

Education, Science, Knowledge, and Values

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Abstract

Natural science has made great strides in uncovering the laws and principles that undergird natural phenomena. From the behavior of subatomic particles and the function of cells to the nature of outermost stars and galaxies, science has helped elucidate a vast amalgam of theoretical issues which in the past baffled the human intellect for its unfathomable mystery and depth. Given the spectacular progress of science, it is quite understandable for disciplines outside science to seek objective and reliable knowledge by emulating the method of scientific inquiry. Alongside such disciplines like medicine and psychology, education has sought to improve the quality of teaching and learning by adopting the canons of scientific research. Though this trend in educational research has to an extent bettered our understanding of effective pedagogical practice, science cannot and won't solve many of the conundrums teachers daily face inside the classroom. As this paper will argue, this is partly because education raises fundamental questions of value that are beyond the purview of science.

Introduction

Ever since the dawn of human rationality, our natural surroundings have always evoked awe and wonder, resulting in speculations concerning their natural causes and intrinsic nature. Thunder and lightning not only provoked fear for the unknown but whetted our ancestors' appetite to explain its underlining mechanism. Our forebear's yearning for knowledge was also provoked because the natural world evidenced how animals, insects, and

plants were all well-adapted to their habitat. Prior to science, the theoretical accounts of nature often resorted to metaphysical entities and unverifiable philosophical principles. Thunder was thought to be the manifestation of the wrath of demigods and species were well-adjusted to their environment because they were created by a divine intelligence. The intellectual viability of metaphysics and philosophy to explain the laws of nature atrophied and lost credibility when more and more people started adopting science as a mode of investigating the workings of the world. Instead of explaining the nature and behavior of human anatomy and the trajectories of planets in terms of philosophical speculation, people began to explore and seek answers to their queries by subjecting natural phenomena to tightly controlled empirical experiments. With the advent of science, many hitherto inexplicable anomalies and mysteries were brought to light. Newton, through painstaking and meticulous analysis, discovered the laws of motion and gravitation and Maxwell successfully substantiated the intricate relationship between electricity and magnetism. Careful data collection and analysis led Darwin to postulate natural selection to make sense of the variability that exists between species and Harvey discovered the function of the heart and its vital role in blood circulation by adopting the same approach to human anatomy. The success of science demonstrates that nature discloses its secrets to those who subject it to careful empirical scrutiny.

The hallmark of the scientific method that has revolutionized our understanding of the world involves, first and foremost, the postulation of empirically testable hypotheses that attempt to explain a particular phenomenon, to put pieces of the puzzle together, or solve an anomaly. The conjectures are empirical in the sense that they make reference to the world of experience (not to an alleged supernatural realm that transcends the empirical world) and they are testable because they (directly or indirectly)

refer to publicly observable states of affairs that are either compatible or incompatible with what they empirically assert. Once the hypothesis is proposed, members of the scientific community subject it to trenchant criticisms and empirical tests to attest its validity. Science is a communal enterprise where scientists get together to discuss ideas, design experiments, offer critical feedback, and search the truth through mutual criticism. As Dixon (1973) explains, "Science is not a pursuit for the lone recluse, but an activity of an international community of research workers who constantly cross-check their findings and criticize each others' work" (p.35). If the hypothesis withstands the tests, it is tentatively accepted as giving a reliable account of the world. If further evidence that supports the hypothesis is accrued, its verisimilitude grows. That notwithstanding, even hypotheses corroborated by evidence are not incorrigible and irrevocable because facts and data obtained in the future may falsify what they claim. "A million confirming observations merely provide evidence not absolute truth for the correctness of a theory" (Ben-Ari, 2005, p.63). Once problems with the hypothesis are identified, a new theory that is immune to its problems is formulated. The new hypothesis, however, will eventually face falsifying evidence which it cannot adequately explain, whereby the scientific community will seek more accurate and coherent accounts of the world. Empirical science bears witness to a long and arduous process of trial and error in which theories incorporating the truths of conceptual schemes that preceded them are subject to refutation because they are by nature fallible and provisional.

Though the scientific method has tremendously advanced our understanding of the physical world through the discoveries it has made, there are many themes and issues that are beyond its competence. Science is not omnipotent, capable of explaining every conceivable anomaly by

subjecting it to empirical tests. It has inbuilt limitations which preclude it from addressing particular kinds of questions. One such question concerns values. Although the method of science can be used to analyze empirical matters, it cannot be implemented to study and solve questions about values. Three examples will be given to illustrate this point.

First, people often express aesthetic judgements about what is and isn't beautiful or sublime. While some despise Dadaistic art, others are enamored of its unconventionality and artistic depth. And though some find solace in Rococo art, others find it distasteful. Some are drawn to classical music, relishing the symphonies of Mozart and Schubert, while others find it banal and unstimulating. Using visual arts as an example, science can empirically determine the weight of a painting, its age, and the chemical composition of the canvas. But it cannot through experiments and measurements alone determine whether or not it is beautiful. Questions of aesthetics are not empirical by nature; empirical data – size, weight, color, etc. – cannot unequivocally determine the aesthetic quality of any given piece of art. Science can reveal the chemical composition of Rembrandt's self-portrait but not its sublimity. What counts as beautiful springs from the taste, experience, personality, and philosophy of each and every individual. If the aesthetic value of art were a question of fact a consensus would be easy to reach. The very fact that questions of aesthetic merit are contested suggests that they are outside the orbit of scientific analysis.

People also convey their moral views on many issues by pronouncing certain behaviors, policies, or attitudes as ethical or unethical. While some denounce abortion, capital punishment, and euthanasia as morally repugnant, others don't see anything morally dubious or questionable about such practices. Science can certainly administer surveys and polls to empirically determine how many support abortion and the number of people who have

practiced abortion. But these facts alone don't in one way or another settle whether abortion is morally sound. People's opinions don't reliably reveal the moral worth of common practices. In the past, the majority of people viewed slavery, patriarchy, and corporal punishment as unquestionably ethical and denounced the women's right to vote and attend schools. And numbers detailing the prevalence of abortion don't lend themselves to definite moral solutions because vast numbers of people can and do adhere to unethical practices such as gender discrimination and jingoism.

The last example concerns what people regard as ultimately important in life. Again, people markedly differ in their views. Those who embrace a hedonistic philosophy of life contend that physical, sensual pleasure is the end they strive for, imbibing the best wine and dining at the finest restaurants. It is characterized by "an orgy of individual gratification in the form of consumerism; heavy reliance on sex, drugs, and music for release and distraction; a never-ending pursuit of still greater heights of pleasure" (Purpel, 1989, p. 23). Others despise hedonism as too self-centered and pursue a life of faith, dedicating their entire life to God. Many nonbelievers who find religion despicable and illusionary center their lives around politics, maintaining that self-less devotion to the well-being of humanity should guide their life. Still others orient their lives around their family and children, devoting their time and effort in raising a close and loving home. Because every philosophy of life embodies values which people regard with utmost importance, science cannot through empirical investigation pass judgment on its viability. Science can undoubtedly confirm why people commit themselves to certain ideals and the kind of life people generally lead when they orient their life around a particular ideal. Thus, it can empirically ascertain how the pleasure hedonists seek is, on the whole, ephemeral while religious faith gives courage and steadfastness when encountering the travails in life. But science cannot

thereby conclude that the life of faith is preferable to hedonism because for those who value pleasure, psychological serenity brought by belief in God is unimportant while for people of faith, peace of mind when confronting the vicissitudes of life is all that matters. Conversely, a hedonistic philosophy will be nothing more than the embodiment of self-centeredness for those who find meaning and purpose by serving a higher, divine purpose. As Smith (2001) writes, "The campaign against ignorance has expanded our knowledge of nature, but science cannot tell us what we should give our lives to" (p. 152).

As science, by utilizing the empirical method, slowly made progress in both explaining and predicting the course of nature, those working in newly established fields like sociology and psychology became convinced that the problems they attended to would become susceptible to clear solutions if they too adopted the scientific method. The special appeal of science, and their hope that it will help yield definite results, are understandable given that their disciplines showed very little sign of progress. Different schools of thought not only identified different causes, but adopted varying methodologies, and proposed conflicting solutions. Consequently, the underlying causes of social inequity or the psychological factors that give rise to depression remained insoluble, shrouded in mystery. Many thought that a way out of this quagmire was to conscientiously harness the scientific method of proposing hypotheses and subjecting them to empirical tests. To be sure, many disciplines have succeeded in making theoretical progress by embracing and following the principles of scientific reasoning. Consider medical science. During its infancy, many practitioners implemented counterproductive procedures for handling illnesses. Many resorted to superstition, empirically unfounded sayings, and dubious traditions to treat physical ailments. By conducting rigorous scientific experiments, however, medical science has found cures for problems – malaria, polio, etc. – that

were once thought to be fatal and incurable. No one who has reaped the benefits of modern medicine will approach a witchdoctor or soothsayer when suffering from cavity.

Another field that has benefited greatly by incorporating science is criminal investigation. Before bringing those suspected of crime to the court of law for a fair trial, investigators can now marshal more reliable evidence by conducting DNA testing, examining fingerprints, and analyzing the suspects' psychological state of mind through psychiatric interviews, none of which would have been possible without forensic science. Without the benefits of such methods, criminal investigation in the past had no choice but to rely on eyewitness accounts and past criminal records, both of which are not always reliable ways of determining the culprit.

Besieged by innumerable problems that recur throughout the history of education, educational inquiry has also sought refuge in science to help solve the perennial problems of pedagogy. Throughout the course of history, many thinkers and reformers interested in educational issues mandated prescriptions that they thought would revamp prosaic classrooms to vibrant places for learning; curricular changes and more effective pedagogical practice would ensure students' unflagging attention to learning and replace their reticence with dedication and enthusiasm. For the most part, the recommendations in the past hinged on abstract, metaphysical views that were not buttressed by empirical evidence. The Platonic tradition, for example, proposed an elaborate educational scheme that was largely based on its philosophical understanding of human nature and what it thought constituted the moral life. Romanticists also prescribed a wide ensemble of educational practices that was rooted in their vision of an ideal society untainted by social constrictions, coupled with their view that children, left largely to their own, will bloom intellectually. Education was a battleground

for rival philosophies, lacking in objective criteria that would help absolve such metaphysical differences. While the Platonists extolled the virtue of deductive thinking and maintained the importance of a pre-established curriculum, Romanticists were strongly in favor of hands-on experiences to facilitate learning and eschewed curricular plans that were not derived from the students' unique dispositions and interests. A consensus was hard to reach given such deep-seated, irreconcilable presuppositions and commitments.

To help introduce more rigor to educational inquiry and end the perpetual clash of worldviews, many today argue that science should become the predominant paradigm of posing and answering questions in education instead of "relying upon unreflective experience, common sense, 'subjective' views, untested opinion" (Pring, 2000, p. 32). That way, it is argued, education will not unlike physics or chemistry yield reliable knowledge, solve problems, and discover laws that govern learning and teaching. Once we follow science and acquire the relevant laws and knowledge, then it becomes a matter of translating what we learn to effective practice that embodies their insights into human learning. The teachers' role would consist of faithfully applying the fruit of scientific research in the classroom, and student learning is ensured because teaching is founded upon science. Or as Kincheloe argues, teachers "are induced to improve their understandings of the educational process by consuming and incorporating the distanced scientific knowledge of the experts into their professional labors" (p. 66). This overall picture of the relationship between science and education has given birth to a range of scientific research programs conducted in different educational contexts to address and solve the basic problems of education. Classroom research founded on scientific principles is an endemic feature of present educational inquiry, where researchers investigate the effectiveness of various

instructional approaches and the types of tasks that promote learning. Recent science-based studies also analyze the types of interactions that take place in the classroom, ranging from the kinds of questions teachers pose to students to how students orally interact among themselves when in groups. Advocates of such investigations contend that they will help unlock the mysteries of pedagogy and thereby scientifically establish the conditions that are conducive to meaningful and enduring learning.

Though the scientific approach to education is commendable, it has its limitations and shortcomings, one of which is that education by nature entails questions of value – what is right and wrong, beautiful and unattractive, important and secondary, etc. – that cannot be settled empirically. That is, large areas in education are not susceptible to scientific analysis, for they pose questions of value that are beyond the confines of science. This point will be made more explicit by examining the issues raised by an important aim of education, namely the transmission of knowledge.

What knowledge is

Education is the deliberate attempt by teachers to bring positive changes in their students. Lessons are planned, curriculums are devised, and tasks are set so that those under their charge will undergo experiences that will have a constructive and lasting effect on their intellectual, physical, and emotional life. Teachers, among other things, devise activities that challenge their misconceptions and set texts that widen their mental horizon. They also assign cooperative learning tasks to help build their ability to interact and communicate with their peers and many devote countless hours both in and of school lending an attentive ear to their students' personal problems. One of the other crucial aims of teaching is to impart knowledge that helps students

become less ignorant and more knowledgeable about the world they live in. The acquisition of knowledge is valuable because it enables students to become more cognizant of their surroundings through the lens of what they learn. Historical knowledge helps one see how the present political states of affairs are built on the past and scientific knowledge aids in unraveling the puzzling features of the environment once their underlying causal mechanisms are understood.

Because knowledge is instrumental in raising awareness and deepening understanding, a large portion of teaching is quite rightly devoted to the transmission of knowledge whereby students are exposed to a rich and vast range of dates, nomenclatures, conventions, formulas, laws, maxims, and theorems deemed worthy. Yet if knowledge is paramount, if it is something valuable that must be carefully preserved and passed on to future generations for edifying purposes, then one must know what the nature of knowledge is and how it differs from claims, assertions, and contentions that are not. Without a clear criterion that helps adjudicate what is and isn't knowledge, teachers can end up imparting theoretically dubious content, filling their students' mind with useless pieces of information.

What, then, is knowledge? For any proposition, theory, or hypothesis to count as knowledge, it must be true. Knowledge-status cannot be bestowed on claims that are false. Falsified theories – the steady-state theory of the cosmos or phlogiston theory – are merely failed attempts to build our knowledge of the world. Knowledge is also the product of utilizing reliable methods that don't typically lead us away from the truth when used properly and conscientiously. Though the scientific method of subjecting empirical hypotheses to tests is a reliable mode of discovering truth, telepathic communication or palm reading isn't because the truth-claims are nebulous and when they make testable claims, they have been repeatedly and

consistently shown to be untrue. Though many concede that knowledge entails truth and that it is established by reliable methods, they still disagree over what constitutes knowledge because, as we shall see, epistemology is not immune from values.

Degrees of truth: As was mentioned, in order for any piece of information or datum to be included in the corpus of human knowledge, it has to be true. The geocentric theory of the solar system and the theory of the ether to account for light traveling through space have been refuted so they don't comprise human knowledge. Furthermore, astrological claims that correlate our future destiny with the location of stars are pseudoscientific assertions that are not granted knowledge-status because their predictions are unreliable, inaccurate, or wrong. On the contrary, relativity theory is a reliable model of time and space because experiments have shown that time slows down and objects contract when they approach the speed of light. The current model of the atom, where electrons with negative charge orbit the nucleus, is another theory in science that has been confirmed by ample experiments.

Yet within any given field, there are theories, though not untrue, that haven't been verified by a wide spectrum of data and adduced by convincing arguments. They remain probable hypotheses until more evidence can be amassed to establish their truth. The theory, for example, that biological evolution was brought by sudden, dramatic environmental and physiological changes is a provisional hypothesis that awaits further future evidence. Or consider the origin of life. The fundamental constituents of life are proteins which are made up of amino acids. Science still hasn't deciphered beyond reasonable doubt how long and complex chains of amino acids formed from inorganic, lifeless matter. Though very few would question the idea of including well-corroborated theories in the curriculum, teachers and

curriculum specialists differ markedly over the question of whether students should be exposed to hypotheses that haven't been extensively verified. Some regard as knowledge only those theories that have been verified thoroughly because they place a premium on certainty and therefore seek schools to teach what we know for certain. Others have a more far-ranging, broader view of knowledge; theories without firm empirical support still count as knowledge because they value probable truths. Thus, they would not want the curriculum to be too restrictive, transmitting only incorrigible truths. The question of what constitutes knowledge, therefore, cannot be answered without invoking values; though some value scientific theories that have been confirmed by a wide range of data, others prize knowledge that lacks the same degree of certitude.

Empirical science can by means of surveys and questionnaires certainly figure out what percentage of the teacher population values provisional knowledge. But the figures themselves don't really tell what people should espouse because the majority can endorse something they shouldn't and the minority can value something they should. Recent sociological polls, for example, reveal that most people in many developed countries favor surrogate motherhood and euthanasia. But results such as these simply reveal what people actually believe, not what they should value and uphold. Similarly, even if the majority of practicing teachers seeks a curriculum that only covers well-corroborated scientific knowledge, one cannot thereby infer that they should only impart well-established knowledge. Statistical data in education which convey what people think and value may have sociological value but they cannot dictate educational policy. The mainstream view can and often does deviate from the truth while prophets, saints, and sages who don't share the thoughts that characterize the socio-cultural milieu have enduring insights that withstand the test of time.

Method: Besides truth, for propositions and theories to count as knowledge, they must be established by methods that are thought to be reliable. Geometric theorems pass this test because they are derived deductively from self-evident premises and well-established scientific knowledge meets the same criterion for it has been subjected to a vast array of critical tests and criticisms that all attempt to question what it maintains. Beyond such paradigmatic cases, whether or not a particular method is an effective means for establishing truths often hinges on the values people embrace. Consider religious revelation. The monotheistic faiths all affirm the existence of a personal God who revealed his nature, purpose, and will to humanity. The nature of God would have remained totally concealed, shrouded in utter mystery, unless he took the initiative to unveil himself. Because God is by nature the transcendent creator of the world, he is not a being amongst other beings in the universe. His nature and purpose cannot be clearly discerned by empirically examining the items of the world; that is, we cannot unambiguously discover what God is like and the purpose he intends to realize through creating the world by investigating planets and rocks. Divine revelation, for the believer, is the only way of learning what is crucial for human salvation. Now, for atheists and agnostics, revelation is not a proper mode of acquiring knowledge because they question the very existence of God. Faith in a God that bestows truths is conceived to be an irrational, superstitious myth from a bygone age. A being that doesn't exist cannot by definition reveal himself. Hence, for those who have faith and value the religious dimension of human existence, revelation is an indispensable way of deepening their understanding of the ineffable mystery of God. For those who lack faith and understand human religiosity as the epitome of intellectual irrationality and immaturity, revelation is both an unreliable and dubious means of acquiring knowledge. The very possibility of theological

knowledge is contingent on the values we have towards religious faith.

Though one may be tempted to appeal to science to determine the viability of revelation as a way of yielding propositional truths, it is not capable of doing so because God is a being that transcends the empirical world and science cannot investigate what it cannot test empirically. Unlike what science can competently study, God is not a finite object like planets and chromosomes that occupy space, have mass, and reside somewhere in the solar system or a distant galaxy. The author of a novel is not one of the protagonists who appears in the story and the farmer is not one of the vegetables that she cultivates. By the same token, God, the creator of the entire cosmos, is not an item that appears in the universe he is creating. Thus, because science cannot probe the universe with sophisticated instruments to verify the ontology of God, it cannot determine whether historical events and prophets can mediate his purpose and will. The method of science can be applied to solve questions that are raised within the bounds of what can be studied empirically but it cannot address let alone answer questions that touch on matters that transcend the empirical world. If a transcendent and nonphysical God exists, it “would be impervious to scientific exploration and experimentation. Science can study only what it can measure and quantify in the physical world” (Brush, 2005, p. 189).

Types of truth: Just as there are many intellectual disciplines that seek to deepen our understanding of ourselves and the world, it seems fairly sound to assume that there are different types of truths established by these disciplines. Mathematical truth is characterized by its certainty because it is derived deductively from logically self-evident premises by applying logically valid inference rules. Their unassailable truth cannot be denied without committing a logical contradiction. Scientific truth, though for the most part corrigible, is discovered by postulating empirical hypotheses and subjecting

them to experimental tests. This approach to empirical phenomena has been instrumental in discovering many laws that underpin the natural world. Historical truth is another type of truth discovered by historians when they garner evidence to support their theory by inspecting historical documents and scrutinizing archeological records and artifacts. Through historical investigations, historians pierce through the fog and mist that separates the past from the present building an accurate picture of what took place.

Given the fact that there exist many disciplines, each deepening and extending our understanding of the world by utilizing different methods, it seems natural to assume that there are different kinds of truth (historical, mathematical, etc.) which students can learn. Some, however, question the teaching of separate, autonomous disciplines and their disciplinary knowledge because they deny the plurality of truth. Typically they pronounce disciplines outside the one they endorse as incapable of discovering truth. For example, those who champion science as the apotheosis of rationality and objectivity are leery of disciplines like music and art because they don't manifest the same features that characterize science. Unlike science, art and music don't engender a body of knowledge that gives a true and reliable account of the world. Contrary to scientific hypotheses, paintings by Picasso and symphonies by Beethoven don't depict unambiguously and concisely what the world is like. These great works of art convey the artists' subjective stance and attitude towards life and experience, not objective portrayals of empirical phenomena. Monet's canvas might convey his emotional response to a lake but it doesn't reveal its chemical composition. The history of art, furthermore, is not marked by progress; modern art is not necessarily an improvement upon classical art. For those who espouse the works of Monet or Cezanne, the paintings of John Pollock and Andy Warhol are devoid of aesthetic merit. On the contrary, few would

affirm that Epicurus's theory of the atom gives us a more reliable model for understanding the subatomic world than quantum theory. Science, for those who embrace positivism, is the sole arbiter of truth, and disciplines that don't follow its methods and way of thinking don't yield truth. They contend that "science's methods are universal and all-encompassing, in the sense that any claims to knowledge arrived at by others means are spurious" (Hutchinson, 2011, p. 131). Thus, for those who value science, disciplines that make empirically unverifiable truth-claims cannot engender truth. Truth is the prerogative of science. Precious time in education is wasted if effort and energy is spent on learning what cannot be ascertained as true. Positivistic philosophy in turn has its critics. Many critical of positivism argue that great literary works, for example, give us deep, penetrating insights into the human condition that cannot be brought to light by the arcane and dry language of science. Existentialist literature vividly portrays the utter meaninglessness of life where people have no choice but to face life's absurdity with stoic courage and forbearance. What's more, utopian literature indirectly insinuates the flaws and contradictions inherent in society by depicting a society free from human greed and egocentricity. These powerful and convincing pictures of our plight cannot be depicted by mathematical equations and empirical data. Critics of positivism who are convinced of the power of literature don't jettison scientific knowledge as such but accept multiple routes to truth and question science's monopolization of knowledge. In sum, the question of what constitutes truth and knowledge elicits different responses, depending on the disciplines people value.

Both positivistic and anti-positivistic accounts of science are philosophical views about science. They are not one of the many empirical findings or discoveries made by science but are attempts to make sense of

the scientific enterprise from a philosophical point of view. Impressed by the spectacular and unparalleled growth in the body of scientific knowledge and by how the empirical method can be implemented to discover objective truths, positivists conceive science as the gold standard of rationality and objectivity, a yardstick that measures the worth of other disciplines. Positivism is not science; it is simply a philosophical understanding of, a way of interpreting, the methods, assumptions, and aims of science. Similarly, anti-positivism is not science but meta-science, an overall philosophical approach of studying the canons, the findings, and the limitations of science. It typically exposes the inherent limitations of science by posing a series of questions it cannot answer empirically and discloses a wealth of well-corroborated facts that cannot be confirmed by science. It advances argument after argument to show how there are multiple paths to truth besides science. Again, anti-positivism is not science in the sense that it is not one of the many discoveries disclosed by the empirical method.

Now, since the heated disagreements between positivists and anti-positivists over the subject of truth are philosophical in nature, it is not within the power of science to help settle the dispute. Not unlike other philosophical problems, its solution demands conceptual analysis and logical arguments, not controlled experiments and careful measurements. Just as the philosophical debate over the existence of a mind-independent reality or the controversy surrounding the true nature of causality or the nagging philosophical problem concerning the relationship between the mind and body cannot be solved by scientific explorations, science cannot show which philosophical view of science is viable. Scientific investigations ascertain the truth-claims of hypotheses and theories, they cannot ascertain whether scientific truth is the only truth there is. Science explores the world within the limits set by its methods of inquiry, but it cannot thereby claim that there

is nothing beyond the world it investigates. In short, science doesn't concern itself with metaphysical themes that are not subject to the rigors of empirical analysis.

Why knowledge should be taught

Education is a goal-oriented endeavor. Teachers conduct lessons which serve very particular short-term goals. Students read a text to build their vocabulary and write poems and short stories to cultivate their imagination. They also conduct experiments using microscopes and bunsen burners to learn how to investigate matters scientifically. They study about the distant past to help understand the similarities and differences that exist between separate epochs in history. Education also attempts to help realize particular moral aims. Books about saints and prophets are read so that students learn the importance of love and compassion for those in need and the darker and more sinister side of human history is learned to ensure the importance of peace and justice. Group work is set so that students learn to trust and help one another and moral dictums are enshrined in school mottos which students are expected to follow. Besides moral aims, schools seek to enrich the students' aesthetic sensibility through art and music. The life and work of creative geniuses are studied so that they can appreciate the beauty and sublimity of Mozart and Picasso. What happens inside the classroom is driven by short-term goals which are thought to contribute to a richer and more meaningful life for students.

Besides short-term goals that directly affect what daily takes place in class, schools serve more long-term goals that give meaning, purpose, and direction to schooling. They are more abstract and philosophical in nature, reflecting what schools think are binding, laudable, and important. What are

some of the more prevalent long-term goals that can be found in schools? One aim is to help students acquire the necessary knowledge and skills “so that they may qualify for better-paying jobs and to increase our nation’s ability to compete economically” (Noddings, 2013, p. 43). Nations compete against one another in the perpetual march to outperform their competitors in terms of economic growth and technological might. To help advance the economy, schools are held accountable for instilling what can be usefully applied in the workplace. Thus, many schools have courses on computer technology, accounting, and communication skills because they can be readily used when doing work. Less time is allocated to subjects – art, literature, music – that are not directly relevant to economic and technological growth. Schools founded upon religious faith typically endorse religious precepts and principles that are considered sacrosanct. Christian schools mandate religious instruction where students learn the Holy Scripture in depth and delve into the works of the early Church Fathers who laid the foundation of Christian theology. Time for meditation and prayer is set aside so that students can enter into a personal relationship with God and they also engage in different types of volunteer work, visiting hospitals, rest homes, and shelters for the homeless. Progressive schools underscore the value of nurturing critical thinkers who willingly question what they are exposed to both in and out of school. Critical thinking is thought to be paramount because it enables students to become agents for social change by exposing the biases and prejudices that are found in society, by unearthing the distorted hegemonic ideologies that support the status quo, and by uncovering and exposing the uncomfortable facts and figures autocratic rulers seek to conceal. Consequently, they are taught the value of, and gain practice in, discerning fallacious reasoning, identifying underlying assumptions and biases, and differentiating fact from fiction. The importance of critical thinking is also

fostered by learning about societies, both past and present, that constrain and subjugate their subjects by suppressing critical thought and by exposing students to more democratic social orders in which ordinary citizens are given more leeway to express dissent and criticism. Another common aim found especially in countries that are keen on preserving the status quo is the creation of docile, subservient subjects who comply with authority. Such schools are saturated with political propaganda that not only glorifies those in power but portrays the present state of affairs in a glowing manner, ensuring the public that there is no need for radical change. Information is tightly controlled; anything that doesn't accord with what the regime wants the populace to know is censored and ideologies that praise the greatness of the socio-political system are disseminated with utmost care. Political and ideological dogma is handed down by authorities for students to accept unconditionally and "arguments and facts are forced to coincide with the dogma. Students cannot accept statements that do not agree with the dogma" (McCain and Segal, 1988, p.38). Contrary to schools that serve suppressive regimes, those that follow values espoused by the liberal arts curriculum offer a very different educational program. Great emphasis is placed on introducing and building a broad understanding of what is deemed important in a myriad of disciplines. The canons of great literature are scrupulously analyzed to nurture an enduring appreciation of narrative structures and poetic language and students immerse themselves in the historical past to become acquainted with their cultural heritage. Students learn about the natural sciences so as to become acquainted with the complexity and beauty of nature made possible by theories couched in beautiful yet simple mathematical formulas and equations.

Aims are not abstract ideals that have no bearing on schooling. They exert a potent effect and leave an indelible mark on what students

experience at school, influencing every aspect of their lives. The relationship students have with their teachers largely depends on the values educational aims reflect. In progressive schools teachers are not regarded as the embodiment of knowledge and wisdom. Instead of engaging in didactic lectures, where content is poured for students to passively and faithfully acquire, teachers play a more facilitative role, guiding and assisting students who typically engage in more collaborative tasks. This is in stark contrast to schools that adhere to a traditional, liberal arts curriculum. Lessons are more teacher-centered where teachers stand next to the podium, chalk in hand, imparting content for rote-learning. It is characterized by “the inert transmission, the delivery and redelivery of segmented and self-contained dates and formulas” for retention (Rose, 1989. P. 190). Besides teacher-student relationships, aims impact the skills students are required to master. While students in schools that closely follow a traditional, liberal arts curriculum can be seen deciphering the meaning of classic texts in philosophy and literature and memorizing lines of poetry, those attending schools that emphasize practical, relevant skills spend more time typing resumes, reading texts that address urgent contemporary issues, and writing essays on themes that evoke their interest.

Aims also invariably influence the content or knowledge schools impart. To be sure, there are materials most, if not all, schools teach because they are fundamental and crucial for students growing up in any social setting. Whether enrolled in religious or secular institutions, students are all taught a smattering of basic arithmetic, geography, and history without which they cannot function effectively in society. Aside such rudimentary knowledge, schools vary in what they teach because the aims they endorse are different. Religious schools devote considerable time instilling the moral teachings of their founder for ethical guidance and imparting orthodox doctrines on God,

creation, and eschatology to counter heresy. Curricular guidelines of most nonreligious schools, however, don't ostensibly cover theological themes. Religion might be touched upon when covering the Middle Ages or when reading the works of Blake or Eliot. But secular institutions remain theologically neutral on religious matters. Religious instruction is limited to passing references in fear of indoctrinating their students with theological dogma. Furthermore, content covered in progressive schools radically differs from those serving totalitarian states. Because the overriding aim of progressive education is for students to develop the disposition to question what they encounter through books and the media so that they can help build a more democratic and just social order, they learn much about the socio-political ills that beset society and their underlying causes. Social activism, after all, presupposes a deep awareness of both the problems that affect society and how they arise. Without becoming cognizant of how political power struggle, human greed, and economic mismanagement cause unnecessary social inequity and discrimination, students cannot engage in social reform. Those reared in totalitarian states, on the other hand, are fed a curricular diet delineating the feats and accomplishments brought by the present regime so as to suppress discontent and instill a lasting appreciation for the fruits and benefits students enjoy. The status quo cannot be preserved unless it is seen in a favorable light. Knowledge of the outside world is skewed. The living conditions of foreign countries are portrayed negatively and the problems they face are magnified because that way students will feel grateful for what they have and will not experience discontent. Thus, in such totalitarian states, "the educational and cultural system is an exceptionally important element in the maintenance of existing relations and domination and exploitation" (Apple, 2012, p. 9). Again, schools which seek to mold students who can contribute to the nation's economic

advancement are disinclined to teach unpractical subjects that cannot be used in the workplace. As a consequence, subjects like art, music, and literature are marginalized for they don't directly help advance the economy or induce technological breakthroughs. Instead of reading poetry, composing music, and appreciating Surrealism, a large part of the students' education revolves around practicing skills and acquiring knowledge that will be conducive to economic prosperity. Students educated in traditional, liberal art schools, on the contrary, grapple with the canons of great literature, wrestling with the cornucopia of ideas and issues they raise. They also delve into the past by following the historical trajectory from ancient Greece to the contemporary scene, and transport themselves to unfamiliar, alien cultural traditions through learning a foreign language.

Among the many educational programs that serve the same aim, science can determine which is most effective. Schools with a liberal arts curriculum can be compared for their effectiveness by, say, conducting tests that assess how much knowledge students retain after a particular period of time. Or tests on logic and analytic thinking can be administered to determine which school best cultivates the ability to detect fallacious reasoning and to think about a particular problem from alternative viewpoints. But it isn't within the province of science to determine which of these educational aims schools should follow. Ultimately the values we hold shape our views towards these aims. We would value progressive education and view schools subservient to the state with distaste and dismay if we seek students who take proactive measures to eradicate undemocratic, unjust social conditions. Just as science cannot establish whether abstract painting is more valuable and aesthetically more beautiful than classical art, it alone cannot determine whether social change or social compliance is more laudable as an educational goal because that would depend on the values people hold. Those who espouse social

restructuring would find any form of obedience to authority appalling and degrading while those who endorse political conservatism would view social activism as being too disruptive and radical. Those who want to separate politics from education, and think that students should be grounded in a wide and rich range of curricular subjects, would favor a liberal arts education to schools guided by progressive values. Again, as science cannot attest whether or not abortion or capital punishment is ethical, empirical tests conducted in laboratories cannot determine whether progressive education has more educational merit. Thus, because the values educational aims reflect largely determine the content students learn, and because science cannot determine which values are comparatively better, the question of what students should learn cannot be addressed by science.

Who should decide what should be taught and how much should be taught

Who: One of the greatest ironies in education is that those most affected by educational policies and decisions, namely students, have the least power to control their educational experience. Rules and regulations found in school that enjoin how students should dress, behave in class, and address their teachers are unilaterally decided by administrators, teachers, and the school board. The timetable to be followed is predetermined before students even set foot in class; they don't have any right to choose the order in which they are taught. For the most part students have no say in influencing how they are taught. Teachers implement methods and strategies without taking into account the approach to teaching their students think promotes learning. In addition, teachers, by and large, set tasks without consulting their students and finding out what activities they find enticing and meaningful.

Students don't retain the privilege of determining the content or

knowledge they are expected to acquire. The curricular subjects are fixed before class commences. Math and science are taught irrespective of whether students find them interesting and relevant and they take lessons on art and music regardless of their competence in drawing and composition. The content that is taught in each subject is also predetermined. Regardless of student interest and aspiration, the history curriculum covers the political turmoil and unrest of the Medieval Period and in biology the fundamentals of human anatomy and zoology are taught. Without gaining their consent or approval, students are expected to read the works of Shakespeare and Milton during English and memorize chunks of grammatical rules and set phrases when studying a foreign language.

Those who advocate a top-down approach to knowledge transmission are adamant that there are fundamental concepts, arguments, facts, and theories that students need to systematically learn in any given field and, irrespective of their interest, there are core curricular subjects that need to be taught if the aim of education is to create learners who are well-versed in many fields of knowledge. Students simply need to know some history and science if they don't want to remain intellectually blind and ignorant. Furthermore, they contend that students, when given the freedom to design their own learning, will simply pursue their personal interests (whether it be music, fashion, or cars) and avoid subjects that are challenging, being forever ignorant of quality literature, scientific breakthroughs, and basic mathematical knowledge. After all, students, without being coerced, can and will expand their knowledge of what interests them personally during their free time but will not, most likely, encounter the rich and wide troves of knowledge taught in school during the course of their private life. Another rationale for exposing students to core curricular subjects is that they provide them with the chance and opportunity to broaden their interests and

extend their concern and passion beyond their insular world. Through their exposure to literature or physics, seeds of new interests might be sowed and eventually bloom. Moreover, it is questionable whether students will make choices that will serve their long-term interests given that they have very little life experience and wisdom. Some may choose to learn subjects and themes that may have a pernicious effect on their mental outlook all the while thinking that they can only do them good. An unflagging interest in counterproductive themes like drugs and violence won't have a salutary influence on their lives. Finally, proponents of a top-down curriculum underscore the importance of exposing students to the same subjects because a uniform and standardized education will help establish cultural and national unity. By learning the same content, students, in theory, will internalize similar historical and socio-cultural knowledge that will glue otherwise disparate people by the background knowledge they share, making communication and mutual understanding possible.

Critics of predetermined curriculums, on the other hand, argue that students should choose the content they wish to pursue instead of being told what they have to learn. They are keen to point out that students are empowered when they are given the opportunity to mold and shape the course of their education. This sense of control over their learning is vital, they argue, because the realization that what they do and think can make a difference by influencing what happens to their lives is an important precondition to become more socially and politically proactive once they become members of society. Besides empowerment, critics maintain that they will be less inclined to capitulate when facing obstacles while learning because they are engaged in something they find captivating. People, in general, persist when experiencing problems and relish them as challenges if they stem from activities they find meaningful. Furthermore, schools are

being disrespectful towards students, critics argue, because the interests they bring to school are ignored for their banality and triviality, unworthy of sustained intellectual exploration. In fact, their fascinations are regarded as impediments to true learning; their mind, being preoccupied with matters devoid of intellectual substance, cannot attend to what really counts in education. Students will quite naturally conceive their interests as educationally unimportant if their fascinations are sidelined and ignored. It is also customary for teachers to force students to work and stay on task with threats and inducements, ranging from detention and suspension to trophies and stickers, because they regard schoolwork as an onerous grind they have to endure. The problem of disciplining and goading students to put more effort into their work will become less poignant because they will be engaged in something they find meaningful and relevant. As Doyle (2011) argues, "Choice helps improve interest in the topic. Enhanced interest means enhanced engagement" (p. 83).

So should students determine the content they want to acquire and pursue it in depth? The answer again hinges on values. If value is ascribed to building a sense of empowerment over and against breadth of knowledge, a learner-centered mode of teaching will obviously seem more sound and appealing. If weight is given to cultural and national unity, the advantages brought by persistence may seem educationally irrelevant. Both top-down and learner-centered approaches of knowledge transmission have their strengths and weaknesses, their pros and cons. How teachers, students, and curriculum specialists weigh the advantages and disadvantages of each approach will depend in part on the values they have towards education. People will opt for the approach which embodies their concerns and aspirations.

Because science cannot venture beyond the boundaries of the empirical

world, the questions it can legitimately pose and answer are restricted to what can be confirmed or falsified by experience. It is beyond science's area of specialization to inquire into normative questions – what ought to be done – because answers take us beyond what can be weighed and measured empirically. Through polls and surveys, science can figure out the number of those who follow a vegetarian diet but cannot thereby conclude that everyone should become vegetarians because it cannot empirically ascertain whether it is ethical to kill animals. Science, moreover, can estimate the economic cost and the number of casualties that will result from a war but it is beyond the purview of empirical studies alone to pronounce wars as categorically unethical because the idea of a just war raises normative questions that cannot be solved empirically. In a similar vein, science can through empirical means verify a wide constellation of issues that is relevant to learner-centered teaching. It can, for instance, conduct studies to examine the types of topics students are inclined to choose to study and assess their level of motivation when engaged in their self-chosen themes. Empirical studies can also reveal how much students retain when learning is self-directed. But the results of these studies cannot establish whether or not learner-centered teaching should be adopted. Even if learner-centered teaching does raise students' level of motivation and help them retain a significant portion of what they learn, critics would remain unconvinced because they prioritize, and find more value in, the creation of cultural unity and the broadening of students' mental horizon made possible by a pre-established, standardized curriculum. Conversely, proponents of learner-centered teaching would be unimpressed by studies showing how students set undemanding work when designing their curriculum because it is a small and trivial price to pay if they are empowered by being in charge of their education. In short, both critics and proponents of learner-centered teaching

value what their mode of learning can help realize and are unsympathetic towards, and don't see much value in, what the other pedagogical approach can help achieve. Science cannot demonstrate whether cultural unity is preferable to students experiencing empowerment or an increase in motivation brought by learner-centered teaching because it is not a question that can be settled empirically by measuring heights and weights. The scientific method can be used to measure how long students are focused when engaged in self-chosen tasks, but it cannot thereby proclaim concentration to be the most valuable fruit of learning.

How much: Education is obsessed with numbers. Students are given number grades that are said to show how much they know about a given subject or topic. When their grades are known, they are ranked from top to bottom according to how well they performed in tests. Standardized tests are frequently given and the results are used to measure how well teachers and schools are performing. Students' attitude towards learning is also measured in terms of numbers; their interest in reading, for example, is determined by how many books they read and their willingness to participate is often judged based on how many times they raise their hand in class or the number of times they forget their textbook.

The same infatuation with numbers can be gleamed from another important facet of education: knowledge. One of the central issues in education concerns how much knowledge students should be taught during the years they spend in school. Roughly, this issue has provoked two conflicting responses.

Some adopt a 'more the better' policy where it is thought that students should become acquainted with a plethora of subjects and learn as much content as possible within any given subject. That is, instead of focusing just on biology, the science curriculum should contain a wide range of fields

including other subjects like chemistry and physics. If physics is one of the curricular subjects taught, then it should introduce students to a variety of topics, covering the basic principles of electricity and magnetism, not to mention the revolutionary ideas of Newton and Galileo that transformed our view of the world. The language and arts curriculum should at all costs eschew a narrow introduction to a few subjects but offer an amalgam of disciplines, ranging from the visual arts and poetry to foreign languages and music composition. The same philosophy applies to what students learn in each subject. Thus, the English curriculum shouldn't be biased towards a particular genre in literature or writer. It should be a gateway to a kaleidoscopic variety of literary traditions, where they delve into the works of gothic and romantic literature and read historical novels and stories of the macabre. Similarly, history shouldn't just dwell laboriously on the Age of the Enlightenment, but explore the sociopolitical conditions that gave rise to it in conjunction with how it affected the historical events that followed.

Those critical of the 'more the better' approach propound a very different view of how the curriculum should be designed: students should focus their attention on a few central themes that appear in a much more limited and narrower range of subjects. Instead of tangentially covering a smattering of scientific subjects, the curriculum should zoom in on a particular discipline like physics and examine closely two or three of its fundamental concepts – gravity, force, inertia, etc. – in greater depth. The same view holds true for the language and arts curriculum. While undoubtedly students can immerse themselves in art, music, and literature and thereby acquire a superficial and brief introduction to each field, a more intellectually stimulating and enduring education involves students concentrating on a particular piece of art, say the paintings by Renoir, and acquire a deep understanding of them by studying the historical, cultural

context in which they were portrayed and how they embody aesthetic conventions that differ from the past. The idea of learning in depth is captured by Engell (2015): “a few potent things learned so well that children could use them forever” (p. 96).

So which approach is tenable? Should we seek a curriculum that decrees a lot of content or should we opt for one that limits the extent of what students should learn? Alongside the other issues we have examined, the answer in part depends on what values people embrace. Those in favor of quantity do so because they value students whose knowledge spans a wide spectrum of subjects. A polymath with encyclopedic knowledge is more worthy of our educational aspirations than someone with a narrow and myopic conception of the world. Proponents of a narrow yet deep curriculum, however, maintain that a deeper appreciation and understanding of something specific is more worthy than a curriculum that at best produces students who know a little about everything. In other words, depth of knowledge is more valuable than breadth of knowledge.

Science cannot meaningfully address whether breadth or depth is more laudable as an educational ideal. Science concerns itself with factual matters that can be confirmed by empirical data; scientists measure weights and heights; determine causal connections between empirical phenomena; and describe and analyze the empirical features of physical objects and events. While questions concerning empirical matters of fact – colors, weights, lengths, speed, etc. – can be ascertained by science, it is beyond its competence to address normative questions or questions about what ought to be done. Science can corroborate how much fuel a rocket needs to orbit the earth and the number of days the journey will take and the gravitational force that will be exerted on the spaceship. It cannot, however, empirically ascertain whether we should spend a large amount of money on space travel.

Science can give a precise account of the DNA molecule that contains the genetic codes of humans and the exact medical procedures that must be followed to clone people but the morality behind human cloning – whether it should be carried out or not – transcends the domain of scientific facts. In a similar vein, science doesn't have much to say about educational ideals because they involve normative issues – what students should be like – which are beyond its reach. It is certainly within the domain of science to measure and verify what and how much students learn when they follow a narrow or broad curriculum but it cannot thereby empirically adjudicate which approach is pedagogically preferable because the answer ultimately boils down to what people value. Those who value students with a wide range of disciplinary knowledge are critical of narrowly constructed curriculums because their exposure to knowledge is limited. Those who espouse depth are critical of curriculums that underscore breadth because students will only know a little about everything. Science qua science cannot on empirical grounds alone pronounce which educational vision is commendable. Science can certainly verify the educational benefits that result from a curriculum that prizes depth but it cannot thereby assert that they outweigh what students learn when they follow other curricular guidelines.

Which perspective should be taught

Cohen (2011) rightly points out that “Although teachers extend knowledge in different ways, the knowledge they extend is not neutral. To be taught and learned it must be construed somehow” (p. 115). That is, knowledge doesn't ordinarily exist in a theoretical vacuum. It can and often is embedded in a particular frame of reference or theory that bestows it with

meaning and value. Consider history. The historical facts historians uncover can be understood in light of Marxist social theory. From a Marxist perspective, there exists a universal process underlying the historical narrative that unfolds. History is a stage whereupon groups with power usurp and squelch subordinate groups through hegemonic ideologies that conceal the contradictions and injustices that are deeply woven into the social infrastructure. Human history can also be viewed and construed from a Nietzschean perspective where historical events are thought to bear witness to a perpetual and repetitive cycle of past happenings reappearing under slightly different guises. Furthermore, the historical narrative can be conceived from the point of view of Hegelian metaphysics; history for Hegel and his followers is the gradual unfolding and expansion of human freedom over an ever-expanding area of socio-political contexts, resulting ultimately in the construction of a liberal democratic society free from oppression and misery. Historical facts don't speak for themselves. They don't dictate and determine how they should be interpreted. Many frameworks can be brought to bear to help reconstruct historical events and episodes into a coherent picture.

Two points will be made in this section. First, as a way of illustrating how different theoretical frameworks can be used to explore issues found in any field of inquiry, morality and literature will be examined through the theoretical lens offered by different theoretical paradigms. And secondly, it will be argued that science cannot adjudicate which perspective teachers should adopt when teaching.

Morality: Schools serve multiple aims. Besides instilling useful skills and cultivating particular competences, they are expected to impart moral understanding and awareness thought to be binding by society. Hence, school mottos espouse the importance of teamwork and friendship while school

rules and regulations enforce and forbid particular kinds of behavior. Particular texts and readings are selected to promote moral ideals and teachers try to model ethical behavior when relating to their students.

Moral dictums and imperatives can be rooted in a theoretical frame of reference. They can, for instance, be anchored to a humanistic understanding of morals. Ethical norms, given this viewpoint, are invented by humans to help build social cohesion and harmony by sanctioning and prohibiting particular forms of behavior. We shouldn't steal and commit adultery because such acts have negative repercussions that do more harm than good to ourselves and society. We will all be better off if we follow moral precepts sanctioned by society. Social chaos would prevail if people discarded moral imperatives and simply followed their whims and desire. Furthermore, morals don't point to a transcendent source that justifies what is morally good and condemns what is morally impermissible. They are nothing more than conventions created by us to make life more manageable, predictable, and harmonious. Because different societies are committed to different ethical ideals, morality is not universal, but relative to where people live and grow. The morality of capital punishment depends on what moral codes society embrace – it is morally right in the Middle East but wrong in England. There are no overarching ethical standards that can question the moral imperatives found in different societies.

Ethics can be construed from a religious point of view. Morals, when situated in a religious frame of reference, take on a whole new meaning. The dictum to forgive those who do harm or to help those in need is ultimately a decree mandated by God. Particular ethical norms are binding not only because they have positive social consequences but also because they reflect what God wants us to do. Morals are not human constructs but express the will of God. We are obliged to turn the other cheek because it is a divine

imperative that reflects the purpose he has for creation and how he wants us to relate to each other. Because God is the creator of the whole universe, moral truth is not restricted to a given geographical area or social region. What he decrees applies to everyone living in any sociopolitical matrix. Committing adultery and practicing idolatry are wrong regardless of where and when we live.

The moral standards and principles schools wish to impart can be given a secular or religious interpretation. Secular humanists, being religious skeptics, want to separate moral education from religious underpinnings. Moral maxims don't need to be valorized and justified by religion because the very existence of a benevolent and almighty God is doubtful. Students can be taught to be respectful and caring without invoking the name of God. Critics also argue that moral behavior will be rooted in fear if we seek a moral life to avoid eternal damnation and secure a place in heaven. Not only is a life guided by fear damaging to psychological health, but it is also quite self-centered because people are driven by their desire to achieve happiness. Critics of secular humanism, on the other hand, insist that when morality is disassociated from God, people are less inclined to follow an ethical life because their will and outlook are distorted and tainted by the demonic power of sin. The impetus to do good will be lacking if God is not understood to be the author of morality. What's more, if morality is grounded in what societies find to be morally acceptable, morality will be engulfed in a sea of change, unable to offer clear ethical guidelines because societies undergo constant change.

People's attitude towards how to best contextualize morality, therefore, is colored by their religious values. Seen through the lens of secular humanism, the religious vindication of morality is not only superfluous but dangerous. But when morality is viewed from a religious frame of reference,

secular ethics has inherent difficulties it cannot adequately solve. Put differently, secular ethics is thought to be wanting by those who value faith in God and any attempt to base morality on religion will be derided by those unsympathetic to religious faith.

One cannot refer to science to help settle the thorny issue of basing morality on either a religious or secular foundation. Science through empirical experiments can certainly verify the existence of empirical objects like the moons orbiting Jupiter, the nucleus found in human cells, and protons located in the atom's nucleus. But unlike planets and atoms, God is not an empirical object whose existence can be detected by using telescopes and microscopes, no matter how technologically advanced they are. He is the creator of all there is, existing outside the space-time matrix, not one of the many finite beings he brought into existence. Because the perspective on morals to be adopted ultimately boils down to the question of God's existence, science qua science cannot touch upon this issue. The scientific method can be implemented to verify the existence of finite, empirical objects, not a being who is infinite and nonempirical.

Literature: Literature is one of the core curricular subjects taught in many schools and it helps realize multifarious educational aims. Through reading extensively, students cultivate a rich and wide vocabulary and their ability to write creatively and clearly is nourished. Because quality literature is brimful with philosophical and moral insights, they are bound to encounter and reflect on many profound, perennial themes such as the meaning of life or what moral ideals are binding.

There is no shortage of pedagogical approaches teachers of literature can take. Reading comprehension questions are often given to test understanding and essays are set to elicit their students' overall response. Another very common and essential pedagogical practice is to engage in

textual exegesis or to interpret the message or meaning of literary texts. Hermeneutics is indispensable because authors don't ordinarily convey their philosophical views explicitly. Literary works are not akin to Aesop's many fables where the moral of the story can be deduced without much scrupulous reading. The challenge for teachers is that any work of literature can be analyzed from multiple perspectives or "filtered through a grid of analysis, interpretation, and theory" (Graff, 1992, p. 74). Poetry, fiction, and sagas don't dictate a particular mode of literary analysis. What interpretive filters should the teacher adopt to help illuminate the meaning of any given text?

Many contend that literature can be construed most effectively when it is analyzed from a historical perspective. The hidden messages embedded in texts can be retrieved if what the protagonists do and say are situated in their historical context. Instead of interpreting everything in terms of our contemporary outlook, odd and seemingly incomprehensible events and behaviors can be understood better in light of the historical matrix in which they took place. The prevalence of slavery and the subservient roles women played in Athens can appear unethical if viewed from the paradigm we share but will seem more natural and ethical if such conventions are placed in their Greco-Roman context. Furthermore, the value behind literary texts can be appreciated more deeply if we are aware of the literary history that preceded them. Authors don't suddenly appear on the literary scene and start creating novels and poems. Even creative artists who transform their subject by inventing new styles of writing and genres inherit and are molded by the literary tradition established by their predecessors. By understanding the tradition they are raised in, we can further our understanding of why they write the way they do and why their works raise the themes they do.

Besides history, many are convinced that psychology has an important role to play in deciphering literary texts. One of the findings revealed by

psychology that is germane to textual analysis is the potent effect our unconsciousness has on our lives. Thoughts, feelings, and experiences trapped and buried deep in our unconsciousness are said to dictate and control our conscious lives. Our day-to-day lives – the thoughts we entertain, the kinds of behavior we engage in, the responses we make to our experiences – are driven by these blind, irrational forces which elude rational control. We may be able to make more sense of why the characters in novels and plays commit adultery, love someone despicable, and embrace macabre views on life by relating them to suppressed inner drives that are embedded in their psyche.

Philosophy is another discipline that can shed invaluable light on literature. Existentialism, in particular, can be extremely helpful in deepening our understanding of characters and events that appear in narratives. One of the central tenets of existentialism is that humans are not born with a fixed and predetermined nature that determines what we do during the course of our lives. Rather, we cultivate our disposition, character, potentiality, and fate through the choices we make in life. We choose, in other words, to become who we are. This insight into human nature can help us understand how characters in literature emotionally and psychologically grow through the choices they make. It can also help us learn about one of the fundamental weaknesses of human beings. That is, many characters artists portray resemble actual people in the way they evade the responsibility of shaping their lives through their personal choices by succumbing to fixed ideologies and belief systems that do all the thinking and deliberation for them. Another central doctrine of existentialist philosophy is that human life doesn't have any inherent meaning. The purpose and meaning of life is not pre-established by God, political leaders, or our parents. It is something we have to personally seek and find ourselves. Literature is riddled with protagonists who

courageously confront the existential void of life by bestowing it with some meaning and order, thereby revealing the shared predicament of humanity.

Given the fact that literature can be interpreted through multiple lenses, which theoretical frame of reference should teachers adopt? The answer will to a large extent depend on which discipline they value. Many see very little point in examining literature from a psychological perspective. Unlike physical science, there are many conflicting schools of thought in psychology, in which researchers pursue different questions and implement different methods. Because researchers adopt different theoretical paradigms, there are not a whole lot of research findings that everyone accepts without question. Those critical of psychology argue that it doesn't yield a body of objective knowledge that can be used to analyze literature. Those who are more positively inclined towards psychology accept many of the shortcomings of psychological research but argue that there is an element of truth to some of its more well-established findings. Though much of the theoretical claims of Freudian psychoanalysis, for example, is unfounded, it has helped unlock, however partially, the nature of human behavior by highlighting how our conscious decisions and deliberations are expressions of underlying unconscious drives. The anomalies and cracks in the Freudian edifice can be accepted without denying its many insights into the human condition.

Similarly, the value of philosophy for teaching literature is contested, largely because teachers differ in their overall appreciation of philosophical analysis. Some devalue philosophy because the issues and themes it raises are thought to be too abstract and theoretical, unrelated to the concrete issues students face in their lives. Many are convinced that philosophical investigations into, say, space and time will only turn students off because they don't mesh with the problems and dilemmas adolescents are typically

preoccupied with. Moreover, critics are also quick to point out how little philosophy has progressed through the centuries. Contemporary philosophy is still grappling with the issues raised by Plato and Aristotle, and the solution to philosophical problems seems to lie in the distant future. Philosophical musings, furthermore, are devoid of utilitarian value, for they don't help build advanced computers or aircrafts, and nor do they assist scientists discover new cures for cancer and diabetes. Those who espouse philosophy underscore the innumerable academic benefits that are brought by philosophical analysis such as a deeper awareness of the logical structure of arguments and the ability to write clearly and logically, coupled with a deeper appreciation of how life is riddled with philosophical problems that aren't susceptible to easy, quick solutions. Education should also cultivate philosophical inquiry because it is natural for people to ponder about the meaning of life and death as long as they haven't lost their sense of wonder and awe. By circumscribing philosophical reflection, schools are denying and denigrating what makes us truly human.

Again, because the overall merit of philosophy and psychology involves a clash of values, science qua science cannot help settle the dispute. All it can do is empirically ascertain the fruits – depth of understanding, retention of what they read, level of student of motivation, etc. – of studying literature philosophically and psychologically. But if one doesn't value the benefits brought by these disciplines, science cannot thereby pronounce their assessment as wrong. If, for example, philosophical analysis does in fact help students understand the existential themes embedded in the novels they read, science cannot denounce critics who want to devote more class time understanding how the story actually unfolded. Or though defenders of the psychological approach to literature might refer to scientific studies that show how psychology enables students to understand the emotional lives of

literary characters at a deeper level, science cannot cast doubt on those who champion a stylistic analysis of metaphors or a historical reading of literature. Scientific investigations can determine what students academically gain when they follow different modes of learning. But these educational benefits will be construed differently, depending on the aspirations and convictions people have. Science as an empirical discipline cannot weigh these values on a scale and pronounce them right or wrong without overstepping its boundary.

Conclusion.

By sending rockets to space and uncovering the building blocks of matter, science has won unprecedented respect and adherence in many quarters. Education is no exception. To transform the field of education from mere conjecture and speculation to pedagogical practice based on solid empirical evidence, many researchers and practitioners have appealed to science as a way of constructing reliable empirical knowledge that can be put to use in the classroom. Science, however, cannot be the silver bullet that will solve once and for all the problems that beset teachers. This is because education raises questions of value – what is good, meaningful, valuable, beautiful, etc. – which cannot be answered empirically. As a way of illustrating this point, we examined an important function of schooling, that of transmitting knowledge, and saw that it raises many normative issues that are beyond the confines of scientific analysis. Though science will undoubtedly help build a more meaningful and stimulating educational environment by establishing more effective instructional practices and intrinsically motivating tasks, it alone cannot address some of the more challenging and pressing educational concerns because their answers lie

beyond the power of science. As Egan (2012) writes, in education “the most important questions are normative ones and inaccessible to empirical research” (p. 50). Being aware of the limitations of science can be a salutary reminder that educational issues, like other areas in life, can only be dealt by invoking the values we hold dear.

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