X18 – EXchanging Worldviews, 18: EXploring Prospects for Peace & Prosperity, 10: EXtricating Humanity from EXcruciating Problems by, 4: EXploiting Competition

Dear: If you were to complain that I haven't made much progress on this expedition, "exchanging worldviews – exploring prospects for peace and prosperity – extricating humanity from excruciating problems", then I'd tend to agree with you. But surely you'd agree with me that I've got a good excuse: the place is crawling with scorpions and rattlesnakes!

Maybe worst about trying to get through an area crawling with such dangerous "critters" is that you gotta keep your head down, taking care with every step. But when you do that, it's easy to lose sight of where you're headed and to see a good way to get there.

Similarly, here. Therefore, I want to start this chapter by pausing for a bit (where it seems to be safe) to try to identify how to proceed. I'm sure that the best method for "extricating humanity from excruciating problems" is *via* education – but it depends on the type of education.

SOME ILLUSTRATIONS OF CURRENT CONDITIONS

Currently throughout the world, "education" contains far too much indoctrination of kids in their society's culture, philosophy, and religion. Of course, given both the similar indoctrination of parents and most people's aversion to exploring the unknown, one wouldn't expect otherwise, but the consequences can be (and have been) horrible. As Einstein said about state-sponsored education: "Youth is intentionally being deceived by the state through lies."

You may be thinking, "Well, maybe in some countries but not in America", but if so, please think again. For example, think about ways that Americans are indoctrinated with the god idea: every school day, kids are coerced into saying that this is "one nation under God"; every time Americans glance at their money, they encounter "In God We Trust", which Congress mandated in 1955 be on all currency (rather than the motto chosen by this country's founders, *E Pluribus Unum,* i.e., "out of many, one"), and essentially every

political speech ends with "God Bless America". As a result of such indoctrination (at homes, in schools, in public) somewhere around 90% of Americans claim that they believe in the existence of God – even though anyone who has even minimal competence in critical thinking would say something similar to: "Hey, what's with all the god talk? There's zero evidence supporting the existence of any god!"

But certainly I'd agree that it can be (and is) much worse in other countries. Illustrative is the "manifesto" entitled *The Punishment of the Apostate According to Islamic Law,*[1] by one of the "founding fathers" of Pakistan, Abul Ala Mawdudi.[2] In this manifesto, Mawdudi "defends" the Islamic law that stipulates that Muslims who abandon their "faith" are to be executed. Similar laws were used to "justify" executing Socrates and Jesus (if the stories are true); similar executions were carried out in Medieval Christianity and may have been carried out by the notorious Mormon Dantes.

For the new state of Pakistan, Mawdudi wrote the following [to which I've added some notes in "brackets", such as these].

> **III The Execution of the Apostate: A Rational Consideration…**
> [Immediately, Dear, notice that Mawdudi will be relying on reason (for his "rational consideration", attempting to "justify" the murder of people who refuse to buy into his religious delusions), not on data (or evidence), and not on the scientific method. Therefore, for reasons I tried to show you in Chapter **R**, be alert to the two, main, potential sources of errors in any "rational consideration", namely 1) logical errors (and as I'll show you, his essay contains some blatant ones!) and 2) unjustified premisses (and as you'll see, his entire essay rests on the unjustified premisses that some giant Jabberwock or magic man in the sky made and controls the universe and that people are to obey what someone who was clearly insane, i.e., Muhammad, claimed was communicated to him by the magic man in the sky, e.g., that he, Muhammad, was to get 20% of his bandits' plunder – and the first choice of the captured women to be his personal sex slaves).]

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[1] Translated and annotated by Syed Silas Husain and Ernest Hahn, 1994; available at http://answering-islam.org.uk/Hahn/Mawdudi/.

[2] As you can find referenced at the website given in Footnote #1 (above), Charles Adams wrote the following about Mawdudi (in "Mawdudi and the Islamic State" in *Voices of Resurgent Islam*, John Esposito, ed., Oxford University Press, Oxford, 1983, p. 99): "Today Mawdudi must rank among the more popular and respected authors in the Islamic domains, if indeed he is not the single most widely read writer among Muslims at the present time. His writings give strong expression to the themes basic to the present-day Islamic resurgence. When the time comes for the religious history of Islam in the twentieth century to be written, Mawdudi's name will unquestionably have a prominent and an honored place in its pages." I, however, wouldn't have written "honored" but something close to: "a prominent position among the list of villains".

H. The Example of America

After Britain let us take the country of America as the second banner bearer of democracy in the world. Although its laws differ to some extent in detail from those of Britain, in principle they fully agree. They differ simply in that the position given to the king in England is given to the national government and the federal constitution of the United States.

Every person is a natural born citizen of the United States who was born from the children of a citizen, whether he was born inside or outside the United States. And a citizen by choice can be any person, who, after fulfilling some legal conditions, takes an oath of allegiance to the constitution to the United States. Apart from both of these kinds of citizens the remaining people are aliens according to American law.

American law distinguishes between citizens' and aliens' rights and obligations in the same way that British law distinguishes between subjects' and aliens' rights and obligations. An alien is free to become a citizen of the United States after he has fulfilled the legal conditions for citizenship. But after he becomes a citizen he does not have the freedom, while residing within the borders of the United States, to renounce this citizenship and to revert to his previous citizenship. Likewise a born citizen also does not have the right, while in the United States, to choose another nationality and to take an oath of allegiance to another state. Analogously in the United States also the laws of treason and rebellion with reference to citizens rest on the same principles on which the British laws of treason and rebellion are founded.

The above response does not stop with these two powers [viz., the US and the UK]. Consider the law of any nation in the world and you will see the same principles operative, i.e., any state uses force to prevent the disintegration of those elements which unite it and to suppress anything tending to destroy its order… [Notice, Dear, that Mawdudi is making the logical error of arguing by analogy, trying to draw an analogy between treason (e.g., in the US) and apostasy (from Islam). But the analogy is invalid. Thus, Article III, Section 3 of the US Constitution states: "Treason against the United States shall consist *only* [italics added] in levying war against them, or in adhering to their enemies, giving them aid and comfort. No person shall be convicted of treason unless on the testimony of two witnesses to the same *overt act* [italics added] or on confession in open court." That is, in the US, it isn't treason to think, or speak, or petition, or organize demonstrations against the "order" (e.g., to say that the President is a nut and his policies are absurd – otherwise, my writings in this book would be treasonous!), but in Pakistan (and in other Islamic nations) it's "treason" (punishable by death) to speak, or petition, or organize demonstrations against the "order" established by the clerics, which is based on the absurd fairy tale that some giant Jabberwock in the sky controls the universe – and that the madman Muhammad was his messenger!]

L. Muslims by Birth

Related to this, one final question remains that causes confusion in many minds with reference to the command to execute the apostate. You can say about a person who initially was a non-Muslim, then chose Islam and thereafter chose *kufr* [to be a non-Muslim] again, that he knowingly erred. Why did he not remain a *Dhimmi* [i.e., remain a non-Muslim]? Why did he join a community religion, knowing that its door of departure was closed to him?

But it is a somewhat different matter when a person himself never accepted Islam but Islam naturally became his religion by virtue of his being born to Muslim parents. If such a person, having arrived at the age of discretion, is dissatisfied with Islam and wants to leave it, it is a terrible injustice for you to compel him also to remain in Islam by threatening to punish him by death. This not only appears extreme but necessarily results in a goodly number of born hypocrites finding nourishment within the community order of Islam.

There is an answer in principle and a practical answer to this doubt. In principle no distinction can be made in the rules between followers by birth and citizens by choice. [B.S. Such a distinction can be made by any competent legislature!] Nor has any religion ever made a distinction between them. [Even if that were so, it doesn't matter; rigidity needn't rule!] Every religion considers the children of its followers to be its followers by nature and imposes on them all the rules it imposes on citizens by choice. [As I tried to show you in Chapter **If**, Dear, this logical fallacy is known as *Argumentum ad antiquitatem* ("argument from antiquity or tradition").] It is in practice impossible and intellectually utter nonsense that the followers of a religion or, in political terms, the children of subjects and citizens initially be raised as infidels or aliens and when they become mature they be left to decide whether or not to follow this religion or take allegiance to that state in which they were born. No community order in the world can ever function in this manner. [That statement is, of course, utter nonsense (derived using faulty logic) – and as demonstrated below, his statements get worse:]

Survival and strength of the community order for the most part depend upon the permanent population who have demonstrated their allegiance to it and are guardians of its continuity of life. [That (faulty) premiss isn't supported by evidence. Instead, it can be argued from data that, at it's base, "survival and strength" of any community depends on free people desiring the community's "survival and strength". That (and not indoctrination) is why the US and the UK (and…) are strong. In contrast, nations and unions (e.g., the Soviet Union, Muslim dictatorships) fail because people want to be free to decide, and if they're not free, they'll be pleased to see collapse of the order forced on them by their captors!] And such a permanent population only comes into existence through generation after generation taking responsibility for the continuity of the order. [No! "Continuity of the order" occurs either because people are forced to live with the existing "order" (e.g., with the clerics in control) or if the people want to perpetuate "the order", because it provides them with freedom not to do so, e.g., in the US, the UK, et al.!]

If every generation of followers and citizens is followed by another generation which is doubtful and uncertain about preserving this following and citizenship and in maintaining this order, then the foundation of this community order will be permanently unstable and it will never be firm. [Data don't support such a dumb statement! In fact, the opposite seems closer to the truth: a community will be "permanently stable" only if its citizens have the freedom to change it!] Hence to change allegiance and citizenship by birth to allegiance and citizenship by choice and to keep the door open for every succeeding generation to deviate from religion, constitution, laws and all loyalties is to provide for a procedure which in itself is totally irrational [No: it's called freedom!] and which until now no religion, no community order, and no state in the world has chosen. [That's just pure, unadulterated balderdash. What he's claiming is that all religions, communities, states, nations, etc. are frozen in a *status quo* – whereas, in reality, it's only Islam that's frozen (which, I predict, will soon cause it's demise, courtesy what appears to be a "general principle" of the universe, namely, not only that change occurs but also that things evolve or go extinct). I would, however, grant Mawdudi that he did manage to almost freeze Pakistan in a permanent state of backwardness; yet, there remains a small chance that Pakistan will change sufficiently for it to survive – although, personally, I think it's highly doubtful.]

As for the practical response, the apprehension which our critics have expressed in fact has never been apparent in the practical world. Every community which has some power and zest for life carefully arranges to transmit its traditions, its culture, its principles and its loyalties to the new generations born within its borders and to make them as reliable as possible on its own behalf. Because of this education and training [aka "indoctrination"] the vast majority of the new generations, "more than 999 out of a 1000", are pleased to obey the order and to grow up faithful to the order into which they were born. [What else can they then know, with reliability? And if they manage to learn about another "order", perhaps they would be most "pleased" not to be executed by the existing "order"!] Under these conditions only a few can be born who, for various reasons, might grow up with a tendency towards deviation and rebellion or get that way later. [A "tendency towards deviation and rebellion" – or the ability to think for themselves?!]

It is evident that for the sake of a few individuals of this type no such change can be made in fundamentals that would endanger and disturb the life of the total community. [Maintain the *status quo*, no matter what!] If a few such individuals wish to deviate from the community religion, two doors are open to them: either they can leave the state and change, or, if they are firm in their change and faithful in their adherence to this other order which they have chosen and have seriously determined to establish in the place of the religion of their fathers, then let them place their life in danger and play the game of "life risk", apart from which no order can be changed.

Similar sentiment is expressed in the "American Redneck" bumper sticker:

America – Love it or Leave it.

Both sentiments reveal serious sickness! Far better would be:

Our Country is Good – but Let's Make it Even Better!

As Robert Ingersoll said in a speech in 1882:

He loves his country best who strives to make it best.

I hope, Dear, that you clearly see the sickness behind Mawdudi's analysis, which contains foundational principles for Pakistan's government and is similar to the sickness behind all Islamic governments (and, in fact, similar to what's behind all dictatorial regimes).

Can you imagine the horror of being born into such societies?! Jefferson destroyed the idiocy of all such arguments and governments with a single, powerful, glorious statement:

It is error alone which needs the support of government. Truth can stand by itself.

Mawdudi compares a Muslim rejecting Islam with a traitor in a Western society, concluding that execution of a Muslim apostate is therefore "justified". The blatant fallacy behind his argument is to claim moral equivalence between obeying those in power *vs.* following one's own conscience and between stating your own opinion *vs.* engaging in violent action against those who hold different opinions. In Mawdudi's view, a "good citizen" thinks and acts as those in power dictate; anyone failing to do so is a "traitor" (an apostate) and is to be executed.

In contrast, in Western countries, a good citizen thinks and acts as best he or she sees fit, subject only to the limitation that it's traitorous to take up arms against those who think and act differently. It's the difference between enslavement and freedom – and to their unending shame, Islamic clerics indoctrinate "their" children with the lie that people are to be slaves to Allah (not permitting the kids to see the truth, i.e., that people are to be slaves to the clerics). Thus, the essence of Mawdudi's argument is that those who refuse to be slaves are to be killed. In contrast, the essence of Western democracies is, as Patrick Henry said, "Give me liberty or give me death."

Unfortunately for humanity, many people (typically led by clerical or other bureaucrats) in most societies demand maintenance of and conformity to the *status quo*, almost invariably because they enjoy some privileged position in their societies. And many who control such "order" are obviously quite prepared to kill those who threaten those privileges; certainly they're quite prepared to indoctrinate all children in the idea that the *status quo* (i.e., their power) is to be maintained. Thereby, nationalism, patriotism, and various religions are propagated, and thereby, various damnable god memes ("parasitic mental processes… the cultural equivalents of computer viruses") infect additional generations.

Meanwhile, there are those of us who share feelings similar to those expressed by Einstein:

> Heroism on command, senseless violence, and all the loathsome nonsense that goes by the name of patriotism – how passionately I hate them!

As a result of such "loathsome nonsense", essentially all societies are stuck in vicious cycles, devastating positive-feedback loops (or Catch 22s), in which children are indoctrinated with each society's prevailing worldview, forced to adopt general principles without any knowledge of alternatives.

Instead, as Schopenhauer recommended, kids should learn general principles by extrapolating from their own experiences. In addition, it's essential that kids learn "critical-thinking" (or "evaluative-thinking" or "scientific-thinking") skills. As Einstein said about schooling:[3]

> …the general ability to think and judge independently should… take the first priority.

I agree with Einstein that such "evaluative thinking" should be the first priority of all education. Obviously, however, there are major political and practical problems with trying to teach kids to be critical thinkers.

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[3] This quotation, which I've seen only once, was given by Giuseppe Tognon, as reported in what was to me a surprisingly good report put out by the Vatican. It's a workshop report written by Pierre J. Léna entitled *Much More is Required – Science Education in the 21st Century: A Challenge*. It's available at www.vatican.va/roman_curia/pontifical_academies/acdscien/archivio/s.v.105_cultural_values/part3.pdf.

OBSTACLES TO SOUND EDUCATION POLICIES

To briefly review some of the practical problems with trying to provide kids with such valuable education, first consider (again) the definition and summary assessment of "critical thinking" given by William Graham Sumner in his 1940 book *Folkways: A Study of the Sociological Importance of Usages, Manners, Customs, Mores, and Morals* (New York, Ginn and Co., pp. 632).[4]

> *[Critical thinking is]… the examination and test of propositions of any kind which are offered for acceptance, in order to find out whether they correspond to reality or not.* [Italics added] The critical faculty is a product of education and training. It is a mental habit and power. It is a prime condition of human welfare that men and women should be trained in. It is our only guarantee against delusion, deception, superstition, and misapprehension of ourselves and our earthly circumstances.
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> Education is good just so far as it produces well-developed critical faculty… A teacher of any subject who insists on accuracy and a rational control of all processes and methods and who holds everything open to unlimited verification and revision is cultivating that method as a habit in the pupils. Men educated in it cannot be stampeded… They are slow to believe. They can hold things as possible or probable in all degrees, without certainty and without pain. They can wait for evidence and weigh evidence… They can resist appeals to their dearest prejudices. *Education in the critical faculty is the only education of which it can be truly said that it makes good citizens.* [Italics added]

I agree with other commentators that the above is an excellent summary of "critical thinking" (or evaluative-thinking/ scientific-thinking/ problem-solving, decision-making skills/ developing good judgment/ common sense), but if this summary description is used in an attempt to expand school curricula in "critical thinking", then such attempts can lead (and do lead) either to major oppositions from organizations that control the schools (such as local school boards in this country and religious authorities in Islamic countries) or to horrible corruptions of the meaning of "critical thinking" – because of the last sentence: "Education in the critical faculty is the only education of which it can be truly said that it makes good citizens."

Such controversies and corruptions arise from disagreements about the definition of "good citizens". Is a "good citizen": a good Republican or a good Democrat, a good conservative or a good liberal, a good Social Democrat or a good Liberal Democrat, a good Communist or a good Nazi, a

[4] Copied from http://www.criticalthinking.org/aboutCT/sumnersDefinitionCT.shtml.

good Hindu (or Jew) or a good Christian (or Mormon), a good theist or a good Humanist, a good patriot or a good "cosmopolitan" [= "citizen of the cosmos"]? Resulting controversies (and associated corruptions) can be intense, because an enormous number of groups throughout the world (e.g., Mormons, Christians, Muslims, Yahwists, Hindus… as well as Republicans, Democrats, most consumer-orientated companies…) have vested interests in people continuing to be uncritical thinkers, unequipped with problem-solving/ good-thinking skills, lacking good judgment or even common sense! The continued existence of such groups (a goal that each group usually seeks!) can be jeopardized if people become adept critical thinkers.

As a result, there can be (and are) huge obstacles to overcome if attempts are made to teach kids to extrapolate from their experiences and to become critical thinkers. You can get a glimpse of the obstacles by asking yourself what society will permit teachers to stimulate their students to use critical-thinking skills to evaluate their society's "cherished beliefs"? Therefore, although education is almost certainly the pathway to worldwide peace and prosperity, it seems to be essentially impossible to reach that destination: not only is the path crawling with scorpions and rattlesnakes, it's patrolled by corporate profits, guarded by nationalistic zeal, barricaded by clerical stupidity and cupidity, and walled within a castle of corruption, surrounded by a moat filled with god memes!

In turn, such assessments reveal the enormity of task of solving the root problem: to teach children to be able to think for themselves (rather than as desired by those who control the schools) requires gaining permission to do so from those who control the schools! As a result, such permission will be extremely difficult to obtain, because in general, those who control the schools don't want their children to think differently, they want their culture to continue, they want to maintain the *status quo* – of course with them (the clerics and bureaucrats) safely in control. In general, therefore, it's difficult to identify and pursue pathways that would permit people to break free from such vicious circles or Catch 22s.

A GLIMMER OF HOPE

There is, however, a glimmer of hope that humanity can break free from such vicious circles, a chance of breaking "the grasp of the dead on the throat of the living", a chance of breaking free from the bondage of bureaucrats, a chance of overturning the *status quo* – courtesy competition.

Throughout history, again and again, competition has forced societies to abandon their complacent, soft, religious, corrupt, bureaucratic *status quo:*

- The ancient Persians out-competed the Egyptians when they became too religious, soft, and bureaucratic,
- The ancient Greeks out-competed the Persians when they became too rigidly religious and bureaucratic,
- The Romans out-competed the Greeks when they became too soft, religious, and complacent,
- The Northern European "barbarians" out-competed the Romans when they became too bureaucratic, soft, and "other worldly" with their Christian religion,
- The Roman Catholic Church froze the *status quo* during the thousand-year Dark Ages of Europe, but Protestants, writers, inventors, and scientists of the Renaissance out-competed the corrupt Catholic bureaucracy,
- European democracies out-competed the "nobilities" of Europe when they became too soft and corrupt, and during my lifetime,
- Free nations out-competed the German, Italian, and Japanese fascist bureaucracies, and capitalistic systems out-competed corrupt Communist bureaucracies.

Which then, Dear, leads to possibilities during your lifetime. Currently, Asian "tiger economies" (e.g., S. Korea, Japan, Taiwan, Hong Kong, Singapore…) are roaring, some Eastern European lions (e.g., Finland, Estonia, Latvia, the Czech Republic, Hungary…) are getting frisky, two sleepy elephants (China and India) are awakening, and many people in Islamic nations are getting restless, realizing that something about their system is terribly wrong: the autocrats have their automobiles, the bureaucrats have their benefits, and the clerics have their comforts, but on their satellite TVs (at least, on those uncontrolled by their states' bureaucracies), the people are getting glimpses that ordinary people such as they needn't be so destitute and oppressed. Thus, "change is in the air" – and inevitably, competition follows.

The inevitability of competition is clear. Although all people seem to relentlessly pursue their trio of survival goals (of themselves, their families, and their values), circumstances change, and although some people

obviously choose to cling to the *status quo*, "survivors" learn how to adapt to change. It's called evolution. Societies either evolve or become extinct.

Driving cultural evolution, the forces for change (although sometimes subtle) are actually huge and overpowering. They're similar to the enormous forces derived from heat sources within (and resulting convection of) the Earth's magma; the resulting drag from the magma on the Earth's crust causes the slow drift of the Earth's plates, and when temporarily held back, these "tectonic motions" usually lead to major earthquakes – or in the human case, to revolutions.

In the human case, there are many, huge, and related forces of change: advances in (scientific) knowledge and associated technological applications (e.g., in communications), democratization, economic globalization, over population, environmental degradation, and still other forces of change (increasing urbanization and specialization; decreasing trust in clerics, bureaucrats, and politicians; increasing influence of nongovernmental organizations; decreasing influence of patriarchs, tribal leaders, warlords, plutocrats, aristocrats, etc.). Whether such unstoppable forces result in evolution or revolution depends on the wisdom of the country's clerical and political leaders – and on the courage or endurance of the people (who, in every society, eventually realize that it is they, the people, who ultimately hold predominant power).

In American, the founders chose revolution; Jefferson even added: "I hold it that a little rebellion, now and then, is a good thing, and as necessary in the political world as storms in the physical." Currently in the Islamic world, bin Laden and his cohorts have chosen revolution (albeit a revolution against evolution, trying to return Islam to its "former glory), but most Muslims seem to be waiting for evolution and are trying to endure.[5]

In any event, the forces for change are relentless. In response, with nations throughout the world competing economically, then as I began to illustrate at the end of the previous chapter, their leaders are committing their nations to "economic progress" and (therefore) to improve their own "science and

[5] As an update, Dear, notice that I wrote the above about 5 years before bin Laden was killed and before the Arab revolutions that have been dubbed "the Arab Spring." Also notice, however, that in most Arab countries in which their dictators were overthrown, Islamists have (currently) gained control. As a result, it appears that the people have failed to gain freedom and will be dragged back down into Islamic idiocy – until the next wave of brave people try (again) to purge their societies of such ignorance.

technology" through improved science education. Such competition provides humanity with a glimmer of hope for peace and prosperity – albeit not without its own set of dangers.

The glimmer of hope arises from the following. There's "no way" that kids can learn sufficient science (so that their nations are economically competitive) without the kids learning the basis of the scientific method. Further and importantly, there's "no way" that kids steeped in the scientific method won't simultaneously learn all there is to learn about "critical thinking". Eventually, therefore, when the kids are older, they'll inevitably apply their scientific-thinking (or "evaluative-thinking" or "critical-thinking") skills to evaluate the foundational customs, philosophies, and religions of their cultures – and seek better ways to promote worldwide peace and prosperity.

It is, however, only a glimmer of hope – a candle flickering in the wind – because (as you well know) there are significant "downside risk potentials" (or excrescences!) associated with advanced science and technology. These risks include 1) environmental degradation and associated ecological damage, both caused by increased consumption and 2) the use of advanced science and technology to develop "advanced" weapons (including "weapons of mass destruction", such as biological, chemical, and nuclear weapons). I've mentioned such dangers in earlier chapters and will return to them in later chapters; the dilemma is well summarized by the title of John Avery's book *Space-Age Science and Stone-Age Politics* (although I think that the predicament would be better described with the title "Space-Age Science and Stone-Age Philosophy"). But I'll temporarily set aside further comments on such dangers – to comment further on the hope.

EXPLOITING BENEFITS OF EDUCATION IN SCIENCE

The hope for more peace and prosperity worldwide, arising from exploiting science education, arises not just from associated technological advances (for alleviating poverty, drudgery, sickness, ecological damage, etc.); instead, the grounds for hope are more basic and broader. Education in the scientific method will, of necessity, engender kids both with "critical thinking skills" ("of necessity" because "critical thinking" is synonymous with "scientific thinking") and with a "reality-based worldview" ("of necessity" because the essence of science is conformity with reality).

This "reality-based worldview" will encompass not just "environmental reality" but also a realistic view of the role of humanity in "the scheme of things", both for interactions among people and with the rest of nature. For example, no kid who has learned to apply the scientific method will accept assertions about any giant Jabberwock (or magic man) in the sky (because no data support such assertions and no testable predictions follow from such speculations). Jefferson saw it and wrote essentially on his deathbed (upon being invited to attend the 50th anniversary of American Independence):

> May it [America's Independence] be to the world what I believe it will be (to some parts sooner, to others later, but finally to all), the signal of arousing men to burst the chains under which monkish ignorance and superstition had persuaded them to bind themselves, and to assume the blessings and security of self-government. That form which we have substituted restores the free right to the unbounded exercise of reason and freedom of opinion.
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> All eyes are opened, or opening, to the rights of man. *The general spread of the light of science* [italics added] has already laid open to every view the palpable truth that the mass of mankind has not been born with saddles on their backs, nor a favored few booted and spurred, ready to ride them legitimately by the grace of God. These are grounds of hope…

Furthermore, from learning, understanding, and applying the scientific method, kids will develop a realistic view of their roles in this universe, e.g., as intelligent hosts of life (viz., hosts of DNA) confronting an otherwise totally dumb universe that, nonetheless, must be managed intelligently, for the benefit of future generations.

In fact, there are significant additional benefits from educating kids in the scientific method, benefits derived from "the virtues of science". I've mentioned these benefits in earlier chapters and will return to them again; here, I'll just briefly review them. They include intelligence, openness, honesty, cooperation, diligence, and perseverance. As Feynman said:

> The only way to have real success in science… is to describe the evidence very carefully without regard to the way you feel it should be. If you have a theory, you must try to explain what's good about it and what's bad about it equally. In science you learn a sort of standard integrity and honesty.

Such integrity leads to the egalitarian and self-governing nature of science. Stated differently, science "shoots itself in the foot" if it doesn't seek the best contributions from men and women of arbitrary nationality and ethnicity. The only criterion for contributions is competence. Thus, in

contrast to religion (which is autocracy, bureaucracy, and plutocracy at its worst), science is democracy and meritocracy at its best.

TROUBLES ON THE TRAILS AHEAD

Dear, if you followed the above "trail of thought" and now think that the best way forward seems reasonably clear, then I'm sorry, but I feel compelled to remind you that the trail is crawling with scorpions and rattlesnakes – and that it's wise to entertain the possibility that, in reality, it's impassable. As a minimum, it won't be easy; it won't be neat. Further, at the rate we're going, it'll take decades and maybe even centuries – assuming that, before then, some idiots don't destroy the world!

In general, I doubt if there's a single, neat answer to the question of how to expedite any cultural change. In essentially any such change, there are winners and losers, and it's to be expected that the losers (and those who are worried that they might lose) will resist the possible change. Consequently, if a specific cultural change is to occur, resistance from such losers must in some manner be overcome, e.g., by convincing them that they won't lose, that they'll be compensated for their loss, that their loss will be less than their gain, etc. As a last resort, the losers must be effectively pushed aside. In "revolutionary" cultural changes, sometimes being "pushed aside" has meant imprisonment or death

In the case of expanding science education, there are legions of losers and potential losers, typically with different groups of losers in different societies. In the US, in particular, opposition to expanding science education has come from a variety of sources:

- Opposition from the teacher's union (not normally because of opposition to the general goal of expanding science education, but usually because of methods proposed to accomplish that objective – such as increasing the salaries only of science teachers or increasing the time allotted to teaching science, at the expense of other subjects),

- Opposition from many teachers (either speaking and acting individually or with support of their union) who feel incompetent to teach science – and who therefore feel, if not threats to their continued employment (because they are tenured), then threats to their status as competent teachers,

- Opposition from industries that supply the current schools systems (schools of education in colleges and universities, textbook publishers, school bus producers and

drivers, construction and building companies, catering services…) who have vested financial interests in maintaining the *status quo,*

- Opposition from fundamental religionists (with their resistance applied not only against teaching evolution but also against teaching scientific studies of human sexuality, psychology, and various social phenomena, including morality and religion itself),

- Opposition from those parents who want their children to have a "more balanced education" (which not infrequently means that the parents, understandably, want their kids to follow in their footsteps, thereby "validating" their own choices in life and of life-style), and

- Opposition from those kids who have the sneaking suspicion that science is tough (which isn't true – if it's taught properly!) and, thank you very much, they'd sooner "goof off".

Similar resistance is encountered in most other countries – of course with substantially greater resistance from the ruling clerics of Islamic countries, who are understandably reluctant to relinquish their power over the people.

Now, Dear, I don't want to try to dig into details of such resistances, not only because you can do the digging by yourself but also because (as you'll soon find if you start digging, e.g., on the internet) you can easily get buried in the details. In this and subsequent **X**-chapters, I'll sketch a few suggestions about how at least some such resistances might be overcome (or "short circuited"). In particular, I want to focus on the question: What are some of the problems (and their potential solutions) in attempting to use instruction in science to teach kids how to think critically?

[And once again let me add: I'm promoting science education, not to enhance any nation's economic advantage (and certainly not to increase any nation's military capabilities!), but "solely" for kids to learn what EVALUATE! means – and thereby, for kids to develop more realistic worldviews.]

In what follows, I want to begin to show you what I mean and begin to offer some suggestions about how, perhaps, the trail ahead might be made a little easier and safer – and traveled a little faster. The method that I plan to use is as follows. I'll list some of the many problems encountered in trying to expand and exploit science education; I'll formulate most of the problems as questions and put them in boldface type. Then, for each question / problem,

I'll suggest ways that various people and groups are attempting to find answers and solutions. I don't plan to go into any of these problems and their potential solutions in much detail, for as you'll see, some of the details are astoundingly complicated. I'll start with where I expect you'd expect me to start, namely, with the obvious question:

What's the goal, what's the objective, of science education?

The answer to that question is also obvious, namely: there isn't just a single objective; different groups identify and choose different goals.

For some groups, the goal of science education is, in turn, related to an economic goal. For example (as illustrated in the previous chapter), political leaders throughout the world promote more science education as a means toward their nation's economic growth; the common refrain is some version of: "To be economically competitive in the 21st Century, our nation needs more well-qualified scientists and engineers." Many parents try to impress similar goals on their children, with comments similar to: "To get a good job – a job with a future – study science."

For other groups, the goal of science education is to produce better-informed citizens. Illustrative is the following statement from the report entitled *Lost in Space: Science Education in New York City Public Schools* by the Committee on Education, chaired by Eva. S. Moskowitz:[6]

> Everyone needs a science education to develop the skills and knowledge to make good choices as citizens and consumers. *A staggering two-thirds of Americans* surveyed by the National Science Foundation do not clearly understand *the scientific process*… [Italics added] Some 55% cannot define DNA, the chemical building block of genetic information, more than half mistakenly believe that humans lived at the same time as dinosaurs, and nearly half incorrectly think that antibiotics can kill viruses… Yet all adults must make personal or political decisions on food safety, stem cell research, infectious disease, climate change, and many other issues that require both reasoning skills and knowledge of science.

Meanwhile there are other groups (with which my opinions are more closely aligned) that consider science education to be the way to help kids learn how to base their decision on evidence, to learn how to separate fact from fancy, to abandon participation in what is basically "theater" (promoted by both clerics and most politicians), to develop capabilities to help solve real-world

[6] Available at http://www.nyccouncil.info/media/reports.cfm?VIEWALL=YES.

problems intelligently (e.g., problems dealing with peace and sustainable prosperity), and thereby, to help kids develop realistic worldviews.

And I would be remiss if I didn't mention other groups, namely, those who promote education in science and technology for the development of advanced weapons. This has occurred throughout history: Nazi Germany was a classic example; whether the US has now become similar is debated; similar debates, about whether developments of "advanced" weapons are for defensive or offensive purposes are (or have been) made re. North Korea, Pakistan, Iraq under Hussein, and Iran. Yet, let me show you a current hideous example in which there's no question.

I've copied this example from the "Fatwa Database" (what a terrible use of the word "data"!) at "Islam Online". Please read the entire quotation carefully, Dear, so you'll gain some appreciation of how horrible some clerics can be. Notice especially the last line of this hateful stuff. [7]

> **Jews as Depicted in the Qur'an**
> 3/23/2004 8:00:00 AM GMT
>
> Dear Sheikh As-Salam `Alaykum.
> What, according to the Qur'an, are the main characteristics and qualities of Jews?
>
> Answer:
> *In the Name of Allah, Most Gracious, Most Merciful. All thanks and praise are due to Allah and peace and blessings be upon His Messenger.*
>
> *Dear questioner, we are really pleased to have your question and we pray to Allah to make our humble efforts, exerted solely for His Sake, come up to your expectation.*
>
> *As regards the question you posed, the following is the fatwa issued by Sheikh `Atiyyah Saqr, former Head of Al-Azhar Fatwa Committee, in which he states the following:*[8]

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[7] From http://www.islamonline.com/. All I know about the origin of this junk is "Copyright 1992-2005 Aljazeera Publishing, Dubai, United Arab Emirates" and "Aljazeera Publishing owns and operates IslamOnline.com. Aljazeera Publishing is an independent media organization established in 1992, since when it has been delivering news and analysis to readers all over the world. "

[8] According to "Jihad Watch" at http://www.jihadwatch.org/dhimmiwatch/archives/001447.php, "Al-Azhar University in Cairo is the oldest and most respected institute of higher learning in the Islamic world." According to http://weekly.ahram.org.eg/2003/654/eg6.htm, i.e., the Cairo publication Al-Ahram Weekly: "The institution had traditionally been considered the world's foremost Sunni Muslim body, looked upon for guidance by the entire Muslim world."

The Qur'an has specified a considerable deal of its verses to talking about Jews, their personal qualities and characteristics. The Qur'anic description of Jews is quite impartial; praising them in some occasions where they deserve praise and condemning them in other occasions where they practice blameworthy acts. Yet, the latter occasions outnumbered the former, due to their bad qualities and the heinous acts they used to commit.

The Qur'an praises them in the verse that reads: "And verily We gave the Children of Israel the Scripture and the Command and the Prophethood, and provided them with good things and favored them above (all) peoples." (Al-Jathiyah:16), i.e., the peoples of their time.

Among the bad qualities they were characterized with are the following:

1. *They used to fabricate things and falsely ascribe them to Allah.* Allah Almighty says: "That is because they say: We have no duty to the Gentiles. They speak a lie concerning Allah knowingly." (Al-`Imran:75) Also: "The Jews say: Allah's hand is fettered. Their hands are fettered and they are accursed for saying so. Nay, but both His hands are spread out wide in bounty. He bestoweth as He will." (Al-Ma`idah:64)

In another verse Almighty Allah says: "Verily Allah heard the saying of those who said, (when asked for contributions to the war): "Allah, forsooth, is poor, and we are rich! We shall record their saying with their slaying of the Prophets wrongfully and We shall say: Taste ye the punishment of burning!" (Al-`Imran:181)

2. *They love to listen to lies.* Concerning this Allah says: "and of the Jews: listeners for the sake of falsehood, listeners on behalf of other folk." (Al-Ma'idah: 41)

3. *Disobeying Almighty Allah and never observing His commands.* Allah says: "And because of their breaking their covenant, We have cursed them and made hard their hearts." (Al-Ma'idah: 13)

4. *Disputing and quarreling.* This is clear in the verse that reads: "Their Prophet said unto them: Lo! Allah hath raised up Saul to be a king for you. They said: How can he have kingdom over us when we are more deserving of the kingdom than he is, since he hath not been given wealth enough?" (Al-Baqarah: 247)

5. *Hiding the truth and standing for misleading.* This can be understood from the verse that reads: "…distort the Scripture with their tongues, that ye may think that what they say is from the Scripture, when it is not from the Scripture." (Al-`Imran: 78)

6. *Staging rebellion against the Prophets and rejecting their guidance.* This is clear in the verse: "And when ye said: O Moses! We will not believe in thee till we see Allah plainly." (Al-Baqarah: 55)

7. *Hypocrisy*. In a verse, we read: "And when they fall in with those who believe, they say: We believe; but when they go apart to their devils they declare: Lo! we are with you; verily we did but mock." (Al-Baqarah: 14) In another verse, we read: "Enjoin ye righteousness upon mankind while ye yourselves forget (to practice it)? And ye are readers of the Scripture! Have ye then no sense?" (Al-Baqarah: 44)

8. *Giving preference to their own interests over the rulings of religion and the dictates of truth.* Allah says: "…when there cometh unto you a messenger (from Allah) with that which ye yourselves desire not, ye grow arrogant, and some ye disbelieve and some ye slay?" (Al-Baqarah: 87)

9. *Wishing evil for people and trying to mislead them.* This is clear in the verse that reads: "Many of the People of the Scripture long to make you disbelievers after your belief, through envy on their own account, after the truth hath become manifest unto them." (Al-Baqarah: 109)

10. *They feel pain to see others in happiness and are gleeful when others are afflicted with a calamity.* This is clear in the verse that reads: "If a lucky chance befall you, it is evil unto them, and if disaster strike you, they rejoice thereat." (Al-`Imran:120)

11. *They are known of their arrogance and haughtiness.* They claimed to be the sons and of Allah and His beloved ones. Allah tells us about this in the verse that reads: "The Jews and Christians say: We are sons of Allah and His loved ones." (Al-Ma'idah: 18)

12. *Utilitarianism and opportunism are among their innate traits.* This is clear in the verse that reads: "And of their taking usury when they were forbidden it, and of their devouring people's wealth by false pretences." (An-Nisa': 161)

13. *Their impoliteness and indecent way of speech is beyond description.* Referring to this, the Qur'anic verse reads: "Some of those who are Jews change words from their context and say: 'We hear and disobey; hear thou as one who heareth not' and 'Listen to us!' distorting with their tongues and slandering religion. If they had said: 'We hear and we obey; hear thou, and look at us' it had been better for them, and more upright. But Allah hath cursed them for their disbelief, so they believe not, save a few." (An-Nisa':46)

14. *It is easy for them to slay people and kill innocents.* Nothing in the world is dear to their hearts than shedding blood and murdering human beings. They never give up this trait even with the Messengers and the Prophets. Allah says: "…and slew the prophets wrongfully." (Al-Baqarah: 61)

15. *They are merciless and heartless.* In this meaning, the Qur'anic verse explains: "Then, even after that, your hearts were hardened and became as rocks, or worse than rocks, for hardness." (Al-Baqarah: 74)

16. *They never keep their promises or fulfill their words.* Almighty Allah says: "Is it ever so that when ye make a covenant a party of you set it aside? The truth is, most of them believe not." (Al-Baqarah: 100)

17. *They rush hurriedly to sins and compete in transgression.* Allah says: "They restrained not one another from the wickedness they did. Verily evil was that they used to do!" (Al-MA'idah:79)

18. *Cowardice and their love for this worldly life are their undisputable traits.* To this, the Qur'an refers when saying: "Ye are more awful as a fear in their bosoms than Allah. That is because they are a folk who understand not. They will not fight against you in a body save in fortified villages or from behind walls. Their adversity among themselves is very great. Ye think of them as a whole whereas their hearts are divers." (Al-Hashr:13-14) Allah Almighty also says: "And thou wilt find them greediest of mankind for life and (greedier) than the idolaters." (Al-Baqarah:96)

19. *Miserliness runs deep in their hearts.* Describing this, the Qur'an states: "Or have they even a share in the Sovereignty? Then in that case, they would not give mankind even the speck on a date stone." (An-Nisa':53)

20. *Distorting Divine Revelation and Allah's Sacred Books.* Allah says in this regard: "Therefore woe be unto those who write the Scripture with their hands anthem say, 'This is from Allah,' that they may purchase a small gain therewith. Woe unto them for that their hands have written, and woe unto them for that they earn thereby." (Al-Baqara: 79)

After this clear explanation, we would like to note that these are but some of the most famous traits of the Jews as described in the Qur'an. They have revolted against the Divine ordinances, distorted what has been revealed to them and invented new teachings which, they claimed, were much more better than what has been recorded in the Torah. It was for these traits that they found no warm reception in all countries where they tried to reside. Rather, they would either be driven out or live in isolation. It was Almighty Allah who placed on them His Wrath and made them den of humiliation due to their transgression. Almighty Allah told us that He'd send to them people who'd pour on them rain of severe punishment that would last till the Day of Resurrection. All this gives us glad tidings of the coming victory of Muslims over them, once Muslims stick to strong faith and belief in Allah and adopt the modern means of technology.

What incredibly horrible, stupid crap! And notice, Dear, what this damnable, ignorant cleric would have Muslims do: study science and technology, "to adopt the modern means of technology", with "glad tiding of the coming victory of Muslims over them [the Jews]."

All of which, once again, illustrates both Socrates' assessment, "There is only one good, knowledge, and one evil, ignorance", and Goethe's wisdom, "Nothing is so evil as ignorance in action."

The above also illustrates, once again, that the Quran is a horrible manual of racism. What specific Jewish person is it allegedly "describing": Rabbi Hillel (who lived when Jesus allegedly lived and who said "That which is hateful to you, do not do to your neighbor. That is the whole Torah; the rest is commentary…"), Jesus, Spinoza, Freud, Maslow, Einstein, Feynman…? Are only Jews to be classified as a group? If a single Muslim is as bad (as all Jews are slandered to be), then are all Muslims to be labeled as evil? If a single Muslim is dishonest or a thief or a rapist or a child molester or murder or… then are all Muslims similarly indicted? And if the response is that there are some characteristics typical for all members of any group, then while agreeing, let me put my response this way: I'd a million times sooner live among Jews than Muslims, because the majority of Jews seem to realize that they only have this one life to live and therefore seek to live their precious lives in the most intelligent manner possible, whereas the majority of Muslims have been brainwashed into believing that the best is yet to come, after they're dead.

What a pity that the damnable cleric (who wrote the above *fatwa*) didn't demonstrate, instead, that he had some intelligence! Someone with at least a hint of some intelligence would have answered the original question with something similar to:

> Dear Questioner: What does it matter what is written in the Qur'an about the Jews? The Qur'an was written more than a thousand years ago and reveals a barbaric past, when people thought that some giant Jabberwock in the sky ruled a flat world, a heaven above, and a hell below. Anyone with a similar worldview, now, belongs in an institution for the mentally unbalanced. The Jews are one of thousands of ethnic groups, and in all such groups, there's a huge range of personalities, with all pursuing their trio of survival goals (of themselves, their families, and their values). The only difference between you and a Jew is that your ethnic group almost certainly hasn't been subjected to as much stupidity as the Jews, such as the ignorance revealed by your question. To try to wizen up, read the books written by Spinoza, Freud, Einstein, Maslow, and Feynman (all Jews), and then, see if you can build friendship with some Jewish people. Also, why don't you do what you can to see that all copies of the Qur'an (and all holy books) are at least labeled with the warning: *Beware of this book's contents; it was written by primitive people and is promoted only by fools and power mongers*.

And although some Muslim political leaders (e.g., the current president of Iran) exhort similar racist hatred for the Jewish people, others put a different spin on their goals for advanced weapons. For an illustration, consider the following news report (also from Islam Online).[9]

> **Muslims urged to build "Weapons for Mass Protection"**
> 6/1/2006 6:30:00 PM GMT
>
> **Former Malaysian Prime Minister Mahathir Muhammad urged the Muslim world to build its own weaponry for "mass protection" to defend itself against oppression, The Star Online reported.**
>
> Muslims should manufacture their own fighter aircraft, rockets, cannons and pistols, Dr Mahathir, a respected figure in the Islamic world, said in a speech to a student community in northern Malaysia.
>
> The Islamic world shouldn't depend on weapons created by others, as the enemy could easily penetrate their defense system if it knew the weaknesses in the "imported" systems, he noted. [Thus, Dear, notice that those in the West who sell Islamic nations weapons are thereby labeled as "the enemy".]
>
> "To enhance our own defense capabilities, we must build our own brand of sophisticated weapons," Dr Mahathir said.
>
> "Not that we (Muslims) want to attack others, but we need to protect our ummah [community]," he stressed.
>
> The former Prime Minister also said Muslims worldwide were suffering from oppression because they were unable to defend themselves.
>
> "Muslims are weak because we have not made the necessary preparation to defend and protect ourselves and the masses. We could not do it because we have not mastered the knowledge of science," he said.

Meanwhile, the rest of us can only hope that if Muslim kids will "master… the knowledge of science", then they'll be able to reject all the supernatural jabberwocky in which they've been indoctrinated.

In any event, if a goal of science could be agreed upon, then an obvious question that would follow is:

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[9] From http://www.islamonline.com/cgi-bin/news_service/world_full_story.asp?service_id=2245.

When should science education begin?

My immediate reaction to such a question, however, is that it's one of the most misconceived questions ever asked. I have difficulty constraining myself when I hear people discuss pros and cons of starting "science education" at various grade levels ("after learning how to read", "after (or while) learning arithmetic", "not before middle school", etc.). As far as I'm concerned, the correct answer to the question "When should science education begin?" is: "When it does: in the crib!"

Seriously, Dear, whereas the essence of science (viz., the scientific method) is to form opinions based on evidence and subsequently test such derived opinions against further evidence, that's what babies do by themselves! How else did you learn that your mother would come if you cried? How else did you learn if you lifted your arms you'd be picked up? How else did you learn that the monster under your bed would disappear when the lights came on?!

Meanwhile, what's hideous is that the majority of parents, who themselves were brainwashed with god garbage when they were kids, thwart their own kids from continuing to learn *via* the scientific method and from their own experiences – instead indoctrinating them in god garbage: "God is watching you…", "Jesus wants you to…", "Allah knows…" As Ingersoll wrote:

> To succeed the theologian invades the cradle. In the minds of innocents they plant the seeds of superstition. Save children from the pollution of this horror.

And what's so hideous about such "horror" is that, between the ages of about two to five, so many kids' minds are so terribly polluted with superstitious nonsense that their minds will never be purged of the pollution: they'll cling to it with their dying breath – continuing to play their theatrical parts, "convinced" that they're headed for eternal bliss in paradise. And thus the wisdom of Antisthenes mentioned by Schopenhauer:

> "To unlearn the evil" was the answer, according to Diogenes Laertius, Antisthenes gave, when he was asked what branch of knowledge was most necessary; and we can see what he meant.

Unfortunately, many kids are never given help "to unlearn the evil": their parents enroll them in religious schools or choose to "home school" them for religious reasons.

Thus, as I've already shown you a little in earlier chapters and will show you more in later chapters, in most Islamic countries, essentially all schools are "religious schools" – in them, indoctrination in Islam is rampant. Pity the poor Muslim children. Similar idiocy exists even in this country: ~8% of all American kids are enrolled in religious schools and 1 – 2% are home schooled, about half for religious reasons.[10] Again, pity the poor kids: their parents don't recognize their kids to be independent "actors", destined to find and play their own roles in life. Instead, kids are treated as props in their parents' theater, in which life is just an audition for a fictitious eternal life.

Illustrative of such craziness is the following dealing with "Catholic home schooling", copied from the book *Designing Your Own Classical Curriculum* by Laura Berquist.[11]

> This is the heart of designing your own curriculum, classical or otherwise. You need to be explicit about the ends you want to achieve. I would like to tell you about my own goals so that you can see an example of how defining those goals will direct your choice of curriculum, giving you a plan to be implemented over the course of a number of years. Perhaps some of my reflections will also help you in more particular ways, by suggesting materials or methods that will be useful to you in designing the curriculum that fits your particular home schooling situation.
>
> While I was designing my curriculum *I knew that I wanted ultimately* what we all want, *the eternal salvation of my children.* [Italics added] Academically I wanted a truly Catholic intellectual formation. I hoped to instill a lifelong love of learning and to give my children the tools to pursue that learning. [Notice, Dear, that this mother's goal is not for her kid to learn how to think but to learn how to learn! There's a huge difference: essentially anyone can learn how to memorize; a more challenging task is to learn what's worth memorizing!]
>
> More proximately, I wanted my children to be able to go to an academically excellent Catholic college and do well there. *The ultimate end would more likely be achieved this way.* [Italics added] Further, I was concerned that they receive a classical education at college, one that would incorporate the seven liberal arts and the disciplines to which they are ordered, philosophy and theology…

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[10] It's difficult to obtain accurate data on these topics. Two reports on which I relied are 1) http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2006319 (from the National Center for Educational Statistics, for information about private schools) and 2) the 2001 report (available on the internet) by Kurt J. Bauman of the US Census Bureau entitled "Home Schooling in the United States: Trends and Characteristics."

[11] From http://www.love2learn.net/bkbteduc/samples/dyocc.htm; published by Ignatius Press.

> In the light of the ultimate end, I knew that first importance must be given to spiritual formation. This would mean that the Church would have to be at the center of our lives as a family. We would go to daily Mass whenever possible, say the family Rosary and talk about the faith and its practical applications on a daily basis. While this is not an academic goal, it has an academic corollary. *Our curriculum would always, at all levels, teach the doctrine of the faith clearly.* [Italics added] After all, you cannot apply what you do not know… [e.g., how to evaluate!]
>
> To do philosophy well you need to have the beginning of wisdom, which enables you to make good judgments. Experience is essential and can be gained directly, in the obvious manner of doing many (appropriate) things. This would include natural history. *Science has always seemed to me something to be learned in detail later on;* [italics added] in the early years we emphasize natural history. This is a good area for field trips; both the zoo and natural history museums are a pleasant change from school books…
>
> Through an examination of the ultimate end I desired for my children's education, and the more particular end of going to college, a curriculum began to take shape. It would include Latin and English grammar, mathematics, literature, history, music, some philosophy, the *Baltimore Catechism*, and Sacred Scripture…
>
> We would have discussions, and I would endeavor to infuse those discussions with the sense of wonder and reverence for truth [if only she knew what "truth" means!] that could shape the attitudes of my children toward learning in general…

In fact, pity not only the kids, but pity such poor women as well: brainwashed as children into "believing" in "the truth" of "Sacred Scripture", convinced that the "ultimate" goal is "eternal salvation", and concluding that "science has always seemed… something to be learned… later on", they proceed to similarly indoctrinate their own children – and the god meme, "the mental equivalent of a computer virus", proceeds to infect still another generation.

And how astoundingly selfish such people are! Their goal isn't to help their neighbors, help their nations (e.g., in any economic or even military competition), or help humanity. Instead, their "ultimate goal" is solely for their own benefit, to gain "eternal salvation" – a fictitious (and, actually, a meaningless) pursuit. They could equally well seek eternal "dkbsyuib", which is obtained by shifting one's left hand on the keyboard one letter to the right, by shifting one's right hand one letter to the left, and by closing your mind to any demand that words still have some meaning!

Meanwhile, for other kids (e.g., the ~90% of US students in public schools) a pertinent question is:

How (and how soon) can teachers help kids begin to "unlearn the evil"?

In my opinion, it's imperative that, "starting on day-one", teachers begin attempting to get kids to re-learn the scientific method, i.e., to derive opinions from evidence and to test those derived opinions against additional evidence, obtained from designed experiments.

And if, Dear, you think it's naïve of me to suggest that, "starting on day-one", kids could be taught how to use scientific thinking (e.g., to solve their problems), then please reconsider what the scientific method means. Basically it means using "common sense" – plus taking appropriate account of data that initially doesn't seem to make sense. A succinct summary of the scientific method (and associated thinking skills) is simply: "Evaluate!"

In more detail, such thinking skills entail (at least):

- Focusing on objectives,
- Asking questions ("There's no such thing as a stupid question!"),
- Demanding to see the data ("Show me the data!"),
- Being logical – but then testing your reasoning against reliable data (remembering that deduction can't lead to new information and that inductions are useless until confirmed experimentally),
- Being aware that the scientific method is simply a method (as Feynman said) to try to ensure that you're not fooling yourself (by guessing, testing, and re-assessing),
- Estimating probabilities,
- Looking at limits, and
- Realizing that "truth" is an asymptote that can never be reached, that uncertainties are ubiquitous, and therefore, if in doubt, doubt!

Let me put it differently: if kids aren't encouraged to use the scientific method to solve their problems, then (pray tell) what other method is proposed? Praying?! As Einstein said:

The whole of science is nothing more than a refinement of everyday thinking.

What I think what he meant to say, however, is that the whole of science is nothing more than a refinement of what *should be* everyday thinking!

To illustrate how the scientific method ("everyday thinking") can be used to solve kid's problems, let me list some hypothetical examples. A huge number of examples could be given; I'll mention a few, concocted essentially at random.

- A kindergarten kid is frightened by a big dog that always barks at her as she passes its yard while she's walking to school. She wants it to stop. What data are available? Has it ever bitten her? Has it ever been able to get to her? Has she ever seen its owner? Has she tried giving it some food? Has she talked to her parents, or the owner, or a policeman about it? If so, what responses? And so on, through all relevant questions and data. And when all data are considered, then what hypothesis is proposed? That the dog would become friendly if she threw it some food? If so, did that hypothesis pass its experimental test? And so on.

- A first-grade boy is picked on by the class bully. The goal is to terminate the bully's behavior. What data are available? What hypothesis summarizes the data: that there's no way to placate the bully? Really? Does anyone know what his problem is (or his problems are)? Has anyone talked to him? What solution is proposed? What if a group of kids confronted him about his behavior? Will a group of kids help? What's his reaction when a group of kids ask him what his problem is? How about reporting the bully's behavior? To whom: the picked-on-kid's parents? The bully's parents? The teacher? The principal? The police? Who should do the reporting: the picked-on kid, other kids, the teacher? Would it be useful to get a record of the bully's behavior? Should a log be kept, signed by other kids as witnesses? How about getting some other kid to get a record of the bully's behavior on a camcorder or a cell-phone? And so on.

- A second-grade girl hates all the cockroaches investing her mother's apartment. Her goal is obvious. What has she tried? What's been her experience? What information is available about ridding houses of cockroaches? What methods are within her resources? What's the probability that various approaches would work? What has been tried? What was the result? What new method is proposed? How will it be tested? And so on.

- A third-grade boy is sad because he's almost always picked last when the class breaks up into teams. His goal is to be picked sooner. What case of team-choosing bothers him most? Soccer teams? Spelling teams? What could he do about it? Bribe the team captains – or do they keep changing, or is he unable to, or does he realize that bribing would be unfair to the other kids? What about becoming more skillful, so he'd be chosen sooner? How could he do that? What's the possibility of his realizing

that he's learning an extremely valuable lesson (which kids who are picked early aren't learning): that other people's opinions about him aren't nearly so important as his own opinion about himself. And so on.

- A fourth-grade girl is embarrassed by her clothes. Her objective is clear. If her parents can't afford better clothes, could she get a job to earn money to buy clothes? Could she take up sewing and knitting? Could she learn to see that her clothes are no reflection on her worth? Would it help her to learn about successes of other people who were poor when they were children? Can she see that she's lucky to be poor, because it gives her an added incentive to succeed, an incentive that the rich kids are forced to do without – making them "poor little rich kids". What does she think of another statement by Socrates' student Antisthenes (c.445 – c.365 BCE), as reported by Diogenes Laertius: "May the sons of your enemies live in luxury"?

And so on – on and on – for a huge number of problems that kids must face and want to solve, problems from failed friendships to abusive parents, from hunger to obesity, from drugs to unwanted pregnancies, from forced involvement in dumb rituals to gang membership, to doing poorly in school to thoughts of quitting school, from thoughts of suicide to thoughts of revenge…

There is, however, an obvious practical problem in showing kids how to use the scientific method to solve their problems, namely, specific kids can have specific, serious problems that shouldn't be addressed in class. Instead, such problems should be addressed, one-on-one, with, e.g., a school counselor, appropriately trained in psychology – and the scientific method!

Nonetheless, objective, "non-threatening" examples of problems (relevant to every age group, from toddlers through teenagers to retirees!) can be conceived (without stepping on any individual kid's toes), and obviously there are general decision-making/ problem-solving/ good-judgment/ evaluative-thinking skills based on the scientific method that can be learned by essentially anyone and can be applied to all such problems. Then, when people become totally comfortable with using the scientific method to solve their own problems, they'll be much more comfortable and capable with applying their competence to tackle other problems, such as those dealing with peace and prosperity, extrapolating from their own experiences.

Now, Dear, I'm sorry if the above examples seemed "Just too trivial!", but even if so, please consider the astounding ignorance – the evil – of alternative procedures in which so many poor little kids are indoctrinated, beginning when they're toddlers:

- Think of the poor little Hindu kids who are taught to accept their state, placated with the data-less idea that a score is being kept of their sufferings and successes ("karma") and that rectification will occur in reincarnation – without their being told the historical fact that this idea was just a method used by a bunch of con-artist clerics to gain and maintain control over the people.

- Think of the poor little Jewish kids who are taught that the burdens they bear are God's way of testing them, the chosen people: "When you are in distress and all these things come upon you, you will in days to come turn back to the Lord your God and obey him." (*Deuteronomy 4*, 30) – without being told the historical fact that this idea was just a method used by a bunch of con-artist clerics to gain and maintain control over the people.

- Think of the poor little Christian kids who are taught to "turn the other cheek" and to "exult in our present sufferings, because we know [cough, cough] that suffering trains us to endure, and endurance brings proof [cough, cough] that we have stood the test…" (*Romans 5*, 3) – without being told the historical fact that this idea was just a method used by a bunch of con-artist clerics to gain and maintain control over the people.

- Think of the poor little Muslim kids who are burdened with a terrible load of fatalism, that they are to surrender or submit (which is the meaning of the word 'Islam') to Allah, that whatever happens is Allah's will ('Inshallah' = "if God wills it"), that "Allah verily sendeth whom He will astray, and guideth whom he will" (*Koran 35,* 8) – without being told the historical fact that this idea was just a method used by a bunch of con-artist clerics to gain and maintain control over the people.

- And while your at it, think of the other poor little Mormon kids who are taught to endure, "If the very jaws of hell shall gape open the mouth wide after thee, know thou, my son, that all these things shall give thee experience, and shall be for thy good" (Joseph Smith) – without being told the historical fact that this idea was just a method used by a bunch of con-artist clerics to gain and maintain control over the people.

Of course it's my position that no person who's sane could suggest that such methods are preferable to teaching kids how to solve their problems using the scientific method, but the reality is not only that such methods are promoted but also, if you try to teach kids an alternative based on the scientific method, then the political pressures (from these same con artists and their political dupes) can land the teachers in predicaments similar to the one encountered by Socrates. In Islamic countries, a *fatwa* would probably be issued for the teacher's assassination!

But assuming that the political and clerical leaders are convinced (and have convinced their followers) that more emphasis on science education is needed (for their nation's economic "competitiveness", to develop their nation's weapons, or for whatever reason) and assuming that science educators accept the challenge (as they usually do, since it enhances their own job security), then a central question that arises is:

What is science literacy?

A good answer to that question is the following (long!) quotation, taken from the excellent article entitled "The New Quest for Science Literacy" by F. James Rutherford and A. Graham Down.[12] In turn, these authors extensively quote from another source, identified in the text.

> **Changing Ideas about Literacy**
> Conceptions of literacy, far from being static, change with the times. They respond to emerging political and economic circumstances, shifting cultural values, and novel technological possibilities. Notions of literacy are shaped by history and shape history in return. They change at any given time – in what is understood to be the substance of literacy, who is supposed to be literate, and for what purpose. Needless to say, these are tightly linked.
>
> As the liberal-arts view of literacy evolved, it designated the studies suitable for those freemen in society charged with thinking and governing or advising those who did. Eventually, it became codified in the *trivium* (studies in grammar, logic and rhetoric) and the *quadrivium* (arithmetic, geometry, astronomy and music). By the Middle Ages, church scholars – who especially needed to be literate, given their responsibility for preserving knowledge of the past – relied on the *trivium* and *quadrivium*, plus Latin, Arabic and Greek. But Gutenberg changed that. As the Renaissance matured, the liberal arts came to be seen as those studies which imparted a broad liberal education – and hence literacy – in contrast to a vocational or specialized one. The numbers of people who had reason to read, could read, and had access to reading material expanded.

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[12] Available at http://www.cosmos-club.org/web/journals/1995/rutherfd.html. From this source, the following information is available about the authors:

F. James Rutherford, chief education officer of the American Association for the Advancement of Science [AAAS] and a former assistant secretary of education, is director of the AAAS project described in this article. He has taught science education at Harvard and New York University and science in high school.

A. Graham Down ('77) spent the 20 years before retiring in 1994 as executive director and president of the Council for Basic Education, where he was responsible for development and operations. A native of England, he holds degrees from Oxford and Cambridge in history, education, and music.

In the 19th Century, the industrial revolution and creeping democracy accelerated the trend toward universal education. In 1870, England set the pattern with the Foster Education Act guaranteeing a basic education for all. Women's suffrage and other egalitarian movements of the 20th Century, accompanied by rapid technology-driven social and economic changes, and the effects of two world wars, fostered similar advances in the US and most industrialized countries. But if more widespread literacy is in the wind, no longer to be the sole property of an elite, there is little unanimity on how it is to be defined. Should it be in the liberal arts tradition though it must fit everyone, or in the practical tradition because it must?

Just What Is Literacy?

There is one current answer in The National Adult Literacy Study, a project mandated by Congress, carried out by the Educational Testing Service (ETS) and published in 1995. It defined literacy as "using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential." It used three scales to quantify adult literacy: Prose Literacy, Document Literacy, and Quantitative Literacy. The study's conception of adult literacy was severely utilitarian and emphasized the practical skills of everyday life. Some examples from the study: Prose literacy indicators range from Level 1, "Identify the country in a short article" to Level 5, "Interpret a brief phrase from a lengthy news article." Over the same range of Level 1 to 5, document literacy went from "Locate time of meeting on a form" to "Use a table to compare credit cards; identify the two categories used and write two differences between them," and quantitative literacy requirements ranged from "Total a bank deposit entry" to "Use information in news article to calculate difference in time for completing a race."

Of all the adults tested, 21 percent were found to be in the lowest level of prose literacy and only 3 percent in the highest. The corresponding figures for document literacy were 23 percent and 3 percent. For quantitative literacy, the figures were 22 percent and 4 percent. Scores tend to rise with education level, but by these measures the top 25 percent of high school graduates without further education scored higher than the lowest 25 percent of college graduates.

This conception of adult literacy postulates degrees of literacy that are useful for some purposes – although it is not clear that there ought to be an upper limit. An alternate conception of literacy, one that for other purposes may be more useful, is to characterize literacy in terms of the minimum knowledge and skill an individual would need to be considered literate in any given domain. This is the view we take in discussing science literacy.

While the definition of adult literacy in the ETS report speaks of "knowledge that is needed," the knowledge that counts is clearly "process knowledge" rather than "content knowledge" – *knowledge of how to do something rather than knowledge of something* [Italics added] . The functionalist conception of literacy calls for no particular knowledge of the arts, humanities, or sciences. The liberal-arts tradition, on the other hand, tends to place emphasis on the acquisition of understandings and

insights and certain skills associated with its various domains. Our view reflects both the traditional liberal-arts definition and the functional one, but with far more emphasis than in the ETS study on what knowledge characterizes literacy.

The Essence of Science Literacy

The most ambitious effort to date to spell out what constitutes science literacy was initiated in 1985 and the findings were reported in the volume *Science for All Americans*, published by Oxford University Press in 1989 and revised in 1993. The study was funded entirely by the Carnegie Corporation, the Andrew W. Mellon Foundation, and the scientific society that produced it, the American Association for the Advancement of Science (AAAS). The report claims no authority other than that inherent in a study by five independent national science panels meeting frequently for two years and writing recommendations that were reviewed critically by a large and diverse array of scientists, mathematicians, engineers, historians of science, and educators. *Science for All Americans (SFAA)* is essentially a definition of adult science literacy that makes sense, which may explain why it has received the attention of many countries in Europe, Latin America, the Middle East, and Asia, and of international organizations such as OECD and UNESCO.

> The portrayal of science literacy in *SFAA* is based on these premises: Science literacy includes understanding key concepts, principles, and ways of thinking drawn from the natural and social sciences, mathematics, and technology, not just from the basic school sciences. This is because today's scientific endeavor is shaped by the increasing interdependence of science, mathematics, and technology even though each has its own character and history.
>
> Science literacy includes knowing that science, mathematics, and technology are human enterprises and what that implies about their strengths and weaknesses. In that light, science literacy also implies being familiar with some of the ways in which the science endeavor connects to other human endeavors such as literature, history, the arts (practical as well as aesthetic), work, and governance.
>
> Nonscientists need not be competent at doing science in order to be literate in science. Most adults have no call to design and carry out controlled experiments any more than being literate in music, say, means being able to compose a satisfactory violin concerto. *What is essential is that everyone be familiar enough with how science works to be able to respond critically to claims, often spurious, made in the name of science, mathematics (especially statistics and probability), and technology*. [Italics added]
>
> Science literacy is best expressed as a coherent set of understandings (content knowledge) and skills. This is in contrast to setting out a conceptually disaggregated collection of concepts and terms, as in E.D. Hirsch, Jr.'s popular *Cultural Literacy: What Every American Needs to Know,* or, for that matter, in a dictionary or encyclopedia. The criteria for determining what one needs to know and be able to do to be considered science-literate should be both utilitarian and

> philosophical. *Science literacy should be useful in everyday ways, enhancing one's employment prospects and ability to make personal decisions. It should help citizens participate intelligently in making social and political decisions on matters involving science and technology. But there is more to it than that: Knowledge of science should – like great literature – contribute to the ability and inclination of people to ponder, on occasion, the enduring questions of human meaning – our origin, place in the universe and significance.* [Italics added]
>
> One of the two great adventures of our times (i.e., of the last three centuries or so) is science – the other, surely, being democracy. Almost daily it casts new light on who we are, where we are, how we came to be here, where we are headed, and, in its romance with technology, it has much to do with how we live our daily lives.
>
> Finally, establishing a threshold of knowledge and skill is more helpful than creating a continuum of competence if, as in this case, the reason for defining science literacy is to provide schools with an ambitious but attainable set of learning goals for all children to reach by the time they graduate from high school. Without a well-defined floor, it is too difficult to decide what is essential, since a distribution of results – the inevitable curve – does not make clear what is unacceptably low. Literacy is not about how knowledgeable people can be or how ignorant some are but about what is necessary for living a satisfying and responsible life, and, educationally, what is to be expected of all students.
>
> With these criteria in mind, the basic dimensions of scientific literacy, as set forth in *Science for All Americans*, can be summarized in four general categories: *the scientific endeavor, scientific views of the world, perspectives on science, and scientific habits of mind*. [Italics added]

Extracts from *Science for All Americans* that follow illustrate aspects of scientific literacy. Individuals literate in science are aware of the scientific endeavor and how it relates to their culture and their lives. They would, for example, be aware of the following:

> The scientific endeavor stems from the union of science, mathematics, and technology. Technology provides science and mathematics with tools and techniques that are essential for inquiry and often suggests new lines of investigation. In the past, new technologies were based on accumulated practical knowledge, but today they are more often based on a scientific understanding of the principles that underlie how things behave. Mathematics is itself a science [I'm sorry to interrupt your reading, Dear, but that's not a defensible statement: topics in pure mathematics are "simply" logical constructs; only applied mathematics has a scientific base]; it also provides the chief language of the sciences and a powerful analytical tool widely used in both science and technology.

> *The various sciences differ from one another somewhat in subject matter and technique, yet they share certain values, philosophical views about knowledge and ways of learning about the world. All of the sciences presume that the things and events in the universe occur in consistent patterns that are comprehensible through careful and systematic study. Although they all aim at producing verifiable knowledge, none of them claims to produce knowledge that is absolutely true and beyond change.* [Italics added]
>
> Whether theoretical or applied, mathematics is a creative process rather than one of using memorized rules to calculate answers. Mathematical processes include representing some aspects of things abstractly, manipulating the abstractions logically to find new relationships between them, and seeing whether the new relationships say something useful about the original things. The things studied in this way may be objects, collections, events, processes, ideas, numbers or other mathematical abstractions.
>
> In the broadest sense, technology extends our abilities to change the world: to cut, shape, or put together materials; to move things from one place to another; to reach farther with our hands, voices, senses, and minds. Engineering is a process of designing and building technological systems to achieve such changes. Engineers must take into account physical, economic, political, social, ecological, aesthetic, and ethical considerations and make trade-offs among them. [It's rather unfortunate that the focus here was just on Engineering; similar could be said about other fields of "applied science", such as meteorology and medicine.]

Knowledge of certain concepts and principles of science is valuable for everyone because it makes the world more comprehensible and more interesting. To that end, persons who are science-literate will be familiar with, among others, the following concepts from *SFAA*:

> The structure and evolution of the universe, with emphasis on the similarity of materials and forces found everywhere in it, the power of a few general principles (such as universal gravitation and the conservation of energy) to make sense of it, and ways in which the universe is investigated.
>
> The general features of the planet earth, including its location, motion, origin and resources; the dynamics by which its surface is shaped and reshaped; the effect of living organisms on its surface and atmosphere; and how its landform, oceans and rivers, climate, and resources have influenced where and how people live, and how human history has unfolded.
>
> The basic concepts related to matter, energy, force and motion, with emphasis on their use in models to explain a vast and diverse array of natural phenomena from the birth of stars to the behavior of cells.

The rich diversity of the earth's organisms and the surprising similarity in the structure and functions of their cells, the dependence of species on each other and on the physical environment, and the flow of matter and energy through the cycles of life. Biological evolution is a concept based on extensive geological and molecular evidence, as an explanation for the diversity and similarity of life forms and as a central organizing principle for all of biology. The basic structure and functioning of the human body, seen as a system of cells and organs that serve the fundamental functions of deriving energy from food, protection against injury, internal coordination, and reproduction.

The nature of technologies, including agriculture, with emphasis on both the agricultural revolution in ancient times and the effects on 20th-century agricultural productivity of the use of biological and chemical technologies; the acquisition, processing, and use of materials and energy, with particular attention to both the Industrial Revolution and the current revolution in manufacturing based on the use of computers; and information processing and communications, with emphasis on the impact of computers and electronic communications on contemporary society.

Perspectives on Science

Science literacy also includes seeing the scientific endeavor in the light of cultural and intellectual history and being familiar with some powerful ideas that cut across the landscape of science, mathematics, and technology. Examples include:

An awareness that scientific views of the world result both from a combination of incremental changes consisting of many small discoveries that accumulate over long periods of time and, more rarely, revolutionary changes that quickly and dramatically transform ways of thinking about the world.

Familiarity with some of the episodes in the history of science and technology that are of surpassing significance for our cultural heritage. These include discoveries about the planetary earth, universal gravitation, relativity, geologic time, plate tectonics, the conservation of matter, and the creation of modern chemistry, radioactivity, and nuclear fission, the evolution of species, germs as a source of disease, and the industrial revolution.

Some important conceptual themes – systems, models, constancy and change, and scale – pervade science, mathematics, and technology and appear over and over again, whether we are looking at an ancient civilization, the human body, or a comet. They transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation and in design.

To be scientifically literate is to possess, at least to a degree, some of the values, attitudes and skills characteristic of science. Some examples of these are:

> *Respect for the use of evidence and logical reasoning in making arguments; honesty, curiosity, and openness to new ideas; and skepticism in evaluation of claims and arguments.* [Italics added]
>
> Computational skills, including the ability to make certain mental calculations rapidly and accurately; to perform calculations using paper and pencil and electronic calculators; and to estimate approximate answers when appropriate and to check on the reasonableness of other computations.
>
> Communication skills, including the ability to express basic ideas, instructions, and information clearly both orally and in writing; to organize information in tables and simple graphs and to draw rough diagrams.
>
> Critical-response skills that enable people to judge carefully the assertions – especially those that invoke the mantle of science – made by advertisers, public figures, organizations, and the entertainment and news media, and to subject their own claims to the same kind of scrutiny so as to become less bound by prejudice and rationalization. [It's a pity that the most important "characteristic" of science wasn't listed, namely, forming opinions based on data!]

Target: The Year 2061

The rendition of adult science literacy found in *Science for All Americans* and summarized here is the first step in the AAAS program to reform elementary and secondary education in science, mathematics, and technology. The launching of this reform effort in 1985 happened to coincide with the approach of Halley's Comet. That prompted musings about what the world will be like in 2061, the date of Halley's next return, and the recognition that the quality of life on the planet then will depend greatly on the character and quality of education received by the children entering school that year. Hence, the name of the reform effort: Project 2061.

Following publication of *Science for All Americans*, Project 2061 transformed the vision of the study into recommendations for what students will need to learn in school to become literate in science. This effort involved more than four years of AAAS-directed collaboration between teams of teachers and scientists and resulted in the publication of *Benchmarks for Science Literacy* in 1993 by Oxford University Press. The volume spells out in detail what all students should know and be able to do in science, mathematics and technology by grades 2, 5, 8 and 12. Today, it is used by 32 states and several hundred school districts to define curriculum frameworks in science. It is also being used by the National Academy of Sciences in formulating national science-education standards.

Meanwhile, Project 2061 is currently engaged in producing additional resources for further reform of science teaching in America's schools. All indications point to eventual success, if, that is, future efforts continue to be as vigorous and persistent as those of the last 10 years. The work still to be done, needless to say, is very great indeed.

And here, Dear, is one of the places where I'll abandon digging into details. In contrast, if you plan to pursue your idea of becoming a schoolteacher, then I'd recommend that you do dig into them, but on your own! Yet, in spite of my decision to not dig any deeper, let me at least point to a number of areas where you might profitably dig.

Of course one place is at Project 2061, instigated and maintained by the largest science organization in the US, i.e., the American Association for the Advancement of Science (AAAS); details of the project are at http://www.project2061.org/. I'd especially encourage you to read the article by George E. DeBoer entitled "History of the Science Standards Movement in the United States;[13] it should give you a useful perspective on the long history of science-education reform in the US as well as current efforts. One interesting historical fact in DeBoer's report is that, associated with the science-teaching reforms of the 1890s, reference was made to Herbert Spenser's 1864 assessment: "Children should be led to make their own investigations and draw their own inferences."

Among the other currently active science-education-reform proposals referenced is the impressive one conducted by the US National Academy of Sciences entitled National Science Education Standards (National Committee on Science Education Standards and Assessment).[14] All of which, in turn, raises the question:

What is the current state of science literacy?

To give an indication of the answer to this question, I'll quote a little of what others have written about scientific literacy of Americans – and realize, Dear, that the US is supposedly one of the "advanced" nations! My first example is from an article entitled "Astronomy Education in the United States, in which Andrew Fraknoi wrote the following.[15]

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[13] http://www.project2061.org/publications/2061Connections/2006/media/ImpactofStandards_ch2.htm.

[14] An overview is available at http://www.nap.edu/catalog/4962.html.

[15] Copied from http://www.astrosociety.org/education/resources/useduc.html#toc, which in turn is "an updated, expanded version of an invited talk given at the 189th Meeting of the American Astronomical Society, held in Toronto, Canada in January 1997."

In 1988, the Public Opinion Laboratory at Northern Illinois University, conducted a survey of a representative sample of 2,041 American adults to get a sense of their scientific literacy. Among the 75 basic science questions was one about the Earth:

1. Does the Earth go around the Sun or the Sun around the Earth?
   21% got it wrong, and 7% said they did not know.

2. The 72% who got it right were then asked what period of time the trip took.
   45% got it right, 17% said 1 day, 2% said one month, 8% said they did not know.

This means 94 million people in our country could not correctly say that the Earth went around the Sun AND that it took a year to do so. And astronomy is not alone in being a field about which Americans know little. The Carnegie Commission on Science, Technology and Government reported in 1991 that 47% of US 17-year olds could not convert 9 parts of ten to a percentage and that (in a multiple choice survey) 63% of adult Americans thought that lasers work by focusing sound waves…

In September 1993, the Dept. of Education issued the report of a survey on adult literacy in the US. In one question, those in the survey were given a calculator, were told the cost a carpet per square yard, and were given the size of a room. The question was, how much should carpet cost to cover the entire room. Even with a calculator, 96% of those interviewed could NOT do it correctly…

That's one part of our problem; here is another. In June 1990, the Gallup organization conducted a national survey of beliefs among adult Americans. *About one in four said they believed in the basic premise of astrology, and 74% read their horoscopes at least occasionally. 47% thought that UFO's are real, and 27% thought that aliens have actually touched down and visited the Earth.* [italics added]

Now you may laugh at the notion of taking this kind of belief seriously. But if a large number of our citizens (and even our leaders) believes that our lives are governed by magic and superstition, will they feel the same urgency we do about the need for more science and technology education to solve the difficult problems of our age? And if you don't believe that such fiction sciences have an influence, I should perhaps just remind you of the revelation during the Reagan administration, that a San Francisco astrologer named Joan Quigley was given control over the president's schedule during much of his time in the White House.

More recent polls have yielded similar results. For example, the following is from "Highlights" of Chapter 7 of the NSF's (National Science Foundation's) publication *Science and Engineering Indicators 2004*:[16]

- Science knowledge in the United States and Europe is not improving. Respondents' ability to answer most questions about science has remained

[16] Copied from http://www.nsf.gov/statistics/seind04/c7/c7h.htm, which provides links to the full report.

essentially unchanged since the 1990s, with one exception: more people now know that antibiotics do not kill viruses. This may be attributable to media coverage of drug-resistant bacteria, an important public health issue.

- More Americans now agree with the theory of evolution. The 2001 NSF survey marked the first time that more than half (53 percent) of Americans answered "true" in response to the statement "human beings, as we know them today, developed from earlier species of animals." [But, Dear, notice that the glass is almost half empty: 47% disagree with that statement!] (In Europe, 69 percent responded "true.") Whether and how the theory of evolution is taught in public schools remains one of the most contentious issues in US science education.

- Most Americans (two-thirds in the 2001 NSF survey) do not clearly understand the scientific process. Knowing how ideas are investigated and analyzed – a sure sign of scientific literacy – is important. Critical thinking skills are invaluable not only in science but also in making wise and well-informed choices as citizens and consumers.

- Studies seem to indicate that not many Americans are "technologically literate." In addition, the public's understanding of technology lags behind its professed interest in the subject.

- Belief in various forms of pseudoscience is common in both the United States and Europe. *For example, 60 percent of surveyed Americans said they believe in extrasensory perception, and 41 percent thought that astrology is at least somewhat scientific. More than half of surveyed Europeans said they believe in astrology.* [italics added] Because society is heavily dependent on Science and Technology, scientists are concerned about the persistence of beliefs that run contrary to scientific evidence.

Similar was reported in a 2005 Reuters News article by Alan Elsner entitled "Is the US becoming hostile to science?"

Polls for many years have shown that a majority of Americans are at odds with key scientific theory. For example, a CBS poll this month found that 51 percent of respondents believed humans were created in their present form by God. A further 30 percent said their creation was guided by God. *Only 15 percent thought humans evolved from less advanced life forms over millions of years.* [Italics added]

Other polls show that only around a third of American adults accept the Big Bang theory of the origin of the universe, even though the concept is virtually uncontested by scientists worldwide.

"When we ask people what they know about science, ***just under 20 percent turn out to be scientifically literate,"*** [italics & boldface type added] said Jon Miller, director of the center for biomedical communication at Northwestern University.

> He said science and especially mathematics were poorly taught in most US schools, leading both to a shortage of good scientists and general scientific ignorance.
>
> US school students perform relatively poorly in international tests of mathematics and science. For example, in 2003 US students placed 24th in an international test that measured the mathematical literacy of 15-year-olds, below many European and Asian countries.
>
> Scientists bemoan the lack of qualified US candidates for postgraduate and doctoral studies at American universities and currently fill around a third of available science and engineering slots with foreign students.
>
> Northwestern's Miller said the insistence of a large proportion of Americans that humans were created by God as whole beings had policy implications for the future.
>
> "The 21st Century will be the century of biology, and we are going to be confronted with hundreds of important public policy issues that require some understanding that all life is interconnected," he said.

In the above, I used italics and boldface type to emphasize the remark: "just under 20 percent [of Americans] turn out to be scientifically literate." I don't know if that's an accurate estimate, but if it's anywhere near correct (and data dealing with belief in astrology, UFOs, gods, etc. suggest that it is), then it's a horrible indictment of our school systems – and then, imagine how much worse it must be in other countries, especially in Islamic nations.

Now, Dear, there are a host of other obvious questions [including such important questions as: 1) Why are so many people so scientifically illiterate? 2) Does it matter (that so many people are scientifically illiterate)? and 3) What can be done about it?], but I'm getting tired of both this chapter's format and this chapter! Therefore, I'm gonna take a break, now, and get some exercise. How about you?