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Designing Transdisciplinary Curriculum: A Dialogue between Engineering and Humanities

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***Abstract*— The central problem addressed in this paper is the separation of Engineering Studies from the Humanities in our current engineering curriculum resulting in a myopic educational approach that does not take into consideration the holistic nature of either the planet or the engineering education. This separation of the humanities from the sciences, particularly engineering, has made it impossible for the engineering fraternity to effectively contribute to our twenty-first-century society. In other words, if all engineering problems are primarily human problems, then engineers need to be trained not only in the technical skills of engineering but also in social and human skills that enable the engineer to equally navigate the human world for whom all solutions are built. In this paper after exploring the problem, data is presented from the curriculum innovation that is currently underway at the Plaksha University. A case study of the course section 'Entangled Epistemologies' of a new transdisciplinary course called 'Entangled Worlds' is given. This paper demonstrates how the curriculum has been designed uniquely with contributions from both Engineering Sciences and the Humanities and thus is able to deliver a holistic understanding.**

***Keywords*—Transdisciplinary, Humanities, Engineering, Pedagogy, Relativism, Realism, Theory of Relativity**

***JEET Category*—Curriculum Development, Humanities andEngineering Education**

I. INTRODUCTION

The term 'humanities' has been derived from the Latin expression 'literae humaniores', which refers to an 'education befitting a cultivated man'. 'Humanities' were formally defined by Wilhelm Dilthey in the late nineteenth century as a class of subjects under the umbrella of *Geisteswissenschaften*, which investigated the 'expressions ofthe human mind' (Dilthey, 2021, p.83). Rickert in his epistemology of knowledge (1909) indicated that the human sciences are 'idiographic' and that they value cultural contexts over general laws. The aim of these subjects was initially to develop human virtue to its fullest extent, hence its close connection to the word 'humanity'. Italian universities that adopted the s*tudia humanitatis* curriculum were called the *uminasti*, later giving rise to the term 'humanism'.

The earliest study of humanities took place in ancient Greece, where it formed the broad basis of education for students. The Sophists, in the fifth century BCE, provided a liberal arts education to young men through the *paideia*, in preparation for administrative roles (Kitto, 1951). Similarly, there was a separation of liberal arts into seven distinct disciplines in Rome during the medieval period, where importance was given to language, rhetoric and logic (*the Trivium*). The Trivium was considered to be the central "Arts of the Word", in contrast to the *quadrivium*, which dealt with the 'upper' medieval education: arithmetic, geometry, music and astronomy (Brown, 2017). Aristotle's *Oreganon* (work on logic) was considered tobe of a distinct nature from the theoretical, practical sciences. Scientific and humanistic pedagogies were categorised into specific schools, like the Hellenistic *enkyklios paideia* and the late Roman *artes liberals* (Aristotle, n.d.).

The East had its own origins of humanities, from Islamic scholarship to Confucius' six arts associated with 'genteel education' in China. In the fifteenth century, the Renaissance helped spread humanism as a field of study with a shift away from traditional 'scientific disciplines' (Boyd et al., 2010). A distinction was maintained between humane studies and divine ones, with the humanities representing a secular worldview. By the nineteenth century, the conception of this field had expanded such that the distinction now lay between material sciences and human meaning and culture.

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II. THE GREAT DIVIDE: HUMANITIES AND SCIENCES

Dilthey's ideation of the humanistic *Geisteswissenschaften* remains detached from the *Naturwissenschaften,* which are natural sciences that aim to explain the world.

The natural sciences are concerned with observation and empirical measurement, unlike the humanities which specifically investigate the 'expressions of the human mind'.

Neo-Kantian philosopher Windelband described two approaches to studying human knowledge and reality: idiographic and nomothetic (Windelband, 1998). In the context of Windelband's philosophy, idiography refers to the study of individual, unique, and specific events, phenomena, or cases. Idiographic methods aim to provide detailed descriptions and explanations of particular events or instances without seeking to establish universal laws or general principles. This approach is often associated with the humanities and historical disciplines, where the emphasis is on understanding the particularities and complexities of specific cases, rather than formulating broad generalizations (O'Donohue,2019). On the other hand, nomothetic approaches, according to Windelband are concerned with establishing general laws, principles, or theories that apply universally across different cases or phenomena. This approach is more common in the natural sciences and social sciences, where the goal is to identify and test general patterns or regularities that can be applied to various situations. Windelband's distinction between idiography and nomotheticism has had a significant influence on the philosophy of science and methodology, as it highlights the different aims and methods of inquiry in various disciplines. Immanuel Kant, at the close of the eighteenth century, attributed a subsidiary place to the human sciences in his system. Kant prescribed that, in order to count as a science, knowledge should satisfy the requirements of necessity and generality. The paradigmatic science in Kant's eyes was Newtonian mechanics (McAllister et al., 2002).

This division between the sciences and the humanities, also articulated by C.P. Snow in his 1959 "two cultures" concept, highlighted the stark contrast between literary intellectuals and physical scientists. Snow argued that these two groups were separated by a profound "gulf of mutual incomprehension." He claimed that scientists tended to share common attitudes and behaviors, including a higher degree of atheism and a political inclination toward the Left (Snow, 1990). However, these assertions, which sought to delineate scientific and artistic mindsets, faced criticism for trivializing culture and making overly broad generalizations (Leavis, 1962).

In light of this distinction, there remains a crucial need to bridge the gap between the sciences and humanities. Snow (1990) goes on to state that it is essential because once a cultural divide solidifies, societal forces tend to reinforce its rigidity rather than diminish it. This polarization represents a substantial loss for both individuals and society. It encompasses practical, intellectual, and creative losses, and it is erroneous to assume that these three facets can be neatly separated (Snow,1990).

In essence, the entrenched cultural divide between the sciences and humanities is detrimental, and we should strive to overcome it. This division not only hampers our intellectual and creative potential but also has practical implications. Recognizing that these aspects are interconnected is crucial for fostering a more comprehensive understanding of knowledge and culture. Despite the distinction between *Geisteswissenschaften* and *Naturwissenschaften,* both sides share a common notion of knowledge, or Wissenschaft (Hamann, 2017). This means that both the humanities and the natural sciences are concerned with the production of knowledge, even if they use different methods.

III. THE EVOLUTION OF ENGINEERING EDUCATION

The evolution of engineering education reflects not only the development of the engineering profession but also the intertwined history of engineering and human progress. Engineering is defined as fundamentally the application of natural sciences and mathematics to solve practical problems that benefit society. Theodore von Kármán, the Hungarian born physicist and engineer said, "Scientists study the world as it is; engineers create the world that never has been." While engineers and engineering educators often define engineers as problem solvers, this epithet fails to adequately capture the full richness of what it is to engineer (Holt et al., 1985).

The earliest formal engineering education took place in Germany, with the creation of a school known as the "Bergakademie Freiberg," of mining and metallurgy in 1765. In the mid-eighteenth Century, the "École Polytechnique", one of the pioneering technical university to include the foundations of mathematics and science in its program, was established.

In the 1950s, post the First Industrial Revolution, Grinter's Report on the *Evaluation of Engineering Education* (1955) was published. This foundational document recommended that the modern engineer was to study humanities and social sciences alongside their scientific curriculum. The goals for each engineer hence became both technical and social excellence. This change highlighted that engineering was not just about applying sciences but also about creating products and solutions that serve humanity's needs, underlining the humanistic aspect of the engineering profession.

Over time, the focus of engineering education continued to evolve. It transitioned from an emphasis on acquiring knowledge to developing practical skills, mirroring the changing demands of employers (Rompelman, 2000).

Design is one of a defining hallmark of engineering. Engineering design is a multi-faceted and iterative activity that results in artifacts—physical or virtual. Within the realm of design, engineers navigate the intricate interplay between existing knowledge and the generation of new insights. Thus, for engineers, designing is both a creative and a disciplined process. It is an interdisciplinary undertaking. The diversity of disciplines involved extend beyond branches of engineering and include people with backgrounds in the liberal arts and humanities, as well as other technical disciplines from the biological and the physical sciences (Radcliffe, 2014). This perspective underscores that engineering is no more an isolated process but rather an integral part of contemporary human activity (Murthy & Page, 2023).

For example, engineers who work on self-driving cars must work on designing and implementing solutions that are safe, ethical, and sustainable. They must decide how to program the cars to handle situations like pedestrians crossing the street or children playing in the road. They must also consider the

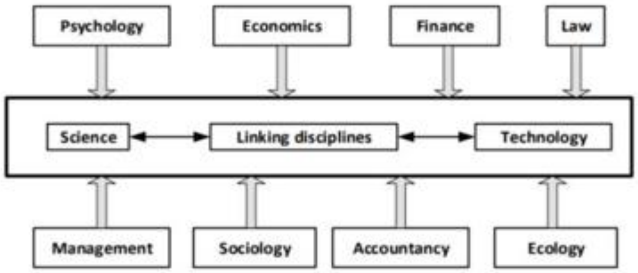

Fig. 1. Bigger Framework for Engineering Process (Murthy & Page,2023)

environmental impact of self-driving cars, such as how they will be powered and how they will be disposed of once they are redundant after serving their purpose.

In addition to technical expertise, engineers need to have strong communication and teamwork skills. They need to be able to explain their ideas to non-technical audiences and to work effectively with people from different disciplines. They also need to be able to think critically and creatively to solve complex problems.

The twenty-first century engineer no longer must follow a pipeline mindset which equips them with a narrow domain of expertise. Instead, they hold a broader, more diverse skill set which equips them to face the problems of tomorrow.

The grand challenges of our planet that arise in the landscape of rapid technological advancements can only be solved by the ‘New Age Engineer’ who challenges norms, collaborates with relevant parties, has an entrepreneurial spirit and takes risks.

IV. NEED FOR HUMANITIES IN ENGINEERING: COMING TOGETHER OF DIVERGENCE AND CONVERGENCE

The holistic view of education proposes that all “arts and sciences” are “branches from the same tree” (Einstein, 2006). Here, we attempt to disentangle their artificial separation into distinct silos. Hudson (1975) in a study of humanities and engineering graduates found that humanities students developed divergent thinking skills while engineering graduates tended to be convergent thinkers. Divergent thinkers are effective at positing issues as problem statements, while convergent thinkers excel at setting parameters and solving problems.

There's a growing concern in engineering education that students are not entirely comfortable with creative thinking and the consideration of real-world contexts (National Academy of Engineering, 2004). Engineering educators have long recognized the need to nurture creativity alongside analytical and technical capabilities. Creativity and innovation are pivotal in design and engineering.

In engineering, it is not so much science as it is ingenuity that is applied to solve problems and satisfy needs and wants (Petroski, 1992). History demonstrates this principle vividly: the steam engine emerged without the formal foundation of thermodynamics, the Wright Brothers achieved powered flight without a comprehensive understanding of aerodynamics as found in most textbooks, and the successful Moon and Mars missions relied on geological knowledge to land safely. Rather than engineering simply following established scientific theories and discoveries, it often paves the way for them. The operation of steam engines, for instance, ultimately led to the development of thermodynamics. Similarly, the pursuit of powered flight pushed the boundaries of aerodynamics, and

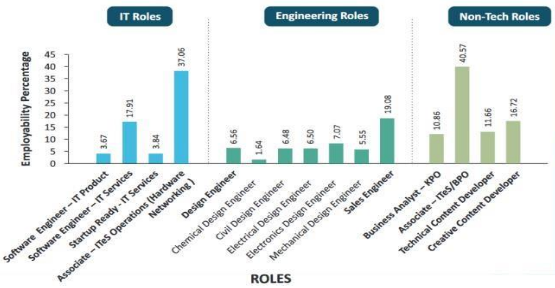

Fig. 2. National Employability Report, 2011

lunar and Martian missions not only collected valuable samples but also enriched our scientific understanding of these celestial bodies. If engineers had waited for complete scientific knowledge before embarking on technological advancements, our world today would be markedly different from the one we know.

Technology today is no longer a separate tool utilized by man but has instead turned into a *Weltanschauung*, or a pseudo- world that alters the user’s thinking processes. Many of us have experienced scenarios in which we've faced automotive troubles and found ourselves consulting with experts from locations as diverse as Germany or Japan. Technology has developed into a world culture, and its spread is not likely to be stemmed. As Eric Hoffer, a self-educated social writer and philosopher, aptly put it, "In a time of drastic change, it is the learners who inherit the future. The learned find themselves equipped to live only in a world that no longer exists” (Sions, 2014).

Without instilling creativity as a necessity in all our students, we are merely preparing a group of "learned" students who soon will be ill-equipped in this ever-changing world. There is a growing need for engineers to make responsible socio-political decisions that shape the world. The humanities are subversive, and help engineers question the status quo. This anti-dogmatism breeds innovation in a constantly changing society (Horgan, 2013). Through the humanities, the value of criticism and dissent is taught, which are essential skills for problem-solving. Despite attempts to teach the humanities through additional courses in engineering education, there has been no conclusive improvement in the student’s cognitive abilities (National Employability Report, 2016).

Here, we propose to integrate transdisciplinary courses into the existing engineering curriculum. The American philosopher Martha Nussbaum stressed the importance of the humanities in preparing students to understand a complicated, interconnected world from a variety of perspectives. She also emphasized the economic value of the humanities: according to Indian reports titled “The National Spoken English Skills of Engineers Report” (2015) and the “National Employability Report for Engineering Graduates”, ninety-seven percent of students cannot speak English appropriate for consulting and corporate jobs, while seventy percent lack cognitive skills. The survey determined that most undergraduate engineers possessed grammar skills equivalent to that of a seventh grader. The 21st-century industry requirements demand that engineers be effective communicators for becoming expert problem solvers, technology leaders, and socially aware humans.

However, it is evident that there is a lack among engineers in the skills of language, accessing reliable knowledge, processing knowledge through different forms of thinking, and articulating themselves persuasively in order to effectively contribute to both local and global conversations. Recruiters today scope out for qualities like critical thinking, information literacy and proactiveness. Students with said skills have a higher preference in the job market in comparison to those with mere academic performance (Madheswari and Mageswari, 2020).

V. EXPLORING TRANSDISCIPLINARY CURRICULUM:INTEGRATING HUMANITIES WITH ENGINEERING

Transdisciplinarity involves the transcendence of the traditional boundaries of humanities, such that they may be applied in science in an integrated form. In this paper, we posit a holistic approach to integrating humanities into the engineering curriculum. Industrial employers (Black, 1994) are keen to view enhanced communication abilities in entry-level engineers.

At Plaksha University several initiatives are being taken in order to truly offer holistic engineering education through a transdisciplinary approach. The Centre for Thinking, Language, and Communication [CTLC] offers communication coursesthat integrate core engineering themes into their projects. For example, in the *Academic Communication* course, the students had to write three argumentative essays as part of their project work. While the CTLC could have chosen any theme to be written on, in consultation with the engineering faculty the essay themes were curated from three core technology courses – Introduction to AI, Nature's Machines, and Innovation Lab for Grand Challenges (ILGC) respectively. While this course helped the students to understand how to work with language and academic communication, the themes they researched and worked on came from engineering courses thus expanding their knowledge of the engineering subjects as well as learning how to articulate engineering knowledge in academic language.

Another curriculum innovation at Plaksha was to design an entirely new course titled *Entangled Worlds: Technology and the Anthropocene*, which sought to truly bring the humanities and the sciences together. The course itself was designed by a team of faculty from both the engineering and humanities departments. The course outline reads like this:

How does one begin to return to a fundamental understanding of the embeddedness of all forms of life as well as so-called inorganic material in a web of interdependence, of inexorable entanglement? Is it even possible for us to engender a radical shift in the way we think about ourselves and planet Earth? Or have we already gone too far in our quest for creating a solely human-centric world? In this course we will explore and reflect on the question of entanglements from a variety of transdisciplinary perspectives including those of art, music, imagination, biological systems, quantum mechanics, language, mathematics, design, thought, time, space, history, philosophy and technology.

The learning objectives and the course outcomes primarily sought to get engineering students to see the planet and the world around them through the lens of transdisciplinary perspectives in order to view the fundamental interconnectedness of everything. One of the sections is termed 'Entangled Epistemologies' which is being taught by two faculty, one each from the humanities and engineering departments respectively. The aim of this section is to take themes that historically have contributions from both philosophy and physics and then to bring out a holistic teaching on the theme by having a dialogue between the perspectives put forward by philosophy and physics respectively. Furthermore, a pedagogical innovation that is being enacted is that the two faculty belonging to the philosophy and engineering disciplines will have an actual conversation and dialogue, with the students listening in to this conversation and participating by joining in with their questions and comments. Let us take an example:

The first two sessions of the section *Entangled Epistemologies* are titled 'Realism and Newtonian Physics' and 'Relativism and the Theory of Relativity'. In the first session realism as a school of thought which influenced scientific findings like that of Newton will be studied. Plato's traditional epistemology of realism asserts that 'forms' exist independently of perception and are unchanging, regardless of the subject's state. This is the historical origins of realism. Classical or Newtonian physics follows a similar framework: the idea of absolute space is an example of a so-called 'objective truth' which remains immovable and unchanging, regardless of reference frame. According to the laws of Newtonian dynamics, an inertial frame is one with a time scale relative to which the motion of an undisturbed body is rectilinear and uniform. For instance, while considering celestial mechanics, the centre of mass of a closed system of stars is thought to be constant. Although both Platonian and Newtonian realism have been critiqued over the centuries, a conversation between both reveals the close connection between philosophical thinking and scientific frameworks and how perhaps one has contributed to the emergence of the latter.

In the second section, 'Relativism and the Theory of Relativity', we study a new epistemology that originated with Kant's seminal theory on metaphysics (1781). Relativism is the view that the theory of knowledge is subjective, and reliant on the perceptions of the learner. Heidegger's work in existential phenomenology, following Kierkegaard, Nietzsche and Husserl acts as the founding text of such a theory. Both Derrida and Foucault, the fathers of postmodern philosophies, exhaustively explored the situated nature of knowledge. On the other hand, relativity was popularized in the sciences by Einstein's *Special and General Theories of Relativity*. These theories highlight the subjective nature of time, space and gravity: concepts that were previously considered inflexible and rigid.

The goal of doing these sessions in this transdisciplinary manner is because both realism and relativism are epistemological positions that highlight certain aspects of reality while making other aspects invisible. The entanglement of these different epistemologies will negate the dichotomy between the two, enabling a fuller understanding of the world. Richard Bernstein's *Beyond Objectivism and Relativism* aptly probes this sense of going 'beyond' the binaries we have set up for ourselves.

VI. CONCLUSION

The aim of this exploratory paper has been to explore the interconnectedness between the humanities and engineering education. The first part of the paper raises the question about this separation through a brief historical survey and in the latter part this apparent division between the humanities and engineering studies is critically examined and evidence from CTLC's work at Plaksha University has been offered as a counterargument with a view to demonstrate that a transdisciplinary approach in engineering curriculum design can truly bridge this gap between engineering studies and the humanities. Transdisciplinary approaches with their innovative pedagogies in curriculum design are still at a nascent stage in Engineering Studies and this opens a whole new avenue for research to empirically verify that these approaches can truly offer a holistic education to engineering students.

REFERENCES

Aristotle. (n.d.). *Aristotle Organon And Other Works*. Retrieved September 6, 2023, from http://archive.org/details/AristotleOrganon

Bod, R., & Kursell, J. (2015). Introduction: The Humanities and the Sciences. *Isis*, *106*(2), 337–340. https://doi.org/10.1086/681993

Boyd, C. A. (2010). Review of C.S. Lewis and Philosophy as a Way of Life: A Comprehensive Historical Examination of His Philosophical Thought; C.S. Lewis as Philosopher [Review of *Review of C.S. Lewis and Philosophy as a Way of Life: A Comprehensive Historical Examination of His Philosophical Thought; C.S. Lewis as Philosopher*, by A. Barkman, D. Baggett, G. R. Habermas, & J. L. Walls]. *VII: Journal of the Marion E. Wade Center*, *27*, 104–107.

Brown, E. (2017). Plato's Ethics and Politics in The Republic. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2017). Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/fall2017/entries/plato-ethics-politics/

Dilthey, W. (2021). *Wilhelm Dilthey: Selected Works, Volume III: The Formation of the Historical World in the Human Sciences* (R. A. Makkreel & F. Rodi, Eds.). Princeton University Press. https://doi.org/10.2307/j.ctv1mjqv0h

Editor. (2015, August 28). Indian engineering graduates held back by limited English. *ICEF Monitor - Market Intelligence for International Student Recruitment*. https://monitor.icef.com/2015/08/indian-engineering-graduates-held-back-by-limited-english/

Engineer of 2020: Visions of Engineering in the New Century (p. 10999). (2004). National Academies Press. https://doi.org/10.17226/10999

Hamann, J., Maeße, J., Gengnagel, V., & Hirschfeld, A. (2017). » Macht in Wissenschaft und Gesellschaft «. *Hamann, Julian/Maeße, Jens/Gengnagel, Vincent/Hirschfeld, Alexander (Hg.): Macht in Wissenschaft und Gesellschaft. Diskurs-und feldanalytische Perspektiven. Wiesbaden: Springer VS*, 1-22.

Holt, J. E., Radcliffe, D. F., & Schoorl, D. (1985). Design or problem solving—A critical choice for the engineering profession, Design Studies, 6(2), 107–110. http://dx.doi.org/10.1016/0142- 694X(85)90020-1

Horgan, J. (2013). Why study humanities? What I tell engineering freshmen. *Scientific American*, *20*.

Hudson, L. (1975). *Human beings: An introduction to the psychology of human experience*. London : Cape. http://archive.org/details/humanbeingsintro0000huds_o3 q2

Hynes, M., & Swenson, J. (2013). The Humanistic Side of Engineering: Considering Social Science and Humanities Dimensions of Engineering in Education and Research. *Journal of Pre-College Engineering Education Research (J-PEER)*, *3*(2). https://doi.org/10.7771/2157-9288.1070

Kitto, H. D. F. (1951). *The Greeks*. Penguin Books Limited. http://archive.org/details/dli.ernet.285445

Leavis, F. R., & Collini, S. (2013). *Two Cultures?: The Significance of C. P. Snow* (1st ed.). Cambridge University Press. https://doi.org/10.1017/CBO9781107337169

Madheswari, S. P., & Mageswari, S. D. U. (2020). Changing Paradigms of Engineering Education—An Indian Perspective. *Procedia Computer Science*, *172*, 215–224. https://doi.org/10.1016/j.procs.2020.05.034

McAllister, J. W., Kornet, D. J., McAllister, J., van Benthem, J., Rip, A., Philipse, H., Kornet, D., Devlin, K., Elzinga, A., & Schnabel, P. (2002). Historical and Structural Approaches in the Natural and Human Sciences. In P. Tindemans, A. Verrijn-Stuart, & R. Visser (Eds.), *The Future of the Sciences and Humanities* (pp. 19–62). Amsterdam University Press. https://www.jstor.org/stable/j.ctt46mzw4.5

Murthy, D. N. P., & Page, N. W. (2023). *Education and Research for the Future: Engineering as an Illustrative Case*. Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-29685-7

NATIONAL EMPLOYABILITY REPORT ENGINEERS. (2016) Aspiring Minds, Annual Report. *https://quantumuniversity.edu.in/qlib/document/pdf/National%20Employability%20Report%20-%20Engineers%20Annual%20Report%202016.pdf*

O'Donohue, W. T., Burleigh, K., & Kinzler, A. D. (2019). Capturing The Unique Nature of the Human Sciences: The Second Demarcation Problem. *Behavior and Philosophy*, *47*, 15–33.

Petroski, H. (2005). Technology and the Humanities. *American Scientist*, *93*, 304. https://doi.org/10.1511/2005.4.304

Radcliffe, D. (2014). MULTIPLE PERSPECTIVES ON ENGINEERING DESIGN. In D. Radcliffe & M. Fosmire

(Eds.), *Integrating Information into the Engineering Design Process* (pp. 7–20). Purdue University Press. https://doi.org/10.2307/j.ctt6wq25v.6

Rompelman, O. (2000). Assessment of student learning: Evolution of objectives in engineering education and the consequences for assessment. *European Journal of Engineering Education*, *25*(4), 339–350. https://doi.org/10.1080/03043790050200386

Sharma, D. R. K., & Humanities, H. (2013). *Lending Human Touch: The Role of Humanities in Engineering Education*.

Sions, H. K. (n.d.). *Creativity in the elementary art classroom: Incorporating strategies for encouraging creativity*.

Snow, C. P. (1990). The Two Cultures. *Leonardo*, *23*(2/3), 169. https://doi.org/10.2307/1578601

The Heart of the Matter: The Humanities and Social Sciences for a vibrant, competitive, and secure nation. (2013, August 15). American Academy of Arts & Sciences. https://www.amacad.org/news/heart-matter-humanities- and-social-sciences-vibrant-competitive-and-secure- nation

The Project Gutenberg eBook of The Republic, by Plato. (n.d.). Retrieved September 5, 2023, from https://www.gutenberg.org/files/1497/1497-h/1497-h.htm

Why Study Humanities? What I Tell Engineering Freshmen—Scientific American Blog Network. (n.d.). Retrieved September 5, 2023, from https://blogs.scientificamerican.com/cross-check/why-study-humanities-what-i-tell-engineering-freshmen/

Windelband, W. (1998). History and Natural Science. *Theory & Psychology*, *8*(1), 5–22. https://doi.org/10.1177/0959354398081001