



The Learning Project

by Lincoln Stoller

Neil deGrasse Tyson, The Frederick P. Rose Director, Hayden Planetarium, American Museum of Natural History

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Born: 1959 in New York City, New York

“If I accept you as you are, I will make you worse; however if I treat you as though you are what you are capable of becoming, I help you become that.”

— Johann Wolfgang Von Goethe

LS:

How do you feel about American education, both yours and the ones that you see kids getting.

NT:

I find myself in my old age to have become quite opinionated on this matter. Not even on purpose, it just kind of descended upon me. I opened my eyes, maybe that's what it is. I opened my eyes.

LS:

You had kids.

NT:

Yeah, yeah.... I'll give you a good example, I have a 9 year old and a four and a half year old. The nine year old goes to school, PS 234, and they're introducing this new math curriculum there called "TERC". TERC is a company in Boston, an education research, resource company, and they redid the math curriculum and have been quite influential in this reworked curriculum. But parents hate the curriculum. I was curious what it was about, I didn't have to think about it until my kids went to school, now I see it first hand and the stereotype of it is that it's turned math into this cultural relativist exercise: "Whatever way you use to solve the problem, that's OK." And if that's all you know of it you say "Well, that's kind of stupid." Not "stupid", but there are best ways to solve problems so why should they (the kids) not be exposed to that?

But then I looked closer at the curriculum and I saw what it's actually trying to do. It was trying to stimulate variance in the way that you approach problems, so that when you do hit a problem that you've never seen before in real life, the fact that you've explored may different ways, not some pre-existing way that someone established for you, makes you better able to think. And so I looked at the homework sets, I'll give you one example of one set called "racing dice". On the x-axis is 2 through 12, and on the y-axis is 1 through 10, and you get a pair of dice and you roll them. (For every number that you roll you go to that number on the x-axis and mark an additional unit up y-axis.) And so you're racing (on columns) 2 through 12 to see who's going to get to the top of the page first. I thought this was brilliant.



My daughter came home and said “Daddy I tried this and my favorite number is 10 and I wanted 10 to win but 7 kept winning, and one time 6 came in pretty close...” And I said “Holy cow, this is a brilliant exercise!” It was a race, a bit of probability and statistics was coming in here, it’s making a histogram for goodness sake. This is in third grade!

So I came to value where they were coming from. Meanwhile the parents are saying “But they’re not learning their times tables, they’re not learning the basics of the math.” And I said to myself, “If she’s learning things like this — and poses that kind of question to me after she’s done it — then I’m happy with the kind of wiring that this is producing.” And there other examples that I can give that are similar to this in terms of an unusual and innovative approach to thinking about a math concept. And there is never memorization. It’s always “...just figure it out, figure it out...”

I found myself getting into arguments with parents (who would say to me) “But your daughter is not going to get a high score on the 4th grade exam which will prevent her from ...” And I said to myself “In the end, after you get out of school, no one gives a shit what grade you got.” No one asks you after your first job what your GPA was in elementary school, junior high school, high school or college. So what matters is how you brain is wired. What is your capacity to think innovatively, to solve problems that you’ve never seen before. That’s what matters. So I said to myself “If this is how her brain is wired, I’m happy.” I’m not even worried about the grades.

I value this feature more than I value the grade because today you have people valuing grades without regard to whether or not the person even understands the subject. In fact, they define understanding the subject in terms of having got the high grade, and then you go and ask them a question about it, and they say “Oh, I don’t know. I just memorized so I don’t ...” There’s nothing in the head, there’s no insight, there’s no wisdom, there’s no depth of understanding that you can tap for any later time in life to allow you to become better at whatever it is that you’re doing.

I found myself to be a champion of this approach even though it’s resoundingly criticized by whole generations of parents who want their kids to learn math the way they learned math, the way we learned math.

Elevating this specific case to a broad case, I see too many students who because they got high grades, or because someone deemed them to be gifted and talented, ... let me hold “talented” out of this and just stick with gifted. When I think of talented I think of people who can play the piano, or can tap dance, or can sing. When I think of talent I think of a craft rather than your ability to think. That’s semantic, but for the purposes of this (discussion) that’s how I’m using the words. So people who are deemed “gifted”: someone has made this judgment, and often it’s grade related. I know too many people who were straight “A” students who have no capacity to think innovatively at all.

The real experiment that one should do is go through society and pluck people who we would all agree are successful. Successful, but not in academia. Pick something in life that somebody’s got, so pick a successful lawyer, a successful politician, a successful preacher, a successful poet, journalist, novelist, composer, artist, sculptor, comedians, actors, athletes, CEO’s, inventors. Line them all up and ask them the question “Did you get straight A’s in school?” I think the overwhelming answer is going to be “No.”



In fact, I'll bet the comedians were the class clowns and never did well at all. Not just didn't get straight A's but actually did poorly. I'll bet the CEO's or the politicians didn't do well, but they might have been the most popular. And so what that tells me is — and I get upset reflecting on this — it tells me that the entire educational system is streamlined to value your grade performance in a course without reference to how you might ultimately contribute to society as an adult. And since all these people on this list I just shared with you, if you're good at any of those you're actually famous, you're well known, you're well paid, you have a career. And if you only believed that grades were what mattered, then you wouldn't imagine that you would succeed without having gotten the high grades.

I'm angry because students in the class who got the teachers' affection were the students who got the best grades. That's the measure of your success in school. But what is school but a means to help you prepare to enter the real world? Most real world jobs neither require straight A's or, in fact, straight A's preclude the expression of some talent set that you might have. I think the whole system needs to be revisited, on those grounds alone.

Then I ask, "Well, where are all the straight A students?" They're in academia, that's where they all are. That's where the valedictorians go. Just look them up, you'll see. They go back to academia and become faculty. That's fine too, that's a successful career, but most people in the world are not university faculty. Most people are other things. So there ought to be some other way in school for me to get the attention of my teacher in ways other than showing that I got an A.

My favorite on that list are CEO's. Some percentage of CEO's on the "Fortune 500" didn't even finish High School. And the multi-millionaires (got there) because they had some clever sense, some "people sense" for those that rose up in a pre-existing company, and others had some clever idea.

One of my moments of greatest joy and frustration — emotions held simultaneously — relates to my SAT's, taken twice, once as a junior and again as a senior. I remember taking them first and they said "Oh, you're not expect to finish the test. Just work your hardest but don't rush." So I worked hard and didn't rush and got a particular score, and I saw others that had much higher scores than I did. I said "Well, how is that possible... unless they rushed!" So I said "There's something bogus here, so I'm gonna rush. I'm gonna like, sort of "rev" my head, get the "engine" running and "pop" the clutch and hit it (the test) full bore." I did that and raised my math score a hundred and something points. Higher than what you're supposed to be able to do just by studying. They whole thing was bogus.

My verbal score was sort of average. Nothing anybody would have written home about. Nobody would say "Hey, look he ... HEY!" It would have never happened.

So what's happened over the years? I write a column in a magazine that becomes a book. That book is now translated in ten languages. And then I wrote seven other books since then... Wrote another column.

And in the middle of all that I get a letter from ETS (Educational Testing Service, administrators of the SAT and other standardized exams). Just to show you what sway they still have over you, I'm thinking "What [gasp] are they going to do? Are they going to nullify my SAT scores?!" You know, it's "ETS, Princeton, New Jersey", the headquarters of the purveyors of this exam.



LS:

The National Security Agency of education.

NT:

The NSA of education! [Laughs]

It was addressed to “Dr. Tyson” so it must not have been some old record they were tapping. But I didn’t know what it was, so I opened the letter and it said, “Dear Dr. Tyson, we recently read one of your essays that appeared in Natural History Magazine and we were impressed with its content and its writing style and we want to excerpt it for our upcoming verbal exam in the new SAT that we’re writing. Will you give us permission to do this.”

I didn’t know whether to kiss the letter or burn it, because what does it MEAN if I get an average, mediocre verbal score and they’re coming back to me to want to use my writing! I don’t know what that means! I don’t know! I’m angry just thinking about it.

There’s a fundamental flaw in the system. I mean the hair stands up on my back. You are put in judgment by others based on your score, not based on the fact that I liked to write at the time.

I enjoy playing with words. Words are kind of fun. I like words the kind of way you like math brain-teaser things. Just little curiosities in the language, like, “Are there any cool sentences out there?” Like that artificial intelligence sentence which is a problem for computers. It’s two sentences: “Fruit flies like a banana. Time flies like an arrow.” You hand those two sentences to a computer and ask it to understand them. They are formally identical in their structure, yet one is sort of completely metaphorical and the other is literal. So (one asks) “is there a kind of fly called a ‘time fly’?” ... Right? ... And is an arrow a word for a kind of food? Food has all kinds of names so you have to check the database of world foods, and the animal database of kinds of flies. And ask if there’s a kind of fly that likes a “time arrow” the way fruit flies like a banana. I just like thinking stuff like that.

Call it ambition or call it enchantment, but it was the source of my energy to continue to create, to continue to write. And of course I’ve always had a love for the universe, and that has been since I was 9 years old, first visiting the Hayden Planetarium. You get a lot of that in astronomy because you can be an amateur astronomer and have a telescope. You can’t be a 9-year old physicist, but you can be a 9-year old astronomer. That level of ambition started early and it was deep. And growing up in New York City where there is no night sky, it’s not a part of what you are. My first night sky was the Hayden Planetarium when I was 9 years old. The stars came out (in the planetarium) and I thought it was a hoax. I thought it was a hoax because there are not that many stars. I said, “I know how many stars there are and it’s not that!”

I occasionally lay awake at night wondering had I grown up on a farm, and had I seen the night sky in all of its majesty from birth, whether I would have had this sort of cosmic epiphany that I did. I hadn’t seen the night sky until I was 9 years old! It’s certainly not something I could or would have ever taken for granted. Whereas if it’s always up there from age zero — you go out on the porch at night and there it is... of course it’s there because that’s what it looks like from central Pennsylvania — the assault on who and what I was would not have been there. It wouldn’t have had the singularity of impact that going to the



Hayden Planetarium and seeing the sky for the first time did. So I wonder whether I'd still be an astrophysicist today, had I grown up in a rural community.

But because my interest ran deep, that gave me the drive to never stop. And in spite of personality mismatches between me and my first graduate school, where they voted to dissolve the committee and then their next question was "So, now what are you going to do with your life?" In an attempt to try to help me with a career change.

LS:

What do you mean they "dissolved the committee"?

NT:

I had a Ph.D. committee and things were breaking down and they just dissolved the committee, which was tantamount to them saying "We're kicking you out." You know? That's a whole other story, but my point is that they did not understand the depth of my interest in the subject. They did not understand my resolve with regard to that ambition. So for them to say, "What are you going to do now? Is there anything we can help you with? Do you want to become a computer salesman or ..." It was like "No! No, it doesn't work that way!" [Laughs]

So I reached down into that... that "fuel reserve", summon it up, and re-point the entire operation. I end up transferring graduate schools to Columbia. I'm received with open arms. I finish the Ph.D. there. It's another three years, so there was lost time, but there wasn't lost professional development. I remember with the Ph.D. they kept saying "If you go back to try to get another Ph.D., remember you're going to have to slog through all this again. It's a lot of years and it's...." I thought that was quite patronizing because, well, yes a Ph.D. is a lot of work, but it's not more work than what would be expected of you as a professional scientist. You're writing up research, some projects are large, some projects are small, but that's what you DO! That is the entry into doing the same thing,... that's what science is. So they believed they would get me to say, "You know, I hadn't thought of it that way. OK, I'm gonna leave. Gosh, you know, you're right. Why don't I just take the easy road..."

It was this life of exposure to the universe, spawned by an encounter with the Hayden Planetarium, and my time at the Bronx High School of Science where "nerd-dom" was king, at a time before nerd-dom was even a subject of playful parody. Before the "Revenge of the Nerd" movies. The perseverance and the drive kept me in the game. But, you know, I had to reach for those reserves.

There is no shortage of people telling you what you shouldn't be in life. And why is that so? Like, why do they even give a shit? Why should someone go out of their way to tell you what you can't be?

It reminds me of my father, in fact I carry this example with me to this day. My father is 5'10", lean and muscular, as opposed to bulky and muscular, a cross between a rock climber and a gymnast. He was in junior high school. He's there on the line as you line up for gym class and the gym instructor is describing what kind of body types are suitable for different activities in the track and field. That's kind of what makes track and field interesting because you can have different kinds of talent sets that reveal themselves in different events. So he said publicly in front of all the other students, "Take Cyril Tyson's body for example, that would not make a good running body. He's not built for running." And my father said, "Nobody's going to tell me what I can't do." So he took up running just because the guy said



this. In 1946 (my father) had the 5th fastest time in the world for the 600-yard run. 5th fastest time in the world! So if you want to talk about resolve, he did that just out of spite!

I don't have patience for people who want to limit the dreams of others. I just don't have that patience. As an educator I see it as a breach of the pedagogical contract that you have signed with your students. It's your job to get them to succeed. It's your job to alert them to how to succeed, not to find ways to tell them they can't.

It's better for a person to give up then it is for you to tell them, before they tried, that they shouldn't have attempted it. Because if they try and then give up because they fail, there's a lesson there, there's wisdom, there's insight, there's character building that goes on in that exercise. Whereas just getting in the way and saying, "Don't do it." ... you know ... who gains by that? Unless the teachers is worried that the student's feelings will be hurt because they don't come in first. There's a lot of that going on today too.

In my old age I've become a bit of a pragmatist. Part of it is my access and exposure to the current republican administration. It flows a little bit out of that. I've been appointed by Bush three times, and one appointment (is ongoing) at this moment.

So (for example) there is the "Let's have world peace," as protesters would have you want (when) protesting the Iraqi war. Or there's the (attitude) "How could you be so naïve as to believe that there will EVER be world peace when there has NEVER been world peace in the history of the species! So what, you think you live in special times? So that all of a sudden you can summon up world peace and it will happen now and it has never happened ever before?" Let's be realistic about this. It doesn't mean intentionally wage war, it just means understand a world in which world peace is not a realistic goal. Unless you want to fundamentally believe that we are a different kind of human being in modern times.

What you do is look for solutions that are more sensible given as who we are as humans. That's all I'm saying.

Another thing I figured out — this thing upset me to no end — I thought about it and I said, "Who are the greatest allies that exist in the world today?" The strongest allies. Well, England and America, there's good allies right there. Uh... England and America! Wait a minute, we were mortal enemies 200 years ago. America plus the help of France kicked some serious British butt.

Well how about Japan, we're like buddies with Japan? But we were, like, mortal enemies, and they were completely vanquished. So then I realized that the strongest friends in the world are people where one of them completely vanquished the other. So then I said "OK, we'll put a pin in that fact." And then I said, "Well, let's find wars that had sustained peace from diplomatic solutions." I couldn't find one. I couldn't find one! There were none! None! None!

In other words, if you have two nations that have taken formal state-sponsored arms up against each other, and then diplomats step in and say, "Why can't we all get along?" They sit down at a table and sign a treaty. Every time that has happened war has broken out again within half a generation. Whereas, when one country completely vanquishes the other there is everlasting peace, some of the deepest peace you've ever seen. This upset me because I wished it weren't true. But it kinda' is true.



That's what I mean when I say I've gotten pragmatic in my old age. I just look at stuff that's worked and I try to make it work again.

LS:

How does that play into who you are now and where you want to be?

NT:

It plays in because it's this suite of attitudes that allows me to say, ... rather than say, "Get A's so that you can get a good job", instead let's find people who have great jobs and see if they got A's. And the answer is that they didn't. And so we need to know their stories, not the story of the bookworm.

Harvard, as you may know, has more applicants to its freshman class who are valedictorians of their high school than there are openings to the entering class. They choose to not fill their entering class with valedictorians. Yes, in the end, there are a lot of valedictorians, but not nearly how many as they could have brought in, because there's a missing link there. Harvard wants you to come there, go get famous, and bring more light back to them. Bookworms do not have that talent. The odd thing is that you get a valedictorian from high school who is rejected from Harvard and who says, "Why was I rejected from Harvard? I have the highest grades in the school, I have the highest grades ever here in 5 years!" Then they see, like, a black person got into Harvard: "Oh, well that person got a lower grade... whata whata...". Then it becomes this issue.

I am fascinated by that dynamic! The person isn't wondering whether they would contribute to the campus life, whether they have a personality that enriches the organizations that exist, which creates partnerships, everlasting friendships, political alignments. Whatever it is that goes on that matters in the rest of the world, they don't have it.

My last bit of tirade has to do with what has become of the education establishment. It used to be that you had an expertise that you loved, then you took some education course to learn how to teach that expertise, and then you became a teacher. I'm talking about K through 12 now. But that's not what's happening now. What's happening is people major in education, not in some subject. Well, what does THAT mean?! They learn how to administer exams, how to write the perfect exam. Where's the enthusiasm for learning about birds, or about the sky, or about particles, or about...? It's not there. The educational enterprise is being taken over by people who are experts in education but who have no capacity to impart inspiration.

In the end, I would rather have someone who is inspired by their work stand in front of me and be my teacher, even if they don't know how to teach. Because — you know something — that doesn't matter. In the end what matters is the osmotic link that is made between your and their enthusiasm. Just by being in the same room at the same time. Once you have the enthusiasm as a student, that's what will keep you off the streets, that's what will enable you to turn off the TV — turn off "American Idol" — and go the library, rent a video on the subject. That's what drives you.

LS:

Talk about your enthusiasm, what drives you. You, personally.



NT:

I have an intense curiosity about how the universe works. And I'm intrigued that the public likes the universe enough so that I get tapped regularly to interpret it for them. I'm just tickled to death by that. I don't know of any other scientific discipline where that's true. Yes, the news has medical doctors to interpret the latest New England Journal of Medicine article, but that's because you're worried about your health, not because you have a curiosity of the knowledge and the insight that you glean from having heard it.

That's what keeps me going. As Carl Sagan said "when you're in love you want to tell the world." When I walk down the street and it's clear, and I see somebody looking up trying to point something out, I've got to stop. "What you looking at?" Total stranger. "Oh, this, that, that, that, that." When I see a crowd I feel this urge to run up and get my telescope and set it up on the sidewalk so that I can show people the universe, because it's our universe, not my universe. It's our universe.

And people are intrigued. I don't twist the arms of the newscasters or the editors of the magazines. I don't twist their arms to do a cover story on Saturn, or Mars, or Venus. They do it anyway. There's something deep and fundamental about that interest factor. And I'm part of that community. It's a privilege.

Plus I gotta go. I gotta reconnect with (my wife) Alice.

Where you headed now?