversations, but it would also give some students the exercise they aren't receiving.

10.1.4: Requirements with Choices:

Make requirements more open. Right now, students generally are placed into a pathway—whether that is academic, standard, honors, or AP—and then they more or less take the same classes as everybody else. For example, almost everybody in my physics class was taking AP Calculus. Everybody in my Spanish class was taking European history. There was no variety. And since the only thing many students cared about while selecting classes was GPA, they took many hard classes they really didn't want to take—yet still gave a GPA boost—and then just chugged though them.

So give students an option. For example, if students must take four English classes throughout their high school career, let them choose between classes like "Writing poetry," "Writing for journalists," "Writing seminar: a study of contemporary music," not "English 9," "English 10," "English 11," and "English 12."

And in the history department, don't just require students to take "World History" then "American History" then "European History"; but rather let them choose between those courses, and also "Ancient History," "Art History," "Military History," "Hispanic Studies," "Asian studies," and "African-American studies."

Additionally, these classes should not only be for one grade level. Rather anyone in the school can take them to fulfill their English requirements; as such, there will be students of different grade levels in one classroom. Now you may think that this is absurd, especially considering that students in different grade levels are at different levels in their writing careers. However, the solution is that everyone will complete the same assignment, but teachers will hold higher-level students to higher expectations.

What's the point of this new system? Perhaps the main one is day-to-day interaction that would not occur in a homogeneously aged classroom. Truly, some of my most valuable assets were the elderly students with whom I shared classes like Band; they gave me a different set of opinions than the ones I experience everyday with class members of the same age (after all, I've known them my whole life). Furthermore, educators simply cannot expect different results by following the same guidelines.

Something isn't right: students have become departmental robots, and if we continue to follow the same guidelines, nothing will change.

10.1.5: Don't Make Students Ask to Use to the Restroom:

Why is it that on the last day of high school, I have to ask to go to the restroom, and then the next day, I am expected to make huge life decisions? It's nonsensical. Sure I understand: teachers have full responsibility over their pupils and so they must know the whereabouts of their students to maintain their safety. But it's almost governmental to have to ask to do something so primal as use the restroom.

Making someone ask to use the restroom makes it seem like the person is restricted. Like he cannot do what he wants to do. And where there are restrictions, there simply cannot be creativity (see Creative Open Environment above for more information on how restrictions kill creativity).

10.1.6: Remove "Assigned Seats":

Indeed there are so many external restrictions on students in today's schools that there is really no room to express oneself. Everything is completely controlled (e.g. I cannot sit certain places; I need to carry a pass to walk in the hall; if I am 2 minutes late, I have to bring a note signed by a school official to class; I have an "assigned seat" in class). These restrictions create a sense in the mind that I have to follow along, do exactly what I'm told to do, ask no questions, and sit quietly & listen to the teacher.

There is no freedom. No thinking really happens, just direction following. And so there is no room to stray from the norm. There is no room to think a little differently in the classroom than everybody else.

Some of the most innovative and deep conversations occur when everyone is sitting in a circle, facing each other, not in departmental rows.

10.1.7: Don't Make Students Raise their Hands:

Everyone's heard it: "this may be a stupid question…." Honestly, it's probably not stupid at all; at least the speaker had the guts to ask the question. Most of time, students are simply too scared to ask questions and answer questions because they feel they have something to lose socially by being "incorrect." Why? Hand raising leads to an extreme sense of stress; *everybody is watching, what if I don't answer correctly, what if I ask a "stupid question," what if my best friend…. What if? What if….* See the problem?

Students are afraid to answer and ask questions because they fear the social ramifications of their words. They don't express what they truly think but rather what they think everyone else in the classroom wants them to think.

Truly, raising one's hand to speak is an almost universal action in worldwide classrooms. And yet, this simple action most definitely kills creativity.

On the other hand, in an everyday discussion with a friend, you feel relaxed. You can say whatever you want and don't feel pushed to be "right." So you are willing to open up, explore options, and express your true self.

So why not make discussions, lectures, and recitations like circle conversations? Don't make students raise their hands. Let them speak openly. People will be more likely to open up and express themselves. Students won't feel like someone is watching over them in judging them. So discussions will be deeper and rounder.

10.1.8: Significantly Decrease the Emphasis on Grades:

A point that I emphasized over and over throughout this book is that grades (over genuine interest in a subject) motivate too many students. And as a result, they really don't care about authentically learning a concept. Moreover, schools great emphasis on grades inevitably leads to cheating, a decrease in a student's confidence, and a lack of understanding for a school topic. (See the *College Process Chapter* for full detail on this foremost problem).

10.1.9: Don't Require Uniforms:

Indeed, schools uniforms are perhaps elementally kill creativity in the building. Think about it: if everyone wears the exact same thing, everyone is homogeneous. There is no variation. If students are expected to look like everyone else, they will also start to think like everyone else.

Even though uniforms may lessen short-term problems such as inappropriate clothing, the variation without uniforms allows students to express who they are and simultaneously be creative—a long-term benefit. Ultimately, the long-term benefits seem to outweigh the short-term losses.

10.1.10: Incorporate Technology:

In this age, almost every industry—engineering, business, law, and medicine—has completely woven technology into their methodology. But education hasn't. Sure

most schools have computers, and now more and more are moving towards the ideal of a laptop/iPad for every pupil. But, most students still turn in their assignments with paper.

Moreover, schools aren't teaching topics like Computer Science even though fundamentally great resources such as Code Academy exist online. Plus, online education and a flipped classroom (popularized by KhanAcademy founder and MIT/Harvard grad Salman Khan) where the lecture occurs at home and the problem-solving/homework occurs at school allows for individualized schooling (kind of like how the classes at AwesomeMath worked). Indeed, when the lecture occurs at school, there is not much a teacher can do to help individual students understand topics (unless there are very small class sizes). But online, students can pause, stop, rewind, and forward as they see fit. Then in the classroom, there is more time to ask questions and truly understand concepts individually.

10.1.11: Emphasize "Hands-on" Projects:

On the other hand, an outlier to the idea of incorporating technology into schools is—as the New York Times says it—"A Silicon Valley School that Doesn't Compute." Indeed, this is the private school where many of tech billionaires in Silicon Valley—including the CTO of eBay—send their children to school.

But rather than incorporating technology into their everyday life as schools all over the country are doing, Waldorf School of the Peninsula has decided to completely ban all electronics from the classroom. Rather, fifth grade students often spend time knitting to make socks or playing catch with beanbags.

Moreover there are no standardized tests. As a result, the school's advocates "would be the first to admit that their early-grade students may not score well on tests," since teachers don't "drill [students] on a standardized math and reading curriculum." Later on though, these students quickly catch up to their peers and generally have more life-skills than those who didn't attend the Waldorf School. Indeed, this kind of school seems to epitomize the idea of intrinsic motivation: instead of forcing students to memorize factoids that they would never use, build up intrinsic interest by involving students in research/entrepreneurial/creative projects that they love to do.

As a result, students develop practice hands-on, creative and practical skills (similar to those I proposed in the Research Engineering chapter) that create an "ongoing love and curiosity for art, science, history, cultures, language and philosophy."

In terms of spreading this ideal to other American schools, although it may be incredibly difficult to implement these kinds of completely un-technological schools (especially since more and more schools are pushing to increase technology usage

precisely because of the huge benefits of some internet resources, as I wrote above), one idea is possible: do more hands on projects.

Truly, hands on projects build practical skills that the classroom cannot teach—persistence, problem solving, an appreciation for the humanities, and an overall desire to produce creative projects (see the Entrepreneurship and Research/Engineering chapter for more details on these project).

10.1.12: Free Espresso in the Morning and after Lunch:

Everyone has had the 2:00 PM feeling. Lethargy and a desire to go home & rest trump the desire to learn and work efficiently. Indeed, after lunchtime and in the morning, students are least likely to be successful because of fatigue.

Perhaps a solution is to provide students with a limited amount of free caffeine (under 250 mg of caffeine per day represents a safe amount according to the National Library of Medicine) to help students increase concentration and study more effectively in the school day. Truly, caffeine "ingested in moderation can help improve memory, concentration and cognitive performance," all of which can most definitely help students not only pay attention in school, but also be creative (read more about whether caffeine enhances students performance in school).

Plus, these coffee breaks could increase the chance of "casual collisions" and intellectual conversations between individuals in the school (as described above in *Creative Open Environment*).

10.1.13: Start School Later:

We've all heard this one: why don't we start high school at around 9:30, not 7:15? There are countless numbers of research reports that say that starting high school later is beneficiary to students' academic success and health (click here to read one such study that scientists from the University of Minnesota preformed).

Specifically, researchers found that the later the schools starts the day, the "better off the students were on many measures, including mental health, car crash rates, attendance and, in some schools, grades and standardized test scores."

Moreover, teenagers who have eight hours of sleep "learn better and are less likely to be tardy, get in fights or sustain athletic injuries." And, Jessica Payne—a sleep researcher at the University of Notre Dame—says, "Teenagers are losing the ability not only to solidify information but to transform and restructure it" because of lack of sleep.

So what's the controversy about? If additional sleep has all these benefits, why haven't we changed the high school start times yet? "At heart…experts say, the resistance

is driven by skepticism about the primacy of sleep." Indeed, not enough people appreciate how important sleep is on the brain's function.

And as such, people are afraid of implementing the idea. How would the logistics work out? But there is a simple problem to that as well. There is similar research that suggests that school times for elementary students should be earlier So in the modified system where high school start times are later, busses simply have to switch their pickup of high school and elementary students. (See more about this topic in an article by Jan Hoffman in the *New York Times*).

AUTHOR'S NOTE

First of all, thank you for reading the entirety of this book. After spending the early part of my high school career memorizing factoids and obsessing over the college process, I decided that I need to change and that the education system needs to change. This book and the website I founded—CafeMocha.org—are the results of the said change.

The problems I propose in this book are those that I see after my four-year high school experience. The same is true for the solutions I propose; they are based on my life experiences. For any information I have taken from outside sources, I have provided the hyperlink to the article in the text.

I would like to thank all my high school teachers for all their work. I learned incredible amounts of content management and information seeking skills that I will use for the rest of my life in high school. I am incredibly thankful for all my teachers taught me. Indeed, there are significantly more ideas that do work than those that don't work in the currently in American high school. Still, there is always room for improvement, especially when the stake is the future of the country. *Remember, "Insanity" is "doing the same thing over and over again and expecting different results."*

Specifically, thank you to Mr. Tom Gaffigan for helping me edit this book, and my family for supporting me while I wrote it.

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