Whose Purpose in Education? Which Science of Value?

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A famous student once flunked an exam and blamed the teacher. The teacher in turn blamed the student for not studying. This dispute transpired nearly four thousand years ago as described in the ancient Babylonian document, "*Examination Text A*," historians' archeological find for the first-known activity of formal education.[i] The student's and teachers unique contribution to pupil learning is culled here from the tradition of analytical and empirical scholarship on education.

The Contested Social Contract of Exchange in Education

Disputing the causes of student learning continues on today. These disputes now encompass even more factors, and more subtle factors, than just teaching and studying. A student's peer group, vocational aspiration, nutrition and health, parental influence, and the neural-biology of the brain, have all been found to be influential.

The newer if contested influence of external standardized testing proposes to specify, encourage, and guide, by publicizing the achievement of a more cultivated mind.[ii] The list of causal factors affecting education success or failure goes on with unequal education funding, faculties' varied curricula emphases, unequal adoption of instructional technology, and different academic calendars.[iii] Socrates long ago pointed to this complexity of education as he and Plato resisted the Sophist claim that knowledge could be simply bought, sold, and transferred as a commodity like bread. The multiplicity of agents ever involved in the education enterprise attest to its intricacies ─ concerned parents, trusting pupils, teachers, textbook authors, testing proctors, study monitors, educator vendors, scholarly researchers, administrators, governing bodies of school trustees, assessment professionals, taxpayers, a creditors associated with civil and ecclesial authorities, courts and education lawyers, and philanthropists.

Two Scholarly Questions

Some enduring vein of a common or universal end and means of education is hypothesized to exist, however small, and amidst all this flux. To possibly locate it, two questions seem helpful to ask and to answer about education, at any level from pre-school to graduate school, and from the Americas to Asia:

1. Among all of the various agents involved directly or indirectly with education, *Who does what for whom and for what intended good?*
2. This first question points to a question both more focused and more profound: *Can the casual opinion that ─ School Alpha is Superior to School Beta ─ ever rise to the higher status of valid knowledge?*

Stated otherwise, does the good in education ─ and the causal path securing that distinctive good ─ have any sure conceptual and factual foundation apart from pluralist, shifting, interminable, and thus relative perceptions and tastes?

The Problem of Rival Traditions of Scientific Narratives

The challenge of identifying and formulating the common conceptual thread for objectively appraising any education, prior to any attempted empirical ranking of institutions, might be helped along by the work of the contemporary Neo-Thomist philosopher, Alasdair MacIntyre. The title of this paper mirrors his1988 book, *Whose Justice? Which Rationality*?[iv] These parallel titles highlight the difficulty of scholars, working from distinct traditions or premises, to comprehend similarly and to knowingly assent to some identical good in education.

Moreover, if a single good in education does emerge from across the various sciences, or from within some premiere science or branch of knowledge; only then might it resolve or clarify those right relations or just relations among education agents.

Findings and Methods

Progress has occurred, however provisional, in formulating a universal standard of the good in the purposeful action of agents in education. The education standard proffered here ─ without claiming originality because it emerges from converging traditions of inquiry on education ─ is believed to be both intelligent and intelligible. It contains practical implications for enhancing education, and can secure assent from both professional educators and student clients. Moreover, three distinct forms of gain reside within this singular education purpose.

The quite remarkable large mass of education research today suffers a theoretical bottleneck, all the while being awash in data saturation, of which I have participated for two decades. The empirical studies on formal education prove insightful and continue to ground and to orient the more conceptual turn of reasoning in this paper. The otherwise expert and constructive statistical research on education presumes to measure teacher excellence and school quality without fully revealing or specifying that variable.

The demonstration here, of the finding of teaching excellence, proceeds mainly through a verbal or textual narrative. To show a degree of robustness, this discovered substance of school quality is further verified through a simple geometric illustration, plus a basic algebraic *ratio*, and finally, with empirical-statistical corroboration.

The Intellectual Trap Awaiting the Ranking Relativist

Whether to study more history than literature in grade school, or more finance than biology in college, seems to flow as much from individual preference and vocational interest as from knowledge of some universal good in education. Whether to learn these subjects on-line or in more traditional venues, in small classes or large, through rote memorization or Socratic dialogue, or through conventional textbooks or primary classic literature, seem also to hinge at least in part on circumstance, taste, and convenience.

Derek Bok, president emeritus of Harvard and now research professor, sensibly disagrees with education scholars who otherwise exult one education purpose over other purposes or values, "Nowhere in their writings do the authors make clear why there should be only one dominant purpose for undergraduate education. The very idea seems instantly suspect, since human beings develop intellectually in a number of different ways during their undergraduate years."[v]

Hence, the good in education seems better classified as 'your taste versus mine' and not 'true versus false.' Exacerbating this problem, empirical analysts do find, for example, superior learning of science in some school. That measured fact for that school is obsolete as soon as it is uttered since students, faculties, and sciences are ever in transition. Its' being true yesterday doesn't mean it remains true today or tomorrow.

It seems impossible to escape some relativity, uncertainty, and contingency in education. Civility, therefore, requires concession to some educator discretion, some degree of family choice and monitoring, and free speech among faculty and students, especially in those societies that enjoy constitutional protections.[vi]

Cruelty in Education

Education strangely departs from the absolute principle of welcoming and protecting any and all speech. Judging and rating speech or substantive communications persist in education. Faculties routinely grade some students' essays or math answers higher than others', and even fail and dismiss some students for prolonged faulty answers. Educators must not only discern the correct answers to academic questions, and then score student answers based on their committed if provisional answers, but determine which questions shall even be asked.

The teaching authorities who make these expert judgments suffer rejections of their own. Journal referees and book editors, for example, routinely reject some college faculties' scholarship, while publishing and celebrating others. So education contains some standard or standards for guiding everyday judgments and seemingly harsh decisions and actions.

But can just one of these opinions of the true good in education, from among numerous and pluralist opinions of the good in education, be singled out and rated true for all?

Two Great Causes

By reason of analogy, single notions of the good have been elevated to the status of truth by negating or discounting rival tastes or opinions. The "cause of the environment," which prompts some to support the Sierra Club, refers to the value of clean air and water together with biodiversity. This "cause of the environment" does not yet refer to the instrumental actions of recycling or the taxing of carbon emissions to promote the final cause of pollution abatement. To reject this good of a clean environment is considered not just faulty taste but ignorant. For environmentalists supply a persuasive reason to support the compelling truth of their value of a cleaner environment. Namely, as contaminants increase to a toxic threshold, life perishes and natural beauty fades. Similarly, the final cause or good embedded in education can be identified and rationally defended as true. Its value can be discovered not just imagined and asserted. To see this, why might school alpha objectively rank higher than school beta? Perhaps Eddie the pupil feels better in school alpha. Hence, alpha is superior since feeling better ranks higher than feeling worse. Or better, school alpha has a lacrosse team, and beta does not. Eddie's seeking to play lacrosse at alpha may not constitute the highest reason to rate school alpha superior, but it is one reason and one true reason because exercise and team camaraderie are goods, which together make alpha better, at least in Eddie's case.

These two aforementioned education standards do not impress, since both can also render urban-living superior to rural-living, or render joining the Lion's Club superior to joining the Yacht Club or the Bunco Club. The standards fail for ranking schools because these standards do not pertain exclusively to formal education. Lacrosse teams being more concentrated in urban areas make urban living superior, and feelings of camaraderie might tilt Eddie's decision to favor one social club over another where friendships are cultivated. Eddie's parents, however, more astutely discern the unique good advanced only by the distinct community of a school. Thus, they more sensibly rank school alpha over beta due to Eddie making larger gains of knowledge more often in more subjects. Even more convincing, if demonstrable ─ all students in alpha learn more in all subjects all the time and for all time. This final and better ranking of schools still falls below and far wide of the proposed true standard. Yet these ranking standards have steadily progressed upward from idiosyncratic feeling and opinion toward knowledge.

Expert Skepticism

Even expert faculties wisely claim to be school-ranking Luddites from their first-hand knowledge of education and their sophisticated appreciation for complexity. There always remains some unresolvable ambiguity inside both the faculties' schools and in their sciences. Therefore, invidiously comparing faculties within and across schools is too easily tainted with caricature, distortion, omission, and possibly ruined reputations. Faculties argue that this complexity can render much of the work done in external education assessment foolhardy, along with overly centralized governing of education by tax authorities far-removed from educator's particular students; plus far-removed from those evolving and detailed developments inside each educator's science.[vii] While conceding these points as valid, the inference does not follow that teaching quality and education value is relative, and thus in the eye of the beholder, and thus unknowable.

Faculties' skepticism of a true ranking criterion can serve more as a strategy to resist meddling interference from less-informed third-parties than as a dogmatic affirmation of education relativism. After telegraphing or emphasizing the subjectivity in school-rankings, even when based on student testing outcomes, faculties still go on to make other claims and to teach as if they possess and share some single, true, and unambiguous standard. For example, none clamor to replicate and to substitute the typical education of that occurring in the 7th century for that of today. And most would probably rank the average Canadian school of the 1930's above Nazi schools of the same era, despite the technical prominence of German science in that era. Educators deliberate and plan to secure education improvement, which admits to school alpha surpassing school beta, with school beta here being the school yesterday, before its strategic adjustments, and school alpha being the improved school of today.

A Primordial School Ranking

The stakes involved in resisting an education standard are much greater than mistakenly adopting some lesser form of education from another time and place. Without a ranking criterion, education as an institution dissolves. For the very emergence and diffusion of formal education in history and across nations, teeters precariously on affirming one particular school greater than another.

Namely, a school consisting of systematized instruction, expertly guided reading and exercises, and conscientious grading surpasses that school where a pupil otherwise reads randomly, wonders aimlessly, and tinkers unsupervised, all without any expert checking and corrective feedback.

In other words, skepticism in objectively ranking schooling forces upon us the latter option of pupils' undirected thinking and exploring as a legitimate and live option. A true-believing relativist in school-ranking might very well abandon or liquidate formal education altogether. For if structure and expertise add nothing to school quality, then it only injures families with high expense. So without a ranking principle to violate, we can turn to whatever casual impressions or beliefs that might arise from otherwise everyday experience of work, family, and informal conversation. Some unspecified criterion apparently makes formal education somehow outperform more casual, experiential learning, either in its manner of learning or in its covering more branches of knowledge. Otherwise, we have been taken in and fooled by one of the most pervasive hoaxes and scams in human history called formal education. If formal education was made by man and for man, then perhaps the principle for its emergence and spread is the same principle as that for its perfection and comparative ranking? To conclude, two things cannot be done simultaneously. Embrace and advocate for formal education and oppose any objective principle for ranking schools. Highlighting this unsuspected inconsistency in adhering to both ideas is not the point, however. Determining what practical, agreeable, accommodating, true, and even flexible standard lurks behind our education proclamations and societies' organized work of education is more constructive.

Three Leading False Standards for Ranking Schools

To move steadily toward knowledge and appreciation of a more substantive and true standard of education, three fashionable yet false indicators of school quality need to be bypassed: maximum learning, the labor theory of value, and student ability.

Maximum Learning

The most predominant false standard of a good school consists in this. Pupils learn more in some given subject. This comparative measure of learning, otherwise referred to as cognitive gain or value-added, is taken during some hourly, weekly, or monthly interval between pre-test and post-test. Or more generally, school alpha surpasses school beta because alpha students annually gain high aggregate knowledge of some constellation of the premiere academic subjects. This criterion follows from the commonplace axiom that more knowledge is preferred to less knowledge. Adherents in other words take a principled stance against ignorance. This standard needs to be resisted for grave reasons. It too often corrupts political conversation on education; as debate tends to sink into a feverish and shrill pitch. Candidates for public office seek to more loudly announce and to impress upon voters their favoring ever more knowledge than their opponents, with their opponents apparently suffering from a low standard or a lukewarm dedication to knowledge. Alasdair Macintyre might classify this as a "shrill" substitution of "*emotivism*" from the lack of shared norms for rational and ethical persuasion in education.[viii]

To both advocate for and to seek evermore learning, however, subverts a flourishing life. For stubbornly pursuing maximum knowledge of all things, among all people, all of the time, ends civilization. Current students never leave education, and retired teachers return and forfeit their travel, rest, and volunteer civic services. Current teachers and professors forego their evenings to retain their pupils for additional education far into the night.
In fact, all active workers leave their jobs and head back to school and to college. It thereby terminates food production and health care provision, making this education standard of evermore learning lethal, whether on the margin or in total. Prosperity vanishes further when nobody staffs factories to assemble computers, tablets, and furnishings for even academic use. Nor would calculus homework or writing practice be suspended, even for a day, to attend your friend's funeral or marriage, or to tend to laundry, lawn-care, parenting, or cooking. Each family would borrow a million dollars to finance annually the world's best tutor available to respond immediately and profoundly to every utterance of every pupil, bankrupting each family. This standard cues citizens to move toward becoming sociopaths.

During America's founding in the 18th century, James Madison astutely saw these social constraints prohibiting the attainment of maximum collective knowledge of all things. Soberly, he wrote in *The Federalist Papers* that, "A nation of philosophers is as little to be expected as the philosophical race of kings wished for by Plato."[ix]

The aggressive standard of 'more knowledge is always and everywhere better than less knowledge' pervades education theory and scholarship.

The long empirical tradition of multiple regression research studies nearly always specifies this unbounded learning as the dependent variable or as the object of supreme urgency and of ruthless pursuit, with little consideration of its full implication.

When taken seriously in its literal form, however, this standard of unbounded maximum learning is not workable.

The Labor Theory of Value

The second yet false standard of the good in education leaves behind the difficult and elusive task of specifying and measuring cognitive outcomes. This second theory focuses instead on the quantity of resources or education ingredients flowing into schools. Modern buildings, with the best laboratories and smartest classrooms astonish and thereby secure trust. These more tangible inputs serve as a proxy measure for the more invisible, missing, or contested measure of cognitive excellence. Added resources roughly correlate with school quality, it is thought, by raising the potential for excellence by removing any excuse of insufficient resources. Two species of this mistaken doctrine exist. First, school alpha ranks higher than school beta insofar as more teaching occurs in alpha. To secure more teaching, each faculty dedicates more labor-time to execute a larger course-load or else more money finances additional teachers. Others call faculties away from trivial and obscure research to secure more teaching labor.[x] No matter which of these, they all secure more aggregate teacher labor hours to deliver more instruction.

Yet, evermore numerous teaching hours either exhausts teachers into mindlessness or more extravagantly spends family and taxpayer money, both without advancing any cognitive learning among students. For limited student attention or student study time inevitably causes a bottleneck. This bottleneck wastes the effort of more teaching because it results in little or no gain in pupil learning. Added lecturing, or writing more on-line responses to students, is in vain when there is no corresponding added listening or reading. Even with otherwise more studious and more attentive students ─ whether voluntary or forced by strict study monitors ─ ever more teaching still proves insufficient for securing more student learning. For lots of teaching doesn't somehow makeup for amateurish teaching. Amateur teaching consists of false, obsolete, misleading, partial, redundant, or unintelligible lessons. Ever longer hours of otherwise amateur teaching make more education futile and even harmful. Thus, calling college faculties to teach more at the expense of scholarship assumes that faculties are poised for fabulous teaching after long graduate-school immersion into research faculties' otherwise trivial, faulty, or obscure research. To ignore the activity of otherwise good scholarship in graduate school and its forming of teachers, moreover, adopts a narrow or limited theory of education. No matter that conundrum, neither faculties, nor students, nor administrators, nor parents rate *good* teaching as simply *lots* of teaching.

The second version of the labor theory of value perceives student labor, not teacher labor, as the key yardstick for education quality. This student-labor version of school excellence supposes a school to be better insofar as it enrolls or creates more attentive, studious, long-suffering, undistracted, engaged, curious, persevering, and in a word ─ teachable pupils. The prominent and annual *National Survey of Student Engagement* links "student engagement" to "collegiate quality" by considering both "the amount of time and effort students put into their studies" and how each institution "deploys its resources and organizes the curriculum … to get students to participate."[xi] Yet no valid theory of education or survey of education quality can confuse the institution of a school with that of the student-client seeking its service. A teacher and student take on different offices of responsibility or duty. Upon enjoying or inspiring students' attention, whether for half-days, full-days, or over-time days, still begs the question of education mission of what to best fill that attentive effort with. A good and persevering student, therefore, does not make for a good school or good teacher. So this supposed criterion of school excellence as student excellence equivocates and evades the object sought.

Student Ability

The final and fashionable fallacy rates a school superior insofar as it recruits and matriculates more intelligent or brighter pupils. Adherents to this standard presume that these more talented or gifted students will gain more knowledge, of any subject, from any amount of class time and study time, and from any teacher expertise, because they "comprehend complex ideas, learn quickly, "and are less taken by faulty teaching.[xii] The lesser-able are now advised to dis-engage academically, because even their maximum engagement secures so little learning.[xiii] Superior students also mentor each other better as academic role models outside of class and are better prepared for advanced work.

Scholars find that their superior abilities stem from some combination of their natural-genetic gifts or more native physiological intelligence, better health, or from longer and superior preparatory-school experiences.[xiv]

Locating and *enrolling* more intelligent pupils, however, is not the same as *making* more intelligent pupils through superior schooling. Finding intelligent students is more the work of professional organizations that test, screen, certify, and recruit personnel, and that sort of work does occur in a school's enrollment division.[xv] The activity of advancing student knowledge and monitoring students' advancing knowledge, no matter whether the enrolled students advance rapidly or slowly due to some unchangeable aptitude or intelligence, is more the task of school faculties, with faculties usually exceeding the number of enrollment and testing specialists.

A second defect of this student-ability theory of school excellence is that student ability is hypothesized to originate from outside schooling; that is, in families' genetic code, health, and cultural traits. Yet superior parenting, whether conjugal through superior "assortive mating" or nurturing, does not make for a good school.[xvi] It makes for a good family. To equate superior schooling to superior parenting commits another error of equivocation, again deflecting the inquiry away from the question of school excellence.

Finally, placing the most able "Einstein" into the most elementary arithmetic class results in his learning zero mathematics in that class. He learns nearly zero because instruction is redundant to his superior knowledge. For his school's talented and agile faculty calibrate their instruction for Einstein's classmates who are just beginning to develop their arithmetic skills. In repeated large surveys of American higher education, for example, baccalaureate students of *lower* pre-test scores *gained more* knowledge of American history, government, and economics, and foreign relations compared to their higher-ability peers enrolled in Ivy League institutions, even among students completing an otherwise equal number of these civic courses with equal weekly study hours, and controlling for "test ceiling" effects.[xvii]

Notice "Einstein's" speed of learning approaches zero in the above situation of being in an elementary arithmetic class, rendering him a slow-learner compared to his classmates. A person who knows more-or-less all of the material prior to instruction only *seems* to be catching on faster, for he caught on and excelled long previously. A faculty member, or online instructional software, might instead raise his true learning rate in a private tutorial with advanced instruction. So speed of learning depends partly on the juxtaposition of students' present knowledge to that level of knowledge presumed and executed in the school's curriculum, with this matching feature an attribute of school excellence more than some unchangeable student aptitude.[xviii]

Educators' Distinctive Action and Goal

The proposed and singular standard of the good in education emerges when examining educators' peculiar work, juxtaposed to other forms of work. Educators' action generates clues for the education good sought and obtained.

Chart One below conveys various occupations' actions, and the corresponding ends or results achieved. The unknown variables X and Z denote educators' unknown action and unknown result. To reason by analogy, the general pattern established by the alternative occupations helps to identify the missing words for the educator's line of work.

Chart One: Actions and Results for Selected Occupations

Occupation		Action		Result
Builder	→→	hammers, saws, paints	→ →	shelter
Launderer	→ →	washes, dries, presses	→ →	clean, crisp garments
Magistrate	→ →	adjudicates conflict	→ →	justice
Miner	→ →	explores, drills, hauls	→ →	illuminates, propels, heats
Educator	→ →	**X?**	→ →	**Z?**
Statesman	→ →	taxes, regulates, enters treaties	→ →	secures life and property
Insurer	→ →	collects premiums, pays claims	→ →	financially stabilizes
Innkeeper	→ →	assigns and cleans boarding rooms	→ →	temporary, safe, restful lodging
Chef	→ →	seasons, stirs, bakes	→ →	taste, nutrition
Musician	→ →	plays instrument	→ →	rhythmic sound
Proctor	→ →	monitors, exhorts, punishes	→ →	silence, concentration, valid testing
Physician	→ →	diagnosis, injects, prescribes	→ →	healthful patients

Educators Instruct

The word *instructs* seems to most fully and comprehensively describe the distinctive action of educators. Educators *instruct* or teach, no matter whether an educator is more exactly a tutor, teacher, professor, or scholar. The scholar tends to teach or to instruct professional colleagues, or advanced graduate students, on the findings and methods of his or her research. One educational philosopher and emeritus college president defines instruction as, "inquiry" through "compellingly leading questions [and] artfully superintended conversations."[xix]
To confirm *instruction* as the action of educators, several difficulties from this analogical exercise need to be resolved. First, for a statistician to count up all the high schools or colleges in some nation, they cannot simply count up organizations that instruct. For the senior builder in the first line of Chart One instructs his apprentices on the skills of hammering and painting with an eye toward a sturdier and more beautiful shelter. The magistrate takes a moment to teach litigants that aspect of the law pertaining to a just decision in their present case. So the statistician counting up education organizations may need to look further out toward the final cause or the intended result of instruction to distinguish the underlying substance of educational organizations from that of building contractors and magistrates. Thomas Aquinas long ago anticipated this subtle philosophical work of simple addition when he wrote that, "Intelligible matter is substance as subject to quantity. …Hence quantities, such as number…cannot be considered without understanding the substance which is subject to the quantity."[xx]
In other words, the total sum of schools is biased far upward if it includes grocery stores. For schools are not grocery stores. Yet grocers instruct when the delicatessen manager teaches customers on better preparing some purchased item of meat or fish.

Compared to grocers' instruction, however, educators elaborate more extensively on the underlying reasons and facts, and usually explore a wider-range of topics beyond the supply chain of food production. Moreover, educators' instruction seeks to perfect, refine, and enlarge the pupils' knowledge and reasoning skill for its own sake. Whereas other occupations' primary task does not terminate with learning, but rather with completing tasks here and now like getting the food produced, the shelter built, and the trains to run on time. Instruction and learning among non-educators therefore is more secondary, incidental, briefer, and a byproduct of their more primary tasks. Meanwhile, just as builders do more than just hammer, school personnel do more than just instruct, providing another obstacle in this analogical exercise. In fact, virtually every non-education activity in Chart One occurs at schools and colleges. Laundry, concerts, inn-keeping, student-life judicial proceedings, flu vaccinations, cooking, and construction can all be seen on the terrain of college and grade-school campuses. Educators might boast therefore that education is all of life, for it encompasses all of life's activities. Yet the classifications and words above convey no meaning if every occupation discharges every action equally along with every intended result or outcome. Furthermore, the education organizations comprising the formal education sector do not make for a complete economy. To see this, educators themselves seldom execute the specialized functions f campus construction, cooking, or police protection, leaving these duties more often to non-instructional staff or to outside vendors and contractors.

Finally, to strictly demarcate narrowly permissible actions for each occupation and its proper result might chill or constrain professional creativity. Yet, the person in each occupation surely is free to change occupations or to work in two occupations if so inclined. Plus, for many occupations, including that of educator, the intended outcome can be more fully attained or advanced through more decentralization and responsible freedom, individual professional discretion, and thus important fine-tuning based on local details.[xxi]

A Finessed Cognitive Development

Now what result do educators seek from their instruction? Instructors of consequence seek out the improvement of students. While work generally perfects the worker himself, no professional occupation is indifferent to the result or effect that their enterprise and professional action leaves on others, especially their served clientele. The educator seeks his own intellectual development partly to assist others through his teaching service. Similarly, the builder, launderer, and automaker seek to ever improve their products and services by cultivating their skilled workmanship, all the while remaining sensitive to recipient needs. Good-willed educators seek to leave a maximum and constructive impact on their students through their activity of instruction. To accomplish this, all educators quickly disregard any instructor who might advocate for the provision of *any* instruction or *random* instruction.

Educators alternatively aspire to provide *right* instruction or *smart* instruction, with smart instruction also understood, at least partly, as *effective* instruction. But this still begs the question. Smart instruction proves effective at raising up what attributes in students and for students? Educators instruct with an eye toward *maximum student learning of the most important knowledge and skills using committed resources of instructional money and student study time*. This intended result or purpose of educators' action provides an answer to the result Z in Chart One.

What makes this specified result of educators so critical and so radical?

This discovered result remains intellectual because it seeks maximum student learning. However, more learning cannot be pursued by increasing education inputs. For learning cannot become unbounded and thereby seek ever more money expenditures, evermore teacher hours, and ever more student study.[xxii] In other words, "The good schoolmaster is known by the number of valuable subjects he declines to teach."[xxiii] Education excellence requires that ever more cognitive learning be secured more delicately, with more finesse, and with a smaller footprint of burdens left behind. School excellence, for it to be practicable and to command assent, should bankrupt neither the teachers supplying the instructional service nor families purchasing their educative services by claiming one or the other's total time and money.

Notice however that this goal also seeks no subtraction of any instructional money or student study time, due to the confirmed need of those resources to advance the true good of teaching, learning, and knowledge. More education expenditures, whether in the form of instructional money, teacher work hours, or student study time, may nearly always prove optimal and praiseworthy. But all these added inputs purchase *more* schooling; they do not *improve* schooling. This latter issue of school quality and its improvement constitutes the object being pursued in this inquiry, which too easily slips away at every turn. And by comparison, school quality often explains the variance in human learning more than quantity of schooling.

Socializing Educators into the Education Sector and the Commonwealth

Teachers do in fact aim to instruct for maximum student learning from given resources. Professional discussion and mutual encouragement among teachers and professors, especially in the wake of initial teaching experience, re-directs and refines actions back toward this specified, if still fuzzy, goal. It is less a new standard to which teachers are invited to strive; but more the standard to which the more accomplished teachers and schools have always strived. Helpful language and grammar supply terms for errors or departures from successful education. For example, when a teacher carelessly adopts any instruction or random instruction, then that teacher suffers the rebuke of being confused and confusing. To teach ever longer by dwelling upon trivial details is tedious and pedantic. Simpletons, meanwhile, teach tersely and superficially without development or penetration. To devote one's whole teaching day to securing ever more financial compensation for teaching ─ which generates higher expense for buyers ─ makes one more an acquisitive wealth-seeker than educator. Conversely, students' petitioning continuously for ever lower tuition, or more financial aid, makes them more lobbyist than student, all the while revealing their miserly commitment to financial savings more than to study and to education.

Meanwhile, the fast talking lecturer might get the stigma of being a hustler, while the ever slower lecturer telegraphs contempt for students. The first-talking educator on some new idea or contemporary event can be dismissed as hasty. The never-talking educator, or never-writing scholar, can be dismissed as too risk-averse or too contemplative. A chemistry professor's substituting mostly political history into his chemistry course makes him a trespasser into the terrain of political science and history; plus a deceiver of those students having signed up for chemistry instruction.[xxiv] To completely ignore all other academic subjects in teaching chemistry is to become an academic xenophobe, "man-of-one-idea," and ignorant of the student mind newly arriving over to the study of chemistry. The teacher who never digresses is humorless; the teacher who forever digresses has abandoned teaching. To conclude, these familiar norms guide educators into superior instruction by highlighting and discouraging faulty instruction. They further corroborate the validity of school excellence as securing more students learning from given time and money resources. The instruction that successfully advances this aim is not short or long instruction, or cheap or expensive instruction, or fast or slow instruction, or narrow or superficially-general instruction, or hasty or forever-delayed instruction.

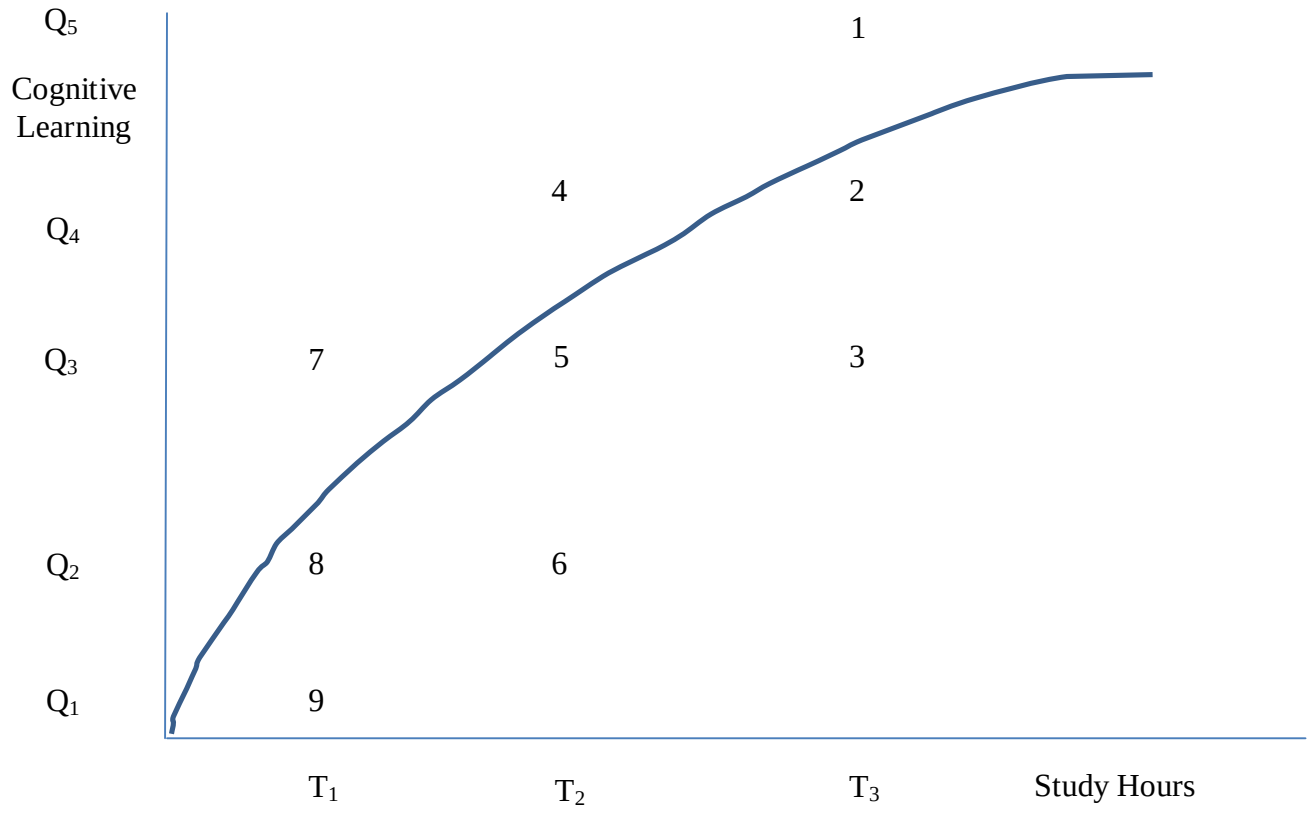
The Geometry of Educational Excellence

Mathematics further illuminates, confirms, and corroborates this proposed and universal end and means of education.

It especially assists in untangling school excellence from that of student excellence from that of school-funding excellence. Geometry further highlights and convinces by spatially illustrating the concept and measure of academic excellence and thus each school's earned status or place in a more objective ranking. Figure One plots student study time (T) on the horizontal axis and the ensuing result of student learning (Q) on the vertical axis. Student learning or cognitive gain is equal to post-test score minus pre-test score in some single academic subject or in several academic subjects. In his classic model of school learning, John Carroll more exactly defined learning as true progress in cognitive growth or skill, or more exactly as, "Going from ignorance of some specified fact or concept to knowledge or understanding of it, or of proceeding from incapability of performing some specified act to capability of performing it."[xxv]

Two facts for each of nine students, attending various schools, are plotted in Figure One. Each student's cognitive learning or gain score is measured by the variable Q, while each student's study time is measured by the variable T hours. For example, student four studied T_2 hours and learned or gained Q_4 amount of incremental knowledge.

Figure One: Study Time and Cognitive Learning for Nine Pupils



Notice that students one, two, and three each studied the identical amount of T_3 hours, with these hours spent both inside the classroom and during homework. Interestingly, they still learned unequal amounts, as student one learned more at Q_5 compared to student two who learned only Q_4; while student three learned least at Q_3. Meanwhile, students eight and six learned the same amount, Q_2. Yet in learning this same amount, student six had to study more at T_2 hours compared to student eight studying less at only T_1 hours. These puzzling yet suggestive fact patterns appear routinely in education data. Despite these peculiar and varying individual outcomes, a general empirical finding emerges. More active study pays off with more learning as illustrated by the curve passing through the coordinates for students eight, five, and two. The curve bisects all nine of the student outcomes as an estimated fitted line from regression. This general pattern suggests that students' can purchase more learning by spending more of their day, or week, or lifetime studying.

The gains from additional study hours do dampen from diminishing returns to study, caused by fatigue, and illustrated by the curve's concavity.

School Quality as Student Eccentricity

Once again, a good pupil understood as a longer-studying pupil doesn't make for a good school. The measure for school excellence or school quality seems nowhere to be found in Figure One. For all of the measures are mere attributes of students their gains in knowledge (Q) and their study efforts (T). School quality is discovered by examining the many student anomalies in Figure One. Students seven, four, and one learn more than expected from their respective study times. It occurred because they all happen to attend the top-ranked school, alpha, that executes superior instruction. In contrast, the lowest ranked school, omega, contains students nine, six, and three, who each learn less than expected from their respective study times. The middle-ranked school, beta, containing students eight, five, and two learn exactly that amount expected from their respective study hours. The superiority of school alpha, to take another example, helps student four to learn more than students five and six, all the while these three students studied the same amount, T_2. To see school excellence from yet another angle, student seven learned Q_3, as did students five and three. Yet student seven studied the least of these three at T_1 hours. Student seven secured the same learning in less study time due to his enjoying superior instruction in school alpha, compared to less effective instruction in schools omega and beta. Students five and three were forced to study more to learn the same amount as student seven. For they had to study more to compensate for the inferior instruction in their lesser-quality schools. The word "anomalies" might mislead here because the anomalies (7, 4, 1, 9, 6, 3) actually outnumber the regularities (8, 5, 2). The analysis thus far merely identifies the meaning and measure of school quality, while not declaring any underlying reason or cause for the unequal instructional impact.

To speculate briefly, the lowest-ranked school omega may stall or slow student learning, in whatever hours its students dedicate to study, because school omega practices that system of education where pupils read randomly, wonder aimlessly, and tinker unsupervised, all without any expert checking and corrective feedback. A good chunk of their study time is wasted reading faulty literature, perhaps by accident, while tediously re-discovering or re-inventing knowledge through long trial-and-error. Acquiring independent initiative and self-directed scholarly skills such as these proves so valuable that graduate schools teach them through formal advanced instruction, but first ascertaining or learning the content of that advanced knowledge from which they are advancing from. An omega school fails at this. Meanwhile, the middle-ranked school beta perhaps offers more systematic and structured instruction, but for some unknown reason their faculties have yet to perfect it as well as faculties in the top-ranked school alpha.

The Multiple Manifestations of School Excellence

This discovery of the meaning and the measure of school quality becomes clearer in Figure Two below. The superior learning curve for school alpha is again juxtaposed to the lower learning curve in the lesser school, beta. Superior education carries radical implications as illustrated in Figure Two. Consider some representative pupil located at coordinate Z in Figure Two. Student Z proceeds along month to month in school beta studying much at T_3 hours, while learning little at Q_1. Now notice the new vista of opportunities awaiting student Z if he could transfer to superior school alpha, or if his own school beta might somehow duplicate school alpha's superior instruction, and thereby attain its higher learning curve.

More Learning, Same Resource

If student Z maintains his current habit of much study and class attendance at T_3 hours, then he enjoys a tremendous gain in learning from Q_1 to Q_3, illustrated by the vertical ray ZY.

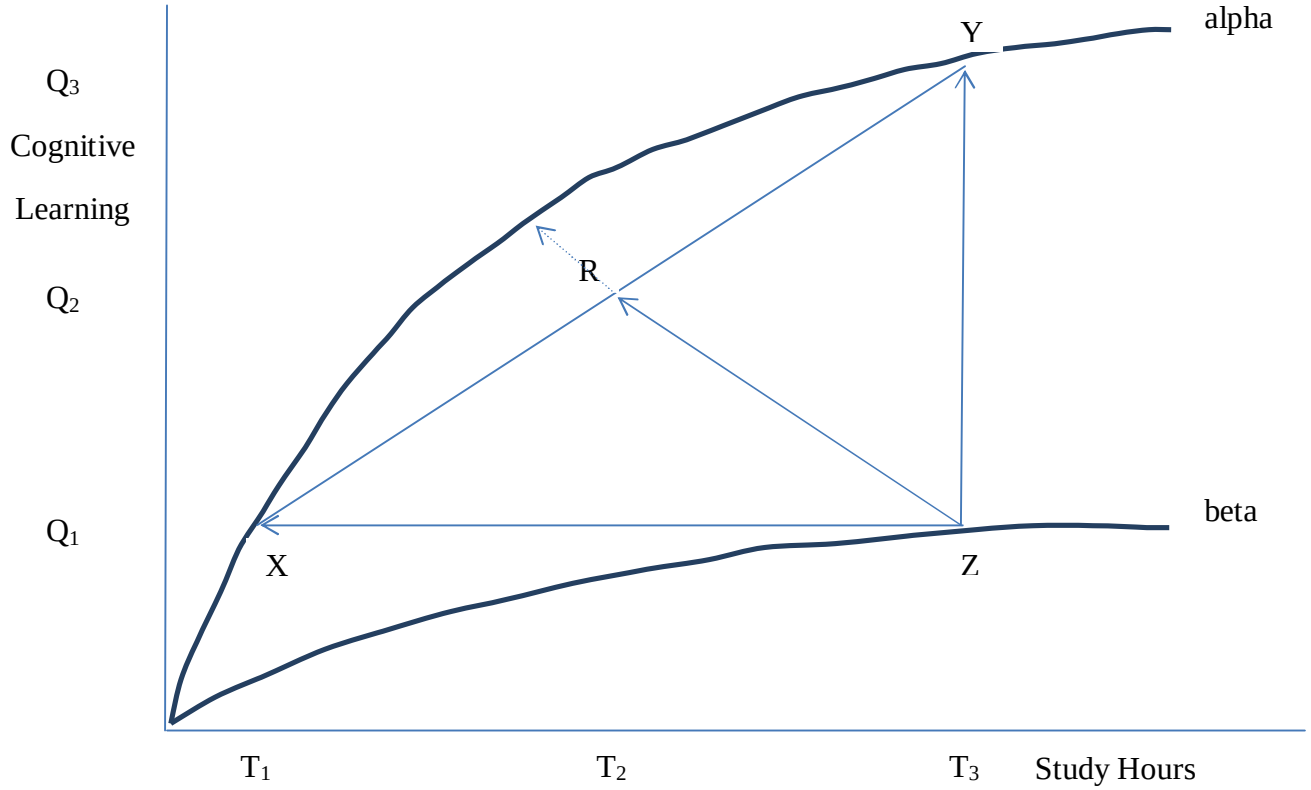
Same Learning, Less Resource

Alternatively, student Z might reduce his study hours, again in terms of both class attendance and homework, from T_3 to T_1, as illustrated by the horizontal ray ZX.[xxvi] This reduced student study effort results, however, in no decline in learning from his original Q_1. His newly improved instruction exactly compensates for his reduced study hours leaving learning unchanged.

So from the improved schooling, student Z can enjoy the same learning with much reduced study hours, as illustrated by the horizontal ray ZX.

He might allocate his freed up time to activities outside of formal schooling such as to recreation, to acquiring more practical experience from part-time employment, or to assist more around his household or community. All of these non-education and valid life activities can be said to improve his overall well-being, and all without subtracting from formal academic learning.

Figure Two: Triangle of Superior Education



This saved time away from formal study in education may not be lost to education. The money he earns form his added work might help to finance his later return to education to earn a baccalaureate or master degree. It renders some time taken away from education today merely delayed time to later put back to education.

More Intensive Learning of More Varied Subjects, Same Resource

If student Z is more typical, however, then student Z most probably adjusts his study time more moderately in response to superior instruction. In this case, student Z reduces his study only slightly from T_3 to T_2 hours per week. Suppose this modest downward adjustment of study time occurs for his math class, which is also where the improved instruction originated. Improved mathematical instruction has now given him both higher math learning, from Q_1 to Q_2, plus more free time, with this windfall of new free time being T_3 minus T_2. The northwest ray ZR illustrates this double gain.(The dashed ray merely illustrates the ignored adjustment for non-parallel diminishing returns between the two learning curves.)

This added block of free time is often now re-allocated to additional study of another course such as history. Hence, improved instruction in mathematics spills over and leads to more learning of both mathematics and history. The higher learning of mathematics came from improved instruction. The higher learning of history came from more study of history by reallocating some small bloc of study time away from math to history.[xxvii] Improved instruction in just math resulted in more depth of learning of both math and history, and more breadth of learning by spreading the otherwise concentrated gain more generally across these two subjects in the curriculum. To summarize, the enhancement of school quality is illustrated by moving from learning curve beta to learning curve alpha. This instructional improvement opens up a wider window of new opportunities, and is conveniently displayed by the triangle XYZ in Figure Two. This geometric picture makes an otherwise subtle and complex gain in educational excellence more visually apparent at a glance. This gain-triangle illustrates a form of educational "free lunch."

An analogous triangle would appear for any student located at any point on the original beta curve, and then enjoying a gain in school quality. Moreover, recall that this overrides the labor theory of school value; for student Z enjoys an improved school all the while putting forth less study or labor time when adjusting to points X or R or maintaining the same study while adjusting to point Y.

This strange exercise of finding the good in education with geometry's assistance did not prove so peculiar to ancient philosophers. Berkeley Philosopher Dorothea Frede in fact equates ethical thought to right measure when writing:

Plato's concern with 'right measure' in a sense that is relevant for ethical thought is, of course, not confined to his late work. It shows up rather early. Already in the Gorgias Socrates blames Callicles for the undisciplined state of his soul and attributes it to his neglect of geometry … : 'You've failed to notice that proportionate equality (geometrikêisotês) has great power among both gods and men."[xxviii]

This synthesis of several traditions therefore helps guide education thought ever nearer to the true value of teaching.

The Final Dimension that Completes the Theory of Educational Excellence

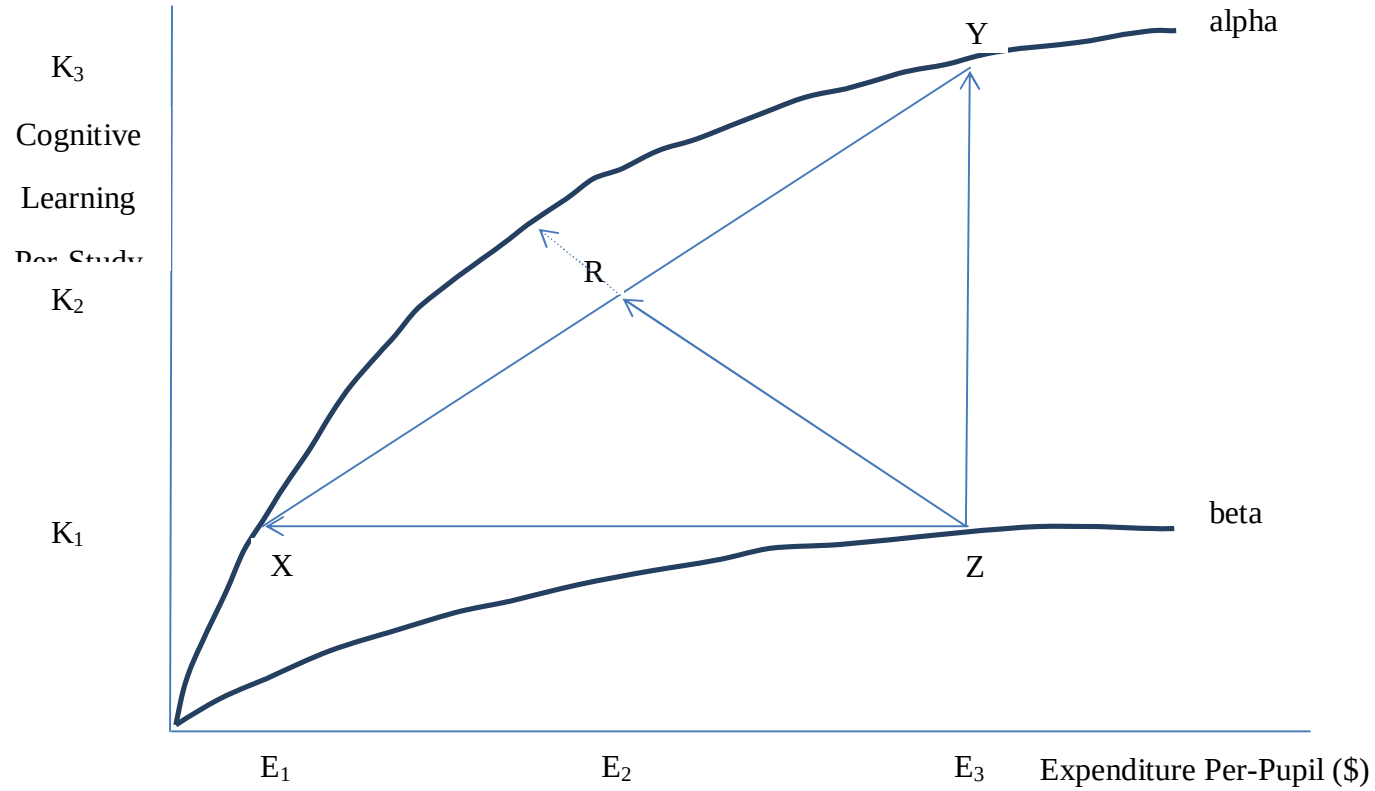
A person does not go into some department store and purchase knowledge, let alone wisdom, as if it might be found in aisle four between furniture and hardware. Moreover, a student cannot even instantly purchase knowledge and take it away from the institution of a school. Responding to Boethius' emphasis on the great use of money, Thomas Aquinas concedes to money's good but also highlights limitations such as this when writing that, "All things salable can be had for money: not so spiritual things [i.e. wisdom], which cannot be sold."[xxix] From this, shall it be affirmed that money expenditure for education is therefore futile? What, if anything, does education money purchase?[xxx] In sending forth his tuition and tax money, the education buyer purchases instruction. But instruction is neither instant nor purely without error. The student-buyer must at least stick around and spend time studying that instruction, with study understood in the burdensome sense of concentrating on the readings, lectures, and webcasts, considering the meaning of them, rehearsing and practicing the assigned homework skills, and thereby assimilating the content of the procured instruction. Instruction contains more or less expert guidance through assorted branches of knowledge or sciences. It contains carefully selected readings, exercises, lectures, discussions, and grading feedback, all sequenced in order to make each student's study hours ever more fruitful in learning. The emerging and innovative testing and on-line tutorial soft-wares accomplish this by scaling instruction of some subject's conventional canon to students' current knowledge.

The only reason to purchase instruction ─ whether from live classroom instruction or indirectly from programmed web instruction ─ is that it facilitates more learning than would be otherwise acquired during the same time spent in independent inquiry and experience away from formal education. Educators assimilate past scholarly discoveries and prominent experiences, from across the globe and from across history, and then sort it and summarize it for pupils to master, and thus hasten their escape from more limited and idiosyncratic thinking and experience. Yet, each school's instruction still varies by the degree to which it converts a student's given dollar and given hour of study into students' accelerated and significant learning of "the best which has been thought and said," and done.[xxxi] If the procured instruction quality varies, then school quality varies. For all schools consist of faculties executing instruction, whether in traditional classrooms, streamed lectures, or assigned texts. Figure Three helpfully and conveniently illustrates this complex process of converting student money expenditures and student study time into more or less learning, all emanating from faculties' instructional action.

Figure Three contains new factual data on various pupils attending schools alpha and beta. Each student's cognitive learning per-hour of study (K) is now measured on the vertical axis. The higher this K, the higher the learning curve for that student, as previously illustrated in Figure Two. (Geometrically, each student's learning rate, K, is the slope of the ray connecting the origin to that student's coordinate for learning and study in Figure Two.) The money expenditure per-pupil ($E) appears on the horizontal axis. This money is paid out and then spent by administrators on behalf of students. This money purchases instruction in order to accelerate or to maximize student learning during every student study interval, whether in class or in assigned homework. Superior education is now understood more completely with the inclusion of finance or money expenditure. The notion of superior education again carries interesting and radical implications as illustrated in Figure Three. Consider again representative pupil Z in Figure Two.

Student Z proceeds along month to month in inferior school beta, spending much money at E_3 dollars, while learning little inside his typical or average study hour, denoted by his lower ratio of learning-per-study-hour, K_1. Now notice the new vista of opportunities awaiting student Z if he could transfer to superior school alpha, or if his own school beta might somehow duplicate school alpha's superior instruction.

Figure Three: Advanced and Completed Triangle of Superior Education



More Learning, Same Resources

If student Z maintains his current spending at E_3, he then enjoys a tremendous gain in learning-rate from K_1 to K_3, illustrated by the vertical ray ZY. For one prominent empirical example, scholars from various traditions and perspectives found high-school students, otherwise equal in beginning knowledge, study hours, family support, and school expenditure, gained more knowledge of secular subjects inside Catholic schools compared to their public school counterparts.[xxxii] Scholars proved more divided in explaining the source or cause of this otherwise undisputed pattern of unequal academic gain. At the collegiate level, students at state-flagship universities gained more knowledge of America's history and institutions than students at Ivy-league institutions, even among pupils completing the equivalent quantity of civic-oriented courses, and despite the Ivy-league students even logging more weekly homework hours.[xxxiii]

Same Learning, Less Resources

Meanwhile, student Z might radically reduce his spending from E_3 to E_1, as illustrated by the horizontal ray ZX. This reduced money expenditure results, however, in no decline in his rate of learning from his original K_1. In this case, the saved money, E_3 minus E_1, might be validly re-allocated to purchase more urgent items outside of education such as health care, his parents' transportation to work, or charitable giving. Or that saved money might beautify education campuses, or expand campus security forces, each a valid expense even if more tenuously related to securing an ever higher learning rate. Or that windfall of freed up money might be saved to defray expenditure on some advanced degree for student Z later in life, all without reducing his present-day learning rate of K_1. So saved money in that case is not lost on education; it is money postponed for later education.

These gains within and across human activities have mutual and symmetrical influence. For example, when mortgage payments decline from lower interest rates, people don't use the entirety of the saved money to strictly purchase only more premium housing, but use some of the windfall for purchasing more education and a new smart phone.

More Intensive Learning of More Varied Subjects, Same Resources

As typical for most optimizing families, student Z and his parents probably reduce their education money expenditure (or slow its growth) more moderately in response to some underlying improvement of education from beta to alpha. If the instructional improvement occurred in the science department, then administrators at Z's school might modestly reduce science department expenditure (or slow its money expenditure growth) by E_3 minus E_2. This freed up money is then re-allocated to that school's foreign language department.

Notice, therefore, what improved schooling means for pupil Z in the context of this administrative adjustment. Student Z's learning increased for both science and for foreign language, each without having to study more total hours or to spend more total money. The learning in science accelerated from improved instruction. It permitted both a higher science learning-rate even with slightly less expenditure on science instruction. The higher rate of learning in foreign language came from re-allocating money to foreign language instruction. Improved instruction in just science resulted in more learning and thus more depth of learning in both science and foreign language, all in the same study time and same money outlay. It generated a wider range of learning by spreading the gain more generally across two subjects.

To summarize, the enhancement of school quality is illustrated by moving from the rate-of-learning curve beta to that of alpha. This instructional improvement opens up a wider panorama of new opportunities, and is again conveniently displayed by the triangle XYZ in Figure Three. This geometric picture makes an otherwise subtle and complex gain in educational excellence more visually apparent at a glance. It also makes an econometrician's empirical capturing of these varied gains daunting. Why? School instructional improvement in one subject easily leads to the same learning in that subject with its gain transferred out to many other academic subjects, or even to gains to non-academic activities. It should not be missed that Figure Three admits to more education expenditure purchasing a higher rate of student learning, though with diminishing returns. Without diminishing returns to money, all things could be learned in one hour or one day if only sufficient money was spent. Moving along this curve of more expenditure, learning expands, moreover, at the *expense* of other life activities. For added education spending removes money from other activities. These areas that shrink might include house construction, concerts, or health care services, listed previously in Chart One.

In contrast, shifting the curve upward improves education from within, by improved mastery of the teaching craft, not by expanding education at the expense of other valid pursuits. To see the parallel, educators prefer that physicians improve their medical services from managerial and technical innovations within their profession before charging more money or higher taxes to expand the purchasing of health care services, which reduces education expenditures. Whether these proposed internal improvements all matter, of course, depends on finding practical actions that in fact improve instruction and thereby secure these remarkable gains. Yet, it is an intellectual achievement to first identify and to clarify these gains both intellectual and non-intellectual. For these gains constitute the end purpose or true value of quality education which emanate from improved instruction. And a spectator is unlikely to recognize or to appreciate all this without having entered the complex details of the education enterprise, participating as a student, instructor, or administrator; or as a scholar, for example, reading the narrative accompanying this geometry.

The Meaning of Superior Education through Algebra

With little warning the concept and measure of school quality entered into a fourth dimension. It makes geometry and algebra more necessary to understand school quality in its complexity. The math reduces the confusing proliferation of clumsy words in navigating the net effect of complex education activity by many agents. For example, the composite measure of school quality would be now spoken awkwardly as the extent of student learning of the most important knowledge per unit of study time per dollar spent on instruction. The mind does not easily rest on the meaning or significance of that extended phrase.

The Parsimony of a Ratio

The stated or verbalized complex fraction which captures the meaning or essence of school quality is now calculated in Equation One:

Equation One: $$School\ Quality = \frac{K}{E} = \frac{\frac{Q}{T}}{E} = \frac{Q}{TE} = \frac{Learning}{(Study\ time)(Expenditure\ per\ pupil)}$$

The larger this fraction, then the better the school executes its collective mission of instruction to make a more maximum and wide-ranging intellectual impact upon its students. Referring back to this paper's title, this conveys the proposed purpose of education, and is now combined together with a scientific narrative describing its true value. As this complex fraction or ratio increases, it secures evermore aggregate learning from whatever level of committed study time and instructional expenditures.

When Assessment Fails

Meanwhile, math does not *empirically* measure school value above; it discovers, identifies, and clarifies its more exact conceptual meaning. Collecting the corresponding and reliable data to execute a school ranking using this concept easily proves so difficult, expensive, and time-consuming to make its net impact subtract from education quality. Donald C. Hubin, for example, finds a meritorious project such as education passing benefit-cost scrutiny; that is, until the prohibitive cost of a thorough-going benefit-cost analysis is included in that project's cost or expenditure. It dilutes the net gain of instruction by distracting educators into endless statistical documenting of its historical activity on bygone students. Benefit-cost analyses or assessment becomes "self-promoting" rather than "self-effacing," or it becomes a rival bureaucratic activity to otherwise merited education activity in the present moment.[xxxiv] This theory of educational excellence contains both the end and two means of education. The two primary means consist of student study time (T) and education expense per pupil (E). With this education expense, administrators purchase faculties' labor to execute the purchased instruction. Education administrators *organize, describe, sustain*, and *direct* the education institution, while faculties *do* the institution's ensuing and core work of instruction. This procured instruction produces the more proximate education cause of each student's learning rate (K). To further illustrate the difficulties of collecting this underlying real data on K, T, and E. Education tradition has adopted more readily apparent and more quickly retrievable proxy measures such as student course credits, grades, and degrees; along with faculty degrees, experience, student evaluations of teaching, and faculty scholarship.

Students' final magnitude of real learning is then obtained by multiplying the learning rate (K) by each student's study time (T). A superb student, with high study habits, joined together with a superb school, which offers a higher learning rate, proves to be a combustible combination over many courses and semesters for securing the highest learning. Yet the distinctive excellence of the pupil and the school has been separated and clarified for the sake of only discussing the school's purpose and the unique good it contributes to that learning. A good school doesn't make learning less irksome or less expensive. Without the exertion of student study time and sacrificial levels of money expenditure, there is no accelerated learning rate and resulting higher learning. Good schools make any level of irksome study effort, with student effort helpful by itself, payoff even more by ratcheting up the fruit of increased learning.

Making Education Priceless

The true underlying or embedded price of education at some institution can now be derived since financial expenditure, study time, and substantive learning are all present. As analogy, if we spend $100 on apples to obtain fifty apples, then the effective price of one apple or its average price is $2. Similarly, the price or cost of education is the inverse of the above fraction for school quality. It takes education expenditure and divides by education output as we do when calculating the apple price.

So a school that maximizes learning per money-spent simultaneously minimizes the price of education, but with the price or opportunity cost of education coming in duplicate as both money and study time.[xxxv]

The price of education (C) is therefore expenditure per pupil per-unit of learning rate, as calculated in Equation Two:

Equation Two: $$\textit{Price of Education} = C = \frac{E}{K} = \frac{E}{\left(\frac{Q}{T}\right)} = \frac{\text{TE}}{\text{Q}} = \frac{(Study\ time)(Expenditure\ per\ pupil)}{\text{Learning}}$$

Notice that the underlying price of education remains unknown until the student completes his education. The money expense (E) or tuition and taxes paid out to enroll in a school or college is not the price of education. That money expense secures only permission to participate in or to witness to the activity of academic instruction. It remains to be seen how much each student will participate as measured by study time, T. Yet students do not purchase instruction per se, but rather they purchase the accelerated learning (K) derived from that instruction.

The price of education is therefore infinite at the opening bell of education. For the expenditures (E) paid out at the beginning and in the numerator is divided by K; but K is zero until instruction commences. Dividing money expenditures by zero drives the opening price of education to infinity. Faculties work with students over the ensuing weeks, months, and years to drive that education price downward toward zero. So the final cause or final purpose of formal instruction is to make education priceless. It becomes nearer to priceless through ever more learning of ever weightier things, all within students' committed study time. In terms of weighting, a student gaining knowledge of one magnificent idea can surpass the learning of ten trivial ideas. So faculties' perfecting their instruction tamps down inflation of the education price to the extent instruction is in fact improved.

This does not set up a race to the bottom, where faculties must work for ever lower wages to secure employment and to keep education expenditures low and the education price affordable. In fact, the highest paid faculty can win the minimum cost bid. Their higher wage purchases their higher expertise which purchases a proportionally higher rate of learning for students. In its net effect, it can thereby secure the lowest bid in terms of lowest price (C) in Equation Two. The less experienced and lesser trained faculties can still find a niche by working for a lower beginning wage more proportional to the lower learning rate they produce, and thereby remain attractive and competitive in education employment and contracting.

Analytical and Empirical Lessons

The language of school quality and the mathematics of school quality lead to important and surprising lessons. These discovered lessons or implications carry theoretical, empirical, and practical significance for the study, intelligent deliberation, and improvement of education.

School Excellence as a Relational Attribute

The concept and measure of school quality does not reduce to some single number. School quality consists of a superior relationship understood by juxtaposing several numbers into a *ratio*. These numbers juxtaposed are student learning, student study time, and education money expenditures. Similarly, school quality remains relational because improving education does not mandate the adjusting or improving of any particular number. For improved schooling commits to increasing neither student's learning in the numerator nor to the decreasing of student study time or money expenditures in the denominator. All that matters is that when learning rises, then expenditures and study time remain the same; or that when expenditure or study time decrease, then learning does not decline. In addition, school quality cannot be located at a single coordinate or vector in the two triangles of school excellence. So a singular ratio of school excellence manifests itself into many diverse outcomes. A single meaning exists without enforcing some stern uniformity; for multiple manifestations emerge from the same notion of educational excellence. After all, unique students, teachers, and societies respond differently to school-quality improvements by adjusting their study time and education expenditures according to their varying and valid priorities, both inside education and outside education. Ghana, suffering average annual income of $1,442, is well-advised to spend less per student than the US, enjoying $54,630 annual income.

But in the midst of all this flux and pluralism a singular school quality was isolated and identified.

A Rationale for this Criterion of School Quality

So what reason might justify adopting maximum learning-per-hour-of-study-per-dollar spent as the true education standard? First, while formal education and resulting knowledge is a good, it still is not the ultimate good, the *summum bonum*. Nor can human happiness be fully synonymous with human knowledge, even true knowledge. John Henry New man further separates knowledge from virtue: "Intellect too…has its beauty… [It] is an object as intelligible as the cultivation of virtue, while, at the same time, it is absolutely distinct from it."[xxxvi]

Hence, education is a good of one sort adjacent to other goods and merited activities such as health care, parenting, cooking, working, voting, worshipping, exercising, resting, traveling, and gardening. This theory of education value does not presume to advance the meaning or purpose of life but only of the education sector. That education sector must nevertheless keep peripheral vision of the more general purpose of life, and the manner in which education relates to life more generally. The aforementioned analogy between the educational and environmental good extends here. A cleaner environment is one of several goods, making the manner of pollution abatement and its extent critical for advancing the common good consisting of a cleaner environment balanced among other activities.

When school quality improves, a student can validly withdraw some increment of study time and re-allocate it to non-education activities for the sake of maintaining a balanced life.

Most compelling, these non-education activities can expand without forfeiting any learning. Similarly, when instructional quality improves inside one academic subject, the student can validly withdraw some increment of study time on that subject and re-allocate it to another academic subject. It secures simultaneously higher and more balanced learning across several subjects. So this standard of school quality gives more connective tissue between a single teacher's excellence, total school quality, and the national common good. It is less about austerity and more about generosity of expenditure of time and money on the general and highest things of life. It acknowledges education to be one good, even one of the higher goods. Meanwhile, it flexibly allows for the known fact that education is not the whole of life; nor is one science or academic subject the whole of education.

Surpassing Partial School Standards

The proposed standard of school excellence steers clear of the pitfalls of the three leading and destructive indicators for school quality mentioned previously. Some students learn the identical amount, though with unequal study time. The fact that these schools produce equal student learning but still rank unequally in quality, contradicts the claim that only student learning accounts for school excellence. On the other hand, some students study the identical amount of hours, and still learn an unequal amount. The fact that students of equal study effort results in unequally ranked schools contradicts the labor-theory claim that only student study effort accounts for school excellence. Some schools spend the identical money expenditures per-pupil, but produce unequal learning-per-study-hour for their pupils. That prevalent outcome contradicts the notion that education funding or expenditure fully determines school quality. It falsifies the dictum that, "All things obey money," even in education or especially in education.

Finally, students of equal ability whether measured neurologically by an MRI scan or by pre-test scores in some science, or by equal IQ ratings can be culled out from any large education data set. This subset of students of equal ability will inevitably show unequal study hours, unequal learning, and unequal education expense. With this variation in learning, study-time, and expense among pupils of otherwise equal ability, a school ranking emerges using the composite measure of school quality. This fact that schools rank unequally in serving students of otherwise equal ability contradicts the notion that school quality hinges exclusively on enrolling students of only higher ability. Moreover, schools also rank differently in providing learning-per-study-hour-per-dollar to just handicapped pupils.

Understanding Two Big Empirical Riddles

Education analysts have been mostly stumped to explain the surprising pattern that higher expenditures per-pupil usually fail to systematically increase student learning, other factors the same.[xxxvii] The triangle of excellence in Figure Two offers a sensible explanation. Suppose more expenditure per pupil at some school increases its students' learning rates. Students might meanwhile remove some study time in tested subjects. The higher learning rate raised student learning, but students lowered study time pulled that gain back down to its initial level. So added expenditures improved the school here by raising students' rate of learning, but did not increase student learning. The mix of education service as opposed any price inflation in education ensuing from the recent debt-financed stimulus funds devoted to K12 schooling to accompany Common Core, prove mostly undistinguished in National income accounting. At other times, analysts find added student study hours fail to raise those students' learning. Suppose a student's extra study causes him to surpass his classmates' knowledge. When that student returns to his formal class, then instruction, reading, and exercises have become too easy or mostly redundant with his now more advanced knowledge.

Thus his learning rate collapses. His higher study time initially raised his learning, while his newly-depressed rate of learning inside formal education pulled his learning back down toward zero. Hence, the hypothesized positive impact of added study hours was cancelled out by a reduced learning-per-hour from ensuing class lessons now proving more redundant.

From Contested Contract to Mutual Gain in the Education Exchange

The education standard proposed here provides an escape hatch from some education conflict. Two actions excite conflict. First, to seek to expand education by raising education expenditures, through either higher tuition or higher taxes, invites resistance from those preferring or needing to use their money otherwise. Secondly and just as agitating, to seek to expand education by raising student homework or teacher instructional hours, invites protest from students and teachers who prefer or need to use their marginal time otherwise. Moreover, to seek more teacher labor hours at their same teacher salary reduces teachers' implicit wage or pay-per-hour.

Yet, teachers, students, and those paying for education all assent simultaneously to the good of learning more in the same study time and teaching time. Teachers' dream of providing this service and families seek it out. Or similarly, they will all assent to the good of learning the same in less study time or teaching time. This more mutually-agreeable standard becomes even more impressive when specific actions are shown below to accomplish this seemingly impossible feat and without reducing teacher employment. Improvements like these occur daily across all industries or sectors, including education, and when summed up constitute the predominant long-run path for aggregate prosperity.

Again, since the school quality measure is a ratio and not a single number, it is relational. It therefore supplies a norm for better analyzing justice in education, for justice is also relational in the sense that is seeks right relations among persons. The fact that this standard of education quality is relational, plus that it corresponds to educational excellence, and finally, that it secures more assent among otherwise colliding education agents, suggests that it might serve as a more reliable norm for guiding education agents into more educational justice if not charity. It helps to move nearer to answering the opening question of, *who does what for whom [in education] and for what intended good?*

Escaping Prevalent Equivocations

This new education standard synthesized from various traditions makes sharper distinctions that can reduce exasperating equivocations in both education scholarship and policy debates. First, with student quality understood as study hours and school quality understood as learning per study hour per dollar spent, no longer can a good school be so casually and mistakenly considered exactly identical to a good student. When seeking to explain successful or failed learning, we now can better link it to its more exact causes..

Secondly, this concept and measure of school quality helpfully distinguishes between *better* and *more* education. To see this, more learning is in fact purchased with added study time. This added study time might occur intensively, by studying more hours per day or per week. Or it might be purchased more extensively, by studying more months in a calendar year or more years over a lifetime, with the latter representing more degrees. Similarly, more learning is in fact purchased by spending more money to hire or to train more and better faculty. These improved faculty secure higher learning-per-hour for their students. Again, the added money expenditure might occur intensively, by spending more education money per month or per year, or more extensively, by spending more education money over a lifetime through the attaining of more degrees. These two expansions of learning purchase *more* learning or more education. Education betterment, however, consists more exactly of a school producing more learning from the *same* expenditure of time and money, whether that study time and money are spent per year or over a lifetime. Therefore, purchasing *more* education is quite different than *improving* education. In a like manner, purchasing more gallons of water differs strictly from improving the quality or purity of a single gallon of water.

Thirdly, the important issue of which branches of knowledge to include in a school's curriculum can now be analyzed separately, or without equivocation, from the distinct question of schools' unequal knack for advancing student knowledge of any branch of knowledge. Moreover, the foundation theory of education offered here seeks more success or more effective learning of some subject, of any valid subject, prior to the important movement toward studying and learning the weightier or loftier things, whether those reside in the humanities or in vocational subjects.

Fourthly, this analysis does not fully resolve the question of whether students' more permanent intellectual ability stems more from biological nature or from nurture. Birth defects, brain injuries, and severe developmentally-delayed children are manifest in numerous cases. The notion of school quality developed here remains relevant only insofar as a trace of students' cognitive development does in fact ensue from some nurturing or environmental impact of formal education. For pupils whose mental process is somehow totally determined by biology ─for good or bad─, then instruction has no impact and instructional excellence has no meaning.

The whole of medical, psychological, and philosophical scholarship seems to acknowledge more or less that we scan, medicate, nourish, and operate on the organ of the brain; while we instruct, test, and correct the mind, with the mind being more of a human faculty or mental power. It seems also that the brain and the mind somehow affect one another and even unite.

To overlook or to omit either the brain or the mind erases this advanced distinction, their mutual causation, and subtracts from scientific knowledge. It would thereby falsify man, male and female, as he happens to be in his full and subtle complexity.[xxxviii]

Finally, the theory of education proposed here further invites the nature-nurture scholarship to address the more exact route of *how* the neurological wiring of the brain, nutrition, exercise, and health affect cognitive learning. Does it alter student concentration, in the sense of alert student study hours, or does it alter the student's speed or rate of translating any amount of alert study hours into accelerated learning? This latter rate of learning or speed of learning, given some interval of attention, is proposed here to extend more, if only incrementally, from school quality than from innate student ability, due to the instructional matching phenomena promoting accelerated learning, among both the higher and even lower aptitude pupils.[xxxix]

Practical Lessons ─Three Actions that Have Improved Education

Formal education intervention still raises the trajectory more or less of most humans' cognitive development. "Environment plays a major role in the way that all abilities develop. Genes are not even close to being everything."[xl]Improved schooling as defined here accelerates pupil learning from their otherwise casual and every-day learning. Instructors improve their impact upon pupils in three distinct ways.

To see these three dimensions of school improvement, first consider that educators are middlemen, as are all specialized workers. Teachers bridge the gap between their science and their pupils' learning of that science. Thomas Aquinas observed that, "We find a twofold matter in the act of teaching… [The teacher's science] pertains to the contemplative life [and] to whom the science is passed on … to the active life."[xli] Aquinas reasons separately that a middleman can justly sell a thing for more than he purchased it for only insofar as he, "improved the thing in some way."[xlii] A teacher more or less adds value to the science that he inherits by teaching it better. Teachers add value by executing three practical actions: canonical communication, instructional veracity, and categorical balance.

1. Canonical Communication

In the teacher's act of *canonical communication*, a teacher seeks to make a student smart in his science, rather than to make the science smart. The teacher seeks to make the science intelligible and understood by his particular pupils, not to make the science more intelligent in the sense of better knowing its object, whether that object consists of the living cell, the government, the atom, the economy, beautiful architecture, , or the planets. To teach each science as it stands today as commonly understood by its experts requires diverse instruction due to pupil diversity. It makes teaching success rest upon the prudent judgment and action of teachers. A teacher otherwise brilliant in Geography, for example, produces a zero rate of learning for his Finnish pupils if he teaches Geography through the medium of English, a language currently unknown or much less known to his Finnish students. So this brilliant geographer must either find English students to which to teach his Geography, or first learn Finnish and change his Geography instruction from English to Finnish. Both actions radically raise his student's learning during student's otherwise identical study-time and expenditure-per-pupil. Switching the translation toggle button can prove a more significant hurdle for instructional excellence than what appears at first glance; for the translator must know the science plus two languages, with each language understood at both their common and technical-scientific levels. A routine, strong, and proven factor in accelerating a student's learning is when the pupil's primary family language, that spoken while growing up in the home, corresponds to that language most used in the pupil's school and texts. Similarly, teaching the full and exact truth of calculus secures zero learning for pupils just beginning their study of arithmetic.

For it is too advanced too soon. Conversely, teaching elementary arithmetic to students poised to learn differential calculus results in a zero learning rate in mathematics for these advanced students having already mastered arithmetic. Hence, superior faculties routinely refine and calibrate their daily instruction according to students' language expertise and scientific or math expertise. It all raises students' learning per study hour per dollar spent.[xliii]

Even if faculties successfully target the median pupil's beginning knowledge, the range of student knowledge around that median undermines learning per hour per dollar. For instance, State-flagship university students gained more knowledge of America's history and institutions than Ivy-league students; partly because the variance of beginning student knowledge was higher among Ivy-league students together with their corresponding decrease in learning per resources.[xliv]

2. Instructional Veracity

The educator's second practical action is not to make his students smarter in his science, but to make his science smarter. That is to make the science know its object better and thus more worthy of students' study and mastery. In doing this, the educator pursues more *instructional veracity* and thus makes the science more intelligent as opposed to making it more intelligible to his students. Making his science more accurate and valid requires that he finds or makes superior course literature that improves upon the conventional canon or professional consensus of his science. He thereby substitutes a larger blend of truer premises, facts, principles, and theorems into his otherwise equal amount of lecture, discussion, texts, and exercises.[xlv] A valid test instrument detects students' gaining more knowledge of truer themes and thereby shows this accelerated gain in learning per study hour; otherwise the test instrument is defective not the instructors' improved and truer science.

The educator needs research time or contemplative time away from active instruction to improve upon his science, all without raising expenditure per pupil and thus reducing instructional excellence. Suspending teaching to do scholarship can be understood as *roundabout* production of instruction, or *higher-ordered* production of instruction; for these terms were classical precursors to the more modern term of *investment*. Alert teachers have done it successfully in this way. A teacher now instructing two pupils in separate tutorials combines them now into one class of two pupils. He reduces their tuition by half because they now share the single cost of his now single course. With the same salary and his freed up block of time gained from teaching one less course, the instructor explores and uncovers superior yet passed-over literature (*ressourcement*), or else engages in new and original scholarship to produce superior literature addressing new developments or facilitating new developments (*aggiornamento*), all to be eventually included in his teaching.[xlvi] This new and more valid course material, of otherwise equal length, accelerates his students' learning-per-study-hour, all without raising expenditures. Tuition in this case was halved and true pupil learning increased.

It even raises the learning per hour of pupils in other schools and colleges. For his distant faculty colleagues also adopt his improved literature in their course teaching. By teaching less here, this scholar indirectly gained more pupil disciples. Less teaching causing more learning again negates the labor-theory of value in regard to hours of faculty teaching. Incidentally, if faculties are forced to forever prod students into longer study, monitoring it as in-person proctors, or forever monitoring log-on activity data of students' online engagement, as the labor-theory of value directs, then it subtracts from faculties' scholarly-teaching and thus school quality. Society permits and even assigns educators the distinct task of putting more thought and scrutiny behind their otherwise equal quantity of words and formulas, which reminds educators of the origin and the advantage of formal education in creating, purifying, deepening, and transmitting knowledge.

3. Categorical Balance

Finally, while *canonical communication* makes a science more intelligible and *instructional veracity* makes the science more intelligent, the final educational improvement of *categorical balance* makes instruction more intelligently complete.[xlvii] The curriculum of formal education is divided up into sciences or branches of knowledge, and further divided into courses inside each science. Each science and course offers a necessarily partial view of the whole of reality; for even the better human minds cannot instantly see and take in the whole of existence at one glance. These various sciences do not necessarily enjoy equal status, as their prominence varies by the importance of knowing the object that each science seeks to understand, and the effectiveness of its uniquely employed method to understand that object.

Historian Richard M. Gamble, for example, provides an anthology of classic writings "On what it means to be an educated human being."[xlviii] The practical question now facing the educator is whether to direct a pupil to his first natural science course or alternatively to his 40th history course, given that he has only forty courses in his overall education. In other words, does the pupil do better to now study this science or that science? Does the student do better to complete this course or that course inside some single science, here and now for that pupil in this school, all the while that pupil has only a limited time or fixed quantity of courses? Similarly, is the student better served reading for the fifth time a classic text or reading for the first time some alternative text?

The principle of balanced instruction, or students' studying and learning a wider range of sciences, guides them successfully to more learning from given resources.

To see this, John Henry Newman finds that this balanced study better cultivates the mind with a higher learning, other things the same and demonstrated by students' improved ability to now take up better any specialized and advanced science or even specialized work. Newman writes that the more generally educated or liberally educated student and professor knows more and can do more:

[The liberally educated] will just know where he and his [new] science stand, he has come to it, as it were, from a height, he has taken a survey of all knowledge, he is kept from extravagance by the very rivalry of other studies, he has gained from them a special illumination and largeness of mind and freedom and self-possession, and he treats his own in consequence with a philosophy and a resource, which belongs not to the study itself, but to his liberal education … It prepares him to fill any post with credit, and to master any subject with facility.[xlix]

Hence, more balanced learning today accelerates learning (K) of some new science or new professional task tomorrow.

Moreover, inside even some advanced and specialized science, balanced instruction remains an active principle for improving instruction. The doctorate student in engineering suffers faulty instruction and thus lesser learning of engineering by studying only electrical circuits and not also fluids and fiber optics, or the Christian theologian studying only the Old Testament and not the New Testament, or the economist studying only macroeconomics and not microeconomics, or the medical student studying only anatomy and not pharmacology and hematology. Evidence corroborates the principle of balanced-learning accelerating total learning from otherwise equal study-time and money outlay for students. For example, taking additional courses in American history, American government, or economics increase students' learning of America's history and institutions. Yet more balanced learning across these three civic subjects further accelerates this civic learning, giving a premium over and above that learning in some total quantity of civic courses. More exactly, the student having completed two courses in each of these American civic subjects learns more than another student also completing six civic courses but with four courses completed in American history, two in economics, and none in American Government, all the while controlling even for the availability of advanced questions in all subjects.[l]

Ascertaining the difficult beginning and creative vision and distinct method of some new science proves more difficult than drawing elaborations from that subject in its advanced courses. Thus a balanced beginning study across several sciences, when combined with our inborn capacity for inference from that beginning, accelerates learning and knowledge from an otherwise equal total number of courses. It promotes greater total learning over and above merely altering the composition of learning across subject areas.

Finally, when a school culpably omits some legitimate science, its students do not cease thinking about its object. Rather, they tend to mistakenly use the methods and principles of sciences they do know to explore the object of the science they were not taught. "The systematic omission of any one science from the catalogue prejudices the *accuracy* and completeness of our knowledge altogether, and that, in proportion to its importance."[li] Students and faculties draw faulty inferences by employing methods poorly matched for understanding the object studied in the omitted science. Economists seldom use telescopes and astronomers seldom use microscopes.

As another contemporary example, grounding for "scientific standards growing out of the Enlightenment" are mostly lost absent the accompanying study of the humanities. For eminent historian George Marsden documents how Ivy-League universities have more or less forfeited the natural sciences' orienting prologue of "theology" as once "mediated through the American Protestant Heritage."[lii] It can result in natural scientists pronouncing upon religious doctrine whose distinctive content and method few scientists ever ascertained during their educations, and vice versa for humanities scholars untutored in science.

To summarize these practical lessons, educators have sought improvement and have secured improvement of their instruction through these three distinct routes of *canonical communication*, *instructional veracity*, and *categorical balance*. Each of these varied forms of improvement increase student's learning-per-study-hour-per-dollar-spent in education. These three principles guide educators into sorting and weighting the universe of literature that they might teach, by turning first and most exclusively to those ideas that will be more understandable, truer, and yet unknown to their pupils. In other words, each alternative faculty action in its own way more fully advances the final education good of, *maximum student learning of the most important knowledge and skills using committed resources of instructional money and student study time*.

A More General Education Theory

To close out, an analytical concept or theoretical measure of school quality has been proposed. Its meaning was advanced without declaring a stance or conclusion on many education issues of the day confronting scholars, teachers, and policymakers. Nowhere for example was it implied that the new Common Core standards prove inferior to more pluralist curricula, or that digital on-line education is superior to traditional classroom learning, or that ever larger universities prove superior to smaller universities, or that non-profit schools outperform proprietary schools; though the analyses here might help to more exactly frame and test education theses such as these.

The focus here was on the meaning and improvement of schools. Whereas some schools adjust their curriculum in order to teach students how to become better students, before returning to the core instruction in the various sciences. Some might also propose that a superior school alternatively cultivates love or appreciation for academic subjects, study, and learning. Cultivating this love of learning and acquired taste for specific subjects seems sensibly helpful. That appreciation must come at least concurrently with satisfactory instruction and thus accurate learning and knowledge of some science. A trace of familiarity with the content and method of a science precedes any resulting attraction or repulsion to that science. Thus, this fact returns us to the prior foundational criterion of school quality. The conclusions in this paper do not further depend on declaring European education superior to Asian education or modern education superior to ancient education. Substantive conclusions were nevertheless advanced here on the end and means of education without declaring purely vocational or technical education superior to purely liberal education, or secular education superior to religious education, or private education superior to government education, or teaching colleges superior to research universities, or diverse student peers superior to more homogenous student peers.

This analysis does propose concepts and reasoning to help guide investigations into the validity of these sorts of education theses. It specifies the meaning or nature of education quality, necessary before identifying factors or policies that supposedly improve education or harm it.

Conclusion

The great cause of education carries the double meaning of two embedded questions. What factors advance quality education and what constitutes quality education? Those questions must be answered together. The impact on education from factors, policies, or new practices cannot be ascertained in the absence of specifying some education goal or result intended. Otherwise analysts don't know whether they're inquiring into whether X causes Y, or whether Y is that object or result of which good educators aim.[liii]

The late Princeton professor, Jacques Maritain, eloquently summed up this thorny problem: "The problem of End and Means is a basic, the basic problem in political philosophy. Its solution is clear and inescapable in the philosophical field; yet, to be applied in the practical field, that solution demanded by truth demands in return from man a kind of heroism and hurls him into anguish and hardship … Means are ways to the end and, so to speak, the end itself in its very process of coming to existence."[liv] Figure three, the completed triangle of educational excellence, demonstrates this near merging of means and ends, and how the means affect both the nature and extent of the good end secured or advanced.

This inquiry began with the overarching question: *Can the casual opinion that ─ School Alpha is Superior to School Beta ─ ever rise to the higher status of valid knowledge?* The affirmative and substantial answer uncovered here caused little collision or fewer fatal collisions of valid academic and economic interests. The answer, moreover, relied upon the contributions of sometimes rival scientific traditions. The notion of education quality or school excellence even if tacit and hard to measure contains more knowledge than opinion.

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