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## Neil deGrasse Tyson on Science Literacy (Part Two)

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**BILL MOYERS:** This week on Moyers & Company we conclude our conversation with astrophysicist Neil deGrasse Tyson on science and democracy.

**NEIL DEGRASSE TYSON:** You have not fully expressed your power as a voter until you have a scientific literacy in topics that matter for future political issues. This requires a base level of science literacy that I don't think we have achieved yet.

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**BILL MOYERS:** Welcome. For two weeks now the astrophysicist Neil deGrasse Tyson and I have been soaring to the outer edges of the universe in pursuit of dark energy:

NEIL DEGRASSE TYSON from Moyers & Company Show 301: We expected gravity to be slowing down the expanding universe. The opposite is happening. We don't know what's causing it.

**BILL MOYERS:** And dark matter:

NEIL DEGRASSE TYSON from Moyers & Company Show 301: We account for one sixth of the forces of gravity we see in the universe. There is no known objects accounting for most of the effect of gravity in the universe. Something is making stuff move that is not anything we have ever touched.

**BILL MOYERS:** Up there, heavenly bodies collide creating spectacular displays of fire and light. But, down here, the collision of science and religion in the rough and tumble of democracy can create its own fireworks. Which brings me to the controversy Neil deGrasse Tyson triggered in the blogosphere when he said this to me in one of our earlier episodes:

NEIL DEGRASSE TYSON from Moyers & Company Show 302: The problem arises is if you have a religious philosophy that is not based in objective realities that you then want to put in the science classroom, then I'm going stand there and say, "No, I'm not going to allow you in the science classroom."

**BILL MOYERS:** The proverbial alien from outer space must be scratching his bug-eyed head over that one. In 21st century America why should our most noted astrophysicist have to defend the science classroom against the intrusion of religion?

Two reasons: Over the past few years, the number of Americans who question the science of evolution has gone up. Look at this Gallup Poll. Forty six percent of the country embraces the notion that "God created human beings pretty much in their present form at one time within the last 10,000 years..."

Perhaps less surprising, a Pew Research survey found that almost two thirds of white evangelical Protestants, the bedrock of the Republican Party, reject altogether the idea that humans have evolved. So while acceptance of evolution has increased among Democrats to 67 percent, among Republicans it's fallen to 43 percent. That's a huge partisan divide.

Something else is happening, too, and no one is certain exactly why. Our Secretary of Education, Arne Duncan, calls it "educational stagnation." Consider this, PISA tests, tests that measure critical thinking in science, math, and reading among high school students in different countries, show that our students aren't doing so well.

In math, students in 33 other countries, including Ireland, Poland, Latvia, the United Kingdom and the Czech Republic, did better than American students. In science, students in 24 countries including Poland, Ireland, and the Czech Republic were ahead of ours. And in reading, our best subject, kids in 21 countries outdid the Americans.

The hard truth, says Secretary Duncan, is that the United States is not among the top performing comparable countries in any subject tested by PISA. That's bad news for our students and the country.

All fodder for my last round with Neil deGrasse Tyson. He's the director of the Hayden Planetarium at New York's American Museum of Natural History, he's also the narrator of a mesmerizing new show at the planetarium called Dark Universe, and this spring he'll appear as

the host of a remake of the classic PBS series "Cosmos." You can see it on the National Geographic Channel and Fox TV. Welcome.

**NEIL DEGRASSE TYSON:** Thank you.

**BILL MOYERS:** Let's talk politics for a moment.

**NEIL DEGRASSE TYSON:** Go for it.

**BILL MOYERS:** All right. According to the Pew Research Center, back in 2009, a comfortable majority of Republicans accepted human evolution as a fact. But now, a plurality rejects it. So I ask you, politics can trump science, can't it?

**NEIL DEGRASSE TYSON:** Well, in a free, elected democracy, of course. You vote who you want on your school board. There is no provision in the constitution for the government to establish what's taught in schools. That's all relegated to the states. Hence, we speak state to state about what's in their science textbook versus another.

And so that's the country we've all sort of bought into, if you will, or born into. I think it's a self-correcting phenomenon. Nobody wants to die, okay? So we all care about health. But above all else, among the Republicans I know, especially Republicans, nobody wants to die poor, okay?

So educated Republicans know the value of innovations in science and technology for the thriving of an economy and business and industry. They know this. If you put something that is not science in a science classroom, pass it off as science, then you are undermining an entire enterprise that was responsible for creating the wealth that we have come to take for granted in this country. So we're already fading economically. If this, if that trend continues, some Republican is going to wake up and say, "Look guys, we got to split these two. We have to. Otherwise, we will doom ourselves to poverty." And so I see it as a self-correcting, I don't know when it'll happen, but they know.

**BILL MOYERS:** So what do you think's at stake? What's at stake--

**NEIL DEGRASSE TYSON:** What's at--

**BILL MOYERS:** --for democracy?

**NEIL DEGRASSE TYSON:** Oh no, it's not, the democracy will still be here. It's a matter of we're just voting into office people who don't understand how to make, how money gets generated. In, you know, since the Industrial Revolution and before, we have known the value of innovation in science and technology and its impact on an economy.

If that begins to go away, it's a different country. We'll still call ourselves America, but we won't lead the world economically. And that's a choice we are making as an elective democracy.

**BILL MOYERS:** How do you explain that no present-day scientist, present company excepted, is a household name, the way Thomas Edison or Einstein were. What does that suggest to you?

**NEIL DEGRASSE TYSON:** If I had to pick, I'd rather they were scientifically literate and didn't know the name of any scientist. Because that's matters much more. It matters much more that you understand what it means to pull oil out of the ground or the energy content of oil versus wind versus sun versus-- that matters.

It matters that you know that an asteroid has our name on it and how it might strike us and how we might deflect it. That matters. It matters what is happening to your health. This requires a base level of science literacy that I don't think we have achieved yet. You have not fully expressed your power as a voter until you have a scientific literacy in topics that matter for future political issues.

**BILL MOYERS:** And that scientific literacy spares you tomfoolery from charlatans, right?

**NEIL DEGRASSE TYSON:** Yes, exactly, science literacy is an inoculation against charlatans who would exploit your ignorance of scientific law to then take your money from you or your opportunity from you. So the world does respond and follow known laws of physics and chemistry and biology.

We understand that. So yeah, I mean, so "Cosmos," when it comes out, again, we're not beating you over the head. I'm not saying, here, learn this or else. It's an offering. It's like, here it is. And here's why it matters. Here's why your life can be transformed just by having some understanding of this. And then I go home.

**BILL MOYERS:** Speaking of scientific literacy, I've brought along some disturbing statistics. As you know, American students are performing poorly on international tests for math and science. In science, just ahead of Russia, and on a similar level as Italy, Latvia, and Portugal. In math, fewer than 9 percent of our students scored advanced, compared to a whopping 55 percent in Shanghai, 40 percent in Singapore, and more than 16 percent in Canada. What's going on?

**NEIL DEGRASSE TYSON:** Yeah, welcome to the new world. Yeah. I mean, okay, there's that fact that you just read. Now look at the rising economies in the world. The rising and falling economies. It's going to track those numbers. The beginning of the end of what we thought of as America, as I grew up in an America that had as a priority leading the world in every metric you can assemble for yourself.

So that's, this is the writing on the wall. Now how, why hasn't it happened sooner? Because a lot of these numbers have been around for decades. I have a hypothesis. But I didn't do the experiment. But it's not good enough to only be smart at something or to score high on an exam. At some point, you have to step away from the exam and say, I have a new thought that no one has had before. And it's not a thought that you told me to regurgitate on this exam that you just wrote, because it's a thought that no one has had before.

And how do you get those thoughts? You get those in an, in irreverent cultures. Possibly, that has delayed our collapse, because it is out of the environment of not regurgitating what someone else has learned in their lifetime that allows you to make a discovery that no one else has made before.

**BILL MOYERS:** You think there are too many tests? We give kids too many tests?

**NEIL DEGRASSE TYSON:** I think we--

**BILL MOYERS:** Of regurgitation--

**NEIL DEGRASSE TYSON:** --put too much emphasis on what the meaning of the test is. I, test people, it's a way to find out what you know. But don't then say, if you don't know this, therefore the rest of your life is screwed. No, no, because go find people who are successful in this world. Find, you know, talk show hosts and comedians and novelists and attorneys and go get the politicians. Put them in a room, say, how many here got straight As throughout school? None of them are going to raise their hands. By the way, throw in inventors, throw in all these people, none of them are going to raise their hand, okay? Bill Gates dropped out of college. Michael Dell dropped out of college.

Those people are not-- the success of those people is not measured by how they performed on the exam that you wrote as professor. Because they're thinking in ways that you have yet to think, because they're inventing tomorrow. And the only way you can invent tomorrow is if you break out of the enclosure that the school system has provided for you by the exams written by people who are trained in another generation.

**BILL MOYERS:** There's something else to this. And, I mean, some people say this educational stagnation that we are experiencing, it's because we have one of the highest child poverty rates in the developed world. They point to the fact that high-poverty schools in America posted dismal scores on these tests, whereas wealthy schools did very well. In fact, students in the wealthiest schools scored so highly that if they were treated as a separate jurisdiction, they would have placed second only to Shanghai in science and reading and would have ranked sixth in the world in math. So inequality matters.

**NEIL DEGRASSE TYSON:** Yes. That's, yeah. And your point is? That's always been the case.

**BILL MOYERS:** My, you--

**NEIL DEGRASSE TYSON:** By the way, my father was active in the Civil Rights Movement in the 1960s. And a lot of my cultural awareness and sensitivities, as I'm floating in the universe, were anchored by just that kind of awareness. The inequality of, the unequal distribution of wealth, but that's almost fundamental to a capitalist system, but you, what you don't want to have happen is to have unequal access, okay? People will sort themselves out by who works harder than the rest of us. I got that. I even embrace that. But if everyone does not have equal access, you are not getting the best people. Your country will falter.

**BILL MOYERS:** And that's where inequality matters--

**NEIL DEGRASSE TYSON:** Because you have disenfranchised a whole community of people that might've been contributing, but no, because they never even saw the light of day. So, the light of the intellectual day. So yeah, that's bad. And it is not the sign of a healthy democracy. It's not even the sign of a healthy capitalist democracy.

Being at the top of your game intellectually, philosophically, politically, is not a forever thing. I read history, I look at countries that rise up and contribute mightily to eradicating ignorance and to making discoveries about our place in the universe. And then by change of force, by change of vision, by change of, by shortsighted leadership, the entire operation collapses.

Look at Islam a thousand years ago, Baghdad was the center of intellectual, it was the intellectual capital of the world, while Europe, they were disemboweling heretics, okay? That's why our numerals are called Arabic numerals, because they pioneered the use of these numerals and invented algebra, itself an Arabic word, and algorithm. Two-thirds of the stars in the night sky have Arabic names. How does that happen? Because they had navigating devices, astrolabes. That culture of discovery ended and has not arisen since.

I look at America, post-war, 20th-century America and say, we were the top of our game. Investing in science and engineering, and education. And yeah, we had our inequalities and we had our problems, but culturally as a nation, we had our vision statement. We were thinking about our future.

We weren't thinking about the now, we were thinking about the tomorrow. That's what the World's Fair was, inventing a tomorrow that doesn't yet exist today. When that's how you think about your country and run your country, you have policy that points in that direction. Innovative, inventive, creative policy that takes you from the present into the future.

Without it, you live in the present and the rest of the world passes you by, you might as well physically be moving backwards. Because that's what you look like to the rest of the world. So as a scientist, I don't care who does the work next, if it's not America. I want to see good scientific results no matter where they're done. But as an American, I feel it. I feel the fading of our luster, the fading of our vision statement as a nation.

**BILL MOYERS:** I saw a quote recently by the physicist, Jonathan Huebner, who says humans are running out of world-changing inventions. He says, "I think the major branches of discovery are behind us." Do you agree?

**NEIL DEGRASSE TYSON:** Of course not. Oh my gosh. That is, we put-- I would say this to the man's face. The-- you can't be more, that's, let me be polite. Previous statements such as that made by physicists of the past have proven to be extremely shortsighted. How's that for polite?

**BILL MOYERS:** That'll do. That'll do.

**NEIL DEGRASSE TYSON:** Okay? So, there was a physicist. One of these Nobel-prize-winning physicists at the, in the 1800s, going into the 1900s, the turn of that century, we were at the top of classical physics. Newton's laws were working, electricity was understood, this, we had the power of knowledge, of the laws of nature. And they said, but, there are a couple of things, there's still some unknowns. But that's just a matter of getting an extra decimal place in the measurement, but new ideas, we're done, we're done here. Just a few clouds on the horizon, we're good to go. Don't become a physicist. There's nothing left to discover.

**BILL MOYERS:** Right.

**NEIL DEGRASSE TYSON:** And what would happen in the next 20 years? Relativity would be discovered. Special relativity and general relativity, the expanding universe, quantum physics, all of classical physics would be turned on its ear because of the discoveries in the very two or three decades to follow the uttering of that statement. So of course he can't see the future. That's kind of what it means to not be in the future.

Half of my library are old books because I like seeing how people thought about their world at their time. So that I don't get bigheaded about something we just discovered and I can be humble about where we might go next. Because you can see who got stuff right and most of the people who got stuff wrong.

**BILL MOYERS:** What is the toughest question you would like to answer before you die?

**NEIL DEGRASSE TYSON:** Oh. I hate to sound cliché about this, but my favorite questions are the ones, dare I use the word, yet to be divined, because there's a discovery yet to take place that will bring that question into the center of the table. I live for those questions. So that means I can't tell you what they are, because they derive from something yet to be discovered.

**BILL MOYERS:** In dark matter? Influencing--

**NEIL DEGRASSE TYSON:** Or for example, if we discover what dark matter is, there's going to be some question about dark matter that will rise up out of the ground and say, I never even thought to ask that question. In 1920, no one thought to ask, how fast is the universe accelerating? Okay? How fast is the universe expanding? Because no one thought the universe was expanding at all.

You can't ask questions about the movement of a universe that you don't even know is in motion. You can't ask questions about other galaxies if you don't even know there are other galaxies. So on my deathbed, I will relish in all of the questions that came up that I never thought to ask, because it was the discoveries of the future that enabled them.

**BILL MOYERS:** Neil deGrasse Tyson, thank you for being with me.

**NEIL DEGRASSE TYSON:** It's been great to be here. Thank you.

**BILL MOYERS:** The battle never ends. And the choices we make in democracy often pit religious or partisan beliefs against scientific evidence that contradicts them. And beliefs can be stubborn, hard to give up. They even determine which facts we choose to accept. Partisans, especially – and who among us is not sometimes a partisan – will twist the facts to fit their preconceived notions. So, when people do stupid things, journalists and politicians included, cherished beliefs are often driving them, sometimes right over the cliff. As people in recovery say, denial is not just the name of a river in Egypt. And that's what makes it dangerous.

Right now, two powerful belief systems have converged to counter facts staring us right in the face. Just as the number of Americans who question the science of evolution has gone up, so too has the number who deny that global warming is happening, and that human activity is causing it. This, at a time when the global scientific community is more certain than ever that you and I, and everyone else, are helping to turn up the heat and seal our fate. And here's the

scary political reality: on both fronts, evolution and climate change, radical right Republicans have made denial a litmus test. You can see it embodied in this man, Paul Broun, Republican congressman from Georgia, and a physician with strong religious beliefs:

**PAUL BROUN:** I've come to understand that all that stuff I was taught about evolution, and embryology, and Big Bang theory, all that is lies straight from the pit of hell. And it's lies to try to keep me and all the folks who are taught that from understanding that they need a savior. You see there are a lot of scientific data that I found out as a scientist that actually show that this is really a young earth. I don't believe that the earth's but about 9,000 years old. I believe it was created in six days as we know them. That's what the Bible says.

**BILL MOYERS:** And when he took on the science of global warming, his fellow Republicans in the House of Representatives enthusiastically applauded:

**PAUL BROUN on CSPAN:** Now we hear all the time about global warming. Well, actually we've had a flat line temperatures globally for the last eight years. Scientists all over this world say that the idea of human-induced global climate change is one of the greatest hoaxes perpetrated out of the scientific community. It is a hoax.

**BILL MOYERS:** Not true, simply not true. Up to a point, we might agree that Representative Broun's personal beliefs are his own business, even when he is telling the extremist John Birch Society that this entire concept of man-made global warming is a conspiracy to, and I'm quoting, "destroy America." But remember, this man is chairman of oversight and investigations for the Science, Space, and Technology Committee of the United States House of Representatives, passing judgment on public policy and science. God help us.

**BILL MOYERS:** At our website, BillMoyers.com, join a group of citizens braving the dead of winter to march the length of New Hampshire, all to make candidates take a stand on the corruption of money in politics.

**LAWRENCE LESSIG:** If you think about every single important issue America has to address; if you're on the right, and you care about tax reform or addressing the issues of the deficit. On the left, if you care about climate change, or real health care reform. Whatever the issue is, if you look at the way our system functions right now you have to see that there will be no sensible reform given the way we fund campaigns.

**BILL MOYERS:** That's at BillMoyers.com. I'll see you there and I'll see you here, next time.