

The

BEACON

News from The Coalition for Excellence in Science and Math Education

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President's Message: Jesse Johnson

"[Physicists] are inspired by two fundamental assumptions: (a) that the world they study exists outside their minds, and, when they have gotten its properties right, it will be seen in the same way by other physicists; and (b) that in the process of getting it right, they must search deeply enough beneath the surface of what they observe so that no more fundamental level can be found."

~McAllister Hull, Rider Of The Pale Horse

When I first met McAllister Hull, he was an emeritus professor of physics at UNM. He was giving a lecture about the history that he had lived, and it was fascinating. In 1943, as WWII raged, he was studying physics at university when he was drafted into the Army. Given his physics background, plus his experience working in an ordinance plant, he was sent to Los Alamos at 21 years of age where he was put in charge of figuring out how to cast the explosive lenses for the first atomic bomb known as "The Gadget", as well as Fat Man, which was dropped on Nagasaki.

Mr. Hull is no longer with us. In 2011, he passed away, but he did leave us a memoir which I quoted at the beginning of this message. This memoir has a 14 page introduction where he discusses what physics is, and in most respects, you can replace 'physics' with 'science' and his discussion would still be valid in this introduction. It is well worth the read, as it is one of the best discussions regarding what physics, and by extension, what science is that I have seen.

The idea that the world exists outside of our minds is certainly not a new one. Another way of stating this is that there is an objective reality, and there is an order to that reality. The universe follows rules, and science is an effective method to teasing out descriptions of those rules. Furthermore, if other physicists are to see these rules in the same way as Mr. Hull stated, it implies universality of these rules. If somebody in India performs the exact same experiment under the exact same conditions as an experiment performed by somebody in the United States, they should get the exact same results. The differing cultures are irrelevant to the outcome of the experiment.

The existence of a consistent objective reality is an underlying assumption behind the scientific method, but so is the idea that our understanding of that objective reality is incomplete, hence the need to dig "so that no more fundamental level can be found."

We can only understand the universe as well as we can observe it, and the example that Mr. Hull gave in his introduction of this is how Newtonian physics eventually gave way to Quantum Mechanics and General Relativity. Is Newtonian physics wrong? Not within the framework that it was originally developed, but we have gotten better at observing phenomena that are very small and others that are moving at mind numbing velocities. Even with these advancements, if I had to predict where an artillery shell is going to land, I'm not going use General Relativity, I'm going to use Newtonian physics. There are other similar distinctions in other scientific fields due to the nature of how our knowledge has progressed.

From time to time, we need to be reminded of what science is. We observe objective reality, and we try to puzzle out how that reality works. We build models that describe that reality, and we let people throw rocks at those models to see if they will withstand the bombardment. If not, we alter or discard those models. If you see works that do not have the underlying assumption that there exists an objective reality outside of one's own experiences, those works are not science.

Simply put, the underlying assumptions behind science dictate that when a tree falls in the forest, it makes a noise regardless of whether somebody is there to observe that sound, Quantum Mechanics not withstanding. The Beacon is published by the Coalition for Excellence in Science and Math Education (CESE). A 501(c)(3) nonprofit corporation, we are incorporated in the State of New Mexico. Visit our website at http://www.cese.org.

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Luring Retirees Back into The Classroom By Lisa Durkin

Coalition for Excellence in Science and Math Education board member and past president, retired educator

With an 84% increase in teacher vacancies, New Mexico has a teacher-shortage crisis, there's no doubt about it. As school administrators scramble to fill vacant positions, students, especially the neediest students, don't have the support they need to acquire the quality education necessary for their success. It is in all our best interest that students are well educated, and without highly trained teachers, we won't see that happen.

After the 2020-2021 school year, the "COVID-19 year," teacher retirements increased by 40% over the year prior. It goes without saying this phenomenon further stressed our staffing crisis. So, what can we do to lure retired teachers back into the classroom? Veteran teachers have experience and training that is essential for catching students up after the COVID-19 year. It makes sense to entice them to return to schools.

Teachers leave the occupation for several reasons, most of which are common to retirees. Much of our current debate about teacher vacancies revolves around salaries. Attracting and retaining professionals in any field is difficult without adequate pay. Historically, low wages have hit retirees especially hard since they weathered many years on a tight budget and couldn't build capital, but they do have a pension. Interestingly enough, financial compensation isn't the number one reason teachers leave the occupation, but it's always in the top three according to Learning Policy Institute¹, Rand Corporation², and National Education Association³ surveys. A supportive work environment is cited as an issue more often than not. Other reasons for the teacher exodus are a lack of autonomy in the classroom and undesirable working conditions. These problems have been repeatedly documented over decades, yet they persist. Veteran teachers are more likely to be affected by them because they've stewed in this pot for years. These "frogs" were cooked during the COVID-19 year where a steep technological learning curve boiled them in a cauldron of frustration.

What might legislators and school districts do to staff classrooms with these knowledgeable teachers who are classroom ready? Since I am one of the aforementioned retirees from the 40%, perhaps I can give some insight. It pained me to retire after 30 years in education. I would be thrilled to return to teaching, it's my calling in life, and I miss the kids dearly, but there would need to be some real changes before I would make that move.

Considerations to lure retired teachers back include support, autonomy in the classroom, realistic expectations, safety and working conditions, money, and the hiring pipeline.

Support

A reasonable workload: For a retiree, "support" doesn't mean more training. Sure, retiree's need expertise in new technological advances, but sinking time and resources into training programs or mandated reform initiatives, must be cut to a minimum. Retirees have seen dozens of them come and go and every one of them requires a greater workload. Canned professional development programs rife with paperwork-intensive obligations and time-consuming workshops robs teachers of what they need most (see below) and often leads to micromanagement. In other words, training mandates can be counterproductive. New educational packages, or mandated accountability initiatives haven't moved the dial significantly in terms of student proficiency. Resources would be better allocated to provide real classroom support that both improves learning outcomes and reduces layers of well-meant training obligations and mandates. Let the new-hires go to training and let the 'old-skees' teach.

Clerical support: The amount of required paperwork that teachers are responsible for has escalated. Here are some of the culprits: biannual evaluations, documentation necessary to meet obligations in an increasingly litigious field, and, as mentioned before, layers of educational reform initiatives. This is especially pertinent for teachers who must address the needs of a roster high in at-risk students and students with disabilities (SWD, formerly known as special education students). Contacting parents can easily add 10 hours to a forty-hour week. During the 2009 economic downturn, educational budgets were slashed and what clerical support teachers did have evaporated. Teachers need clerical support. *Counselor services:* Counselors serve a far bigger role at schools than ever before, and what was once a manageable caseload is now overwhelming, especially in schools servicing challenging demographics. From career and college planning, enrollment procedures and advisement, to interpersonal relationship issues, these vital student services fall on teachers. Teachers must not be tasked with taking the role and responsibility of the counselor.

With our current adolescent mental health crisis, a licensed psychologist at school sites is essential. Suicidal students need much more than a teacher can provide.

Licensure for school counselors requires a specialized master's degree. Perhaps an alternate pathway to school counseling certification could be arranged for those who already hold a degree in education. Many retirees would make great counselors if the certification required only a few graduate credits.

SWD and English Learner support in the classroom: My replacement has a class of over 35 students containing a dozen SWD. One third of his students are English Language Learners (ELLs). His total roster count is over 220 students. Providing a quality education to so many SWD and ELL students without support, while simultaneously delivering a regular program, is impossible if a teacher is to do a conscientious job meeting SWD and ELL needs.

Teacher evaluations require educators to generate hundreds of pages of documentation that SWD and ELL objectives are met. Although staff in charge of ELL and SWD caseloads have plenty of advice, there is no real support in the classroom for these wonderful kids. We have never tried sinking resources into the classroom where education actually happens. Perhaps it is time to give it a go! Here's an idea, give secondary teachers trained classroom assistants or at least have a trained assistant available for overburdened classes.

Class loads and roster counts: There are only so many students a teacher can effectively engage at one time, and there are only so many total students a teacher can manage in one week without cutting corners. We need to have stricter caps.

About the extended school year: Many school districts are looking at making a mandatory move to an extended school year. It makes sense for students, but I don't think teachers can handle that much more: beware of more and more retirees.

Autonomy in the Classroom

Mandatory adherence to reform initiatives and training programs: For retirees, reviving their autonomy is paramount, because they remember when their professional expertise was respected. While it is true that instruction needed to be standardized so that specific standards were taught and one section of a given course requires the same student knowledge and skills as another. micromanaging instruction through training programs and accountability initiatives has undermined the value for professional mastery retirees have to offer. Furthermore, these enterprises have not improved student outcomes significantly. The micromanagement must stop. Perhaps teachers could obtain a new type of additional certification that would make professional development training optional and abbreviate the teacher evaluation. It could be part of the three-tiered system we already have in place.

Realistic Expectations

Over the decades, society has continuously increased the expectation for schools to remedy what they have no control over, to find solutions where there aren't any, and to take blame for what they didn't cause. Educators were expected to fix kids and families, eliminate social inequalities, and boost the economy by producing a higher skilled work force. The accountability movement generated an internal feedback loop of built-in failure. Respect and value for the teaching profession has plummeted as a result of the perceived failures of schools to do the impossible. Policy makers can't do anything about that, but they can reel-back the onerous measures that the accountability movement put in place. These mandates didn't work anyway.

Teacher evaluations: Documenting compliance with instructional criteria requires that hundreds of pages be generated and uploaded. Teachers must cram evidence that their practices meet all classroom

criteria into one evaluation visit. They must spend hours of their personal time to meet instructional leadership criteria. Biannual evaluation benchmarks, even the revised version, needs to be cut way back.

Teacher preparation time: The expectations for what good classroom instruction looks like has significantly improved, but that requires that teachers must spend more time collaborating and preparing. Mandating uninterrupted teacher preparation time would help.

At-risk students: First, ecognize that teaching at-risk students requires far more time and resources. Then sink more resources into classrooms with at-risk student overloads and reduce classroom rosters for educators who teach at-risk kids.

Provide ample classroom materials and supplies: If I have to buy one more ream of paper or roll of paper towels...

Piling on responsibilities: If teachers are expected to fulfill a new requirement, then an old requirement must be eliminated. Retired teachers can't be given any more obligations without the time or resources to fulfill them.

Safety and Working Conditions

COVID-19: Many retirees are in the high-risk age group and concerned about catching COVID-19. If the schools go to distance learning, it puts retirees who are not comfortable with technology in an undesirable situation. Staffing shortages have plagued schools due to illness. There isn't much anyone can do about COVID-19, but schools can suspend extraneous teaching responsibilities.

Facility maintenance: A student faints in a broiling classroom, teachers wear down-coats while giving instruction in a frigid classroom, a teacher passes out behind her desk because of inadequate ventilation in a chemistry classroom, science teachers make do with regular classrooms containing no sink, storage or tables; any retiree can tell you dozens of stories. It's amazing how school districts can afford multimillion dollar extracurricular facilities, but neglect to address the basic needs of a classroom teacher. Provide adequate classroom facilities and maintain them properly.

Allow part-time work: Offer teachers the option of teaching a half-day schedule or a smaller number of course sections rather than requiring them to report for a full load of classes. A four-day schedule, where they can work from home on Fridays, is another idea. **Money**

Pensions and the retirement funds: Double dipping while paying into a pension fund for credits that a retiree will never receive doesn't make sense. Eliminate payment into the pension fund while a retiree draws a pension. Or, suspend pension payments and allow for pension contributions to buy credits that could be tacked onto what has already been acquired for a better pension later.

Higher Salaries: This makes a bigger difference for attracting new hires and retaining the current teaching force. Retirees are already at the top of the pay scale. *Signing bonuses for high demand positions:* That would sweeten the pot for new hires.

Students who witness the conditions in teachers must operate don't want to become teachers. Just ask them. Parents don't want their children to pursue a teaching career either.⁴

Many studies have evaluated teacher dissatisfaction and yielded basically the same results. Teachers need higher salaries, support, and realistic work expectations if we want them to stick around. Yet recommendations focus on teacher recruitment, preparation programs and training. Perhaps it's time to address the disconnect between policy and funding failures verses what educators are concerned about. Obviously, teachers are making an exodus despite efforts made by government and a case can be made that many policies exacerbated the issue. We can shift the conversation and craft legislation that will support teachers and students in the classroom where learning occurs.

1.https://learningpolicyinstitute.org/product/teacherturnover-report

2.https://www.rand.org/pubs/research_reports/RRA112 1-2.html

3.https://www.nea.org/about-nea/media-center/pressreleases/nea-survey-massive-staff-shortages-schools-le ading-educator

4.https://www.edweek.org/teaching-learning/mostpeople-wouldnt-want-their-child-to-become-a-teacherpoll-finds/2018/081

Does Science Literacy Need a Booster Shot?

Yes, and here is why:

It seems that science literacy is on the wane. A significant fraction of our population accepts ideas as facts with no scientific bases.

The most glaring examples come from the challenges we have had with COVID-19. Whoever came up with the idea that hydroxychloroquine, chloroquine, or ivermectin are 'cures' for coronavirus disease (COVID) needs to go back to school and take a basic biology refresher course. What they will learn is that viruses are composed of a protein shell enclosing the genetic material and that they are the ultimate parasite. With no method of generating energy (known as a metabolism) like our cells do, it is debatable whether viruses are living. This is one reason that there is no cure for the common cold much less any miracle cures for other viral diseases. How can you kill something that isn't living but is dependent on living cells? The best we can do is to train our immune system to recognize and deny the virus a host. Chloroquine pharmaceuticals are effective against malaria, caused by a protozoan parasite. Ivermectin is used to treat parasitic worms. Both these pathogenic organisms have cells very similar to ours, which means therapies that attack these organisms may also be toxic to our own cells. Careful studies are necessary to find a dosage that kills the parasite without doing fatal damage to the host. Scientists are in the process of testing any drug to see if it has any activity against SARS-CoV-2 and some early successes have been cleared for emergency use. The point is not to find that miracle cure, but to collect as much data as possible so the disease can be effectively mitigated. This strategy has vielded some promising candidates for repurposing and clinical trials are underway. If you are interested in being part of a clinical trial, go here https://combatcovid.hhs.gov/clinicaltrials.

Getting vaccinated is like taking your immune system to the gym. An intense workout leaves you with sore muscles and so can receiving a vaccination. It is important to take the side-effects into account when you schedule any vaccine and schedule a sick day. If you get COVID, you will use a lot more sick days. The current trajectory of the pandemic is predicted by evolutionary science. The cells of our body have proofreading mechanisms that correct mistakes in DNA. Though not perfect, they help maintain the genetic material in working condition. A virus has no such mechanism, so every time a virus enters a cell it is subject to mutation. Any mistake made can wind up in the new generation of virus that emerges from the cell. Natural selection then takes over, if the mutation creates a virus that doesn't work, then it is an evolutionary dead-end. But viruses with mutations that still work go on to infect more cells and eventually can be transmitted to a new host. Viruses that kill the host too rapidly don't get as much chance to be transmitted as those that are less virulent. The Omicron variants are an example of evolution in action. The latest versions are highly transmissible but don't make healthy and vaccinated individuals as sick. Like the flu and cold viruses, it will be with humans for a long time. In scientific terms, coronavirus will become endemic. This isn't the end of the pandemic, but the stage where human populations reach a level of 'herd immunity' so most (but not all) have some immunity.

An important element for scientific literacy is the concept of 'critical thinking', a term subject to misinterpretation. In an educational sense, critical thinking involves considering a problem from multiple perspectives, another term is global thinking. Critical thinking is not criticism, for example, it doesn't mean claiming that 'that is an ugly hair-cut,' but is a more nuanced approach. Critical thinking involves asking questions without judgement. 'That is an interesting hair-cut,' who cut your hair?' what inspired you have your haircut like that? Do you think that I would look good with that haircut? Critical thinking skills don't completely develop until adulthood.

Other examples of the loss in scientific literacy include the discussions on the effects of climate change. These become more obvious every day as real evidence is gathered and global impacts become evident that human-caused changes to the climate are happening, yet there still seems to be a focus on "global warming" as suggesting that day-to-day weather is only becoming warmer. The difference between climate and weather are misunderstood, as is the relationship between increase in the temperature of the atmosphere and the effects on weather. Many of the predictions made by climate scientist (not politicians) decades ago are proving true and yet some insist that the changes are perfectly natural and there is nothing we can do to mitigate the changes. Humans are facing a "Grand Challenge" with respect to stabilizing our global wellbeing, influenced substantially by the relative stability of our climate. Of course, the other issue we have to resolve is how we temper the societal forces that bring about war, particularly during a time when our weapons of war pose existential threats to the future of the human race.

One might ask "Why hasn't space exploration provided an antidote to anti-science trends?" That is a great question! Our space achievements, including the most recent James Web Space Telescope (JWST) success, the engineering and scientific marvel our time, can certainly go a long way to re-engaging the general population, and NASA has gone to great extremes as part of project to engage the public with educational information and a highly active website (https://webb.nasa.gov/content/webbLaunch/whereIs Webb.html), but we all have to work within our spheres of influence to ensure that the imagination and minds of the younger generation are captured by these achievements and discoveries.

We all need to actively support science literacy, and battle misinformation.

And the Winners Are...

We are pleased announce the winners of this year's State Science Fair CESE special awards;

M. Yeh, La Cueva High School

Effects of Different Combinations of Halogen Additions to anti-B18H22, Molecule on Absorption and Emission Wavelength. This is a promising approach to improve the performance and lifespan of solar panels in space.

N. Lundstrom, Los Alamos Middle School.

Solar Powered Cell Phone Charging Hat. This required overcoming multiple of technical issues to produce a hat that charges cell phones.

Each received a \$100 award.

A Toon by Thomas



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CESE is Pleased to Announce the 2022 Annual Meeting will Feature



Dr. Kurt Steinhaus

Secretary of the NM Public Education Department 'Move the Needle'

Improving Public Education in New Mexico Saturday, June 4, 2022, 1:30 -3:00 pm

In person: UNM Continuing Education, 1634 University Blvd. NE, North Bldg, Room C

Via ZOOM:

https://us02web.zoom.us/j/89763689681 Questions? e-mail kimber@comcast.net

Background Information

https://webnew.ped.state.nm.us/wpcontent/uploads/2021/10/SKS-Entry_Learning-Plan-2021.pdf

