DOWNLOAD PDF THE SCIENCE AND ART OF EDUCATION

Chapter 1 : Division of Science and Physical Education | University of Science and Arts of Oklahoma

The Art of Ed is an online resource for art teachers providing online classes, teaching materials, lessons, videos and much more.

This article was originally published in The Technology Source http: Available online at http: The article is reprinted here with permission of the publisher. Furthermore, administrators facing their own impending retirement often fail to seriously consider which technologies may be standard for university campuses after their tenure in office. Nyce also wave a warning flag: There has been a tendency to let technological possibilities drive Web instructional design and use. The theoretical rationales that have been invoked to justify commitment to Web efforts have tended to be weak: However, perhaps more than anything else, these efforts build on and reflect a kind of naive optimism about technology, particularly new technologies, and the role they should have in higher education. On the contrary, the tendency has been to assume its appropriateness. In addition, there has been little in the way of an attempt made to establish research agendas that address the issue of appropriateness. There is No Pedagogical Deficit These skeptical scholars offer thoughtful and reflective observations about educational technology. But their descriptions rely largely on highly selective anecdotal material. Their implied argument is that using educational technology must result in a "pedagogical deficit," but they have elected not to do original research to support their hypothesis. Technology is Cheap Many of us have indeed learned from our mistakes, especially over the past few years of robust computer-centered media development. Unfortunately, many others have not learned, and remain in the mindset of ten years back or more, before computer-mediated education was both inexpensive and versatile. If [Schutte] had used these methods in his traditional class, costs would not have increased, but because he and his students needed the networked technology of a major educational institution, they incurred the extremely high costs of technology" Neal, In his equation of technology with unnecessary and expensive costs, Neal has stacked the deck with outdated, costly assumptions from ten or more years ago. What if, in the real world, you acquired a PC at the same dollar cost today as the PC you bought 10 or so years ago, which at that time was 1, times less powerful, and then in another ten years acquire a new PC which is 1, times more powerful than your present one, also at the same dollar cost? That is an increase in power of one million times, at the same cost, over just 20 or so years. If we run the numbers from our own experience, we can readily see that what may have appeared improbable is actually plausible. The greatest value by far is in the power of the software in the hands of the individual. Their observations represent common complaints while ignoring reasonable prescriptives for using our rich and increasingly boundless cultural resources to address these concerns. Academia must be able to easily transport thought and ideas through virtual books and journals as though they were, as indeed they are, just alternate forms of the same material. Anything else cheats both professors and students of an entire venue of expression. We may not be doing enough, quickly enough, to deal with the big changes coming in the near future. Our evaluations and decisions are made largely without benefit of the knowledge or intuition gained by the developmental experience of growing up with the overwhelming media environment prevalent now. The background experience of growing up with TV and computers changes our cultural expressions. Will this changed culture impact upon how we think and learn? Not only will it, it already has. Today, the newest configurations of media on the World Wide Web are powerful, inexpensive, highly interactive, individually controlled for self-pacing, ideally suited for independent learning, and ultimately empowering to the user. Technology has already swept over us. It is no longer a technological argument, but rather a cultural change. It would be foolish not to keep up with the cultural changes of the real world. As you read this letter, the new technology driving corporate universities is eating our academic lunch. Our cultural literacy is no less critical in either. Given that these interactive media are becoming increasingly prevalent in our culture, not requiring modern library skills or the communicating skills of using virtual text is not just educationally risky, but is academically, pedagogically, and fiscally unsound. Retrieved October 4, from World Wide Web: Retrieved October 4, from the World Wide Web: Reinventing teaching and learning. Retrieved October 4, , from the World Wide Web: June Does using technology in instruction Enhance learning?

Chapter 2 : Science vs Arts | Comparison between Science and Arts | Science or Arts

In the wake of the recent recession, we have been consistently apprised of the pressing need to revitalize funding and education in STEM fields -- science, technology, engineering, and math.

In a nutshell, a masters of science degree focuses on practical skills while a masters of arts degree focuses on theoretical research. The Master of Science in Education A Master of Science in Education is best for educators who want to work in the field, improve their pedagogical skills and possibly move into academic leadership roles. In fact, this degree prepares the student to move into educational system leadership positions, according to the Bureau of Labor Statistics. A Master of Science in Education provides students with career opportunities inside and outside the classroom. Possible career paths include instruction, curriculum, leadership and special education. This degree focuses on practical, hands-on experiences that enable the student to evaluate education practices and create feasible solutions and strategies. Students will study advanced educational theories, perform in-depth research and explore educational psychology. Sample Coursework for a Master of Science in Education Students will learn groundbreaking teaching techniques, best practices and academic strategies. They will also learn advanced classroom management models and associated assessment tools for student behaviors and achievements. Curriculum coursework will prepare them to design, evaluate and personalize the education experience. Educational leadership teaches best practices for managing change and participating in collaborative decision-making. Student assessment training will empower the student to perform both formal and informal growth and achievement assessments. The first specialization provides tools and strategies for helping students with behavior disorders and learning disabilities. The second teachings advanced approaches to literacy. Therefore, this academic degree centers on contemporary theories and research. The curriculum often emphasizes the fundamental theories related to learning, educational research, curriculum development and student testing and assessments. Graduates are prepared to become teachers in PK schools and higher education institutions. Therefore, they may be required to obtain state licensure. Additionally, a Master of Arts in Education opens the door to becoming a curriculum designer or instructional coordinator. This degree also prepares the graduate to pursue a doctoral degree in education. It is the ideal choice for graduates who wish to pursue instructional or administrative careers in higher education. Clearly, the difference between a Master of Science in Education and a Master of Arts in Education is a focus on practical skills over theories. Sample Coursework for a Master of Arts in Education Coursework will cover child development, language learning, community services, reading literacy and curriculum and instruction. Students will explore different assessment tools and instructional strategies. They will be trained on how to take incorporate technology into classroom instruction. For example, a development specialization would focus on the social, cognitive and linguistic development in young children. The assessment specialization would revolve around developmental concerns and intervention strategies. The diversity specialization would center on multiculturalism and inclusive educational methods. In the end, the difference between a Master of Science in Education and a Master of Arts in Education comes down to two specific areas of focus:

Chapter 3 : The Art & Science of Math Education

It has become a mantra in education that No Child Left Behind, with its pressure to raise test scores, has reduced classroom time devoted to the arts (and science, social studies, and everything else besides reading and math).

Physics education Physics education is characterized by the study of science that deals with matter and energy, and their interactions. It also aims to increase the number of students who go on to take 12th grade physics or AP Physics, which are generally elective courses in American high schools. The fact that many students do not take physics in high school makes it more difficult for those students to take scientific courses in college. Chemistry education Chemistry education is characterized by the study of science that deals with the composition, structure, and properties of substances and the transformations that they undergo. Chemistry is the study of chemicals and the elements and their effects and attributes. Students in chemistry learn the periodic table. The branch of science education known as "chemistry must be taught in a relevant context in order to promote full understanding of current sustainability issues. As children are interested by the world around them chemistry teachers can attract interest in turn educating the students further. Biology Education[edit] Biology education is characterized by the study of structure, function, heredity, and evolution of all living organisms. In the United States, there is a growing emphasis on the ability to investigate and analyze biology related questions over an extended period of time. Science education has been strongly influenced by constructivist thinking. Constructivism emphasises the active role of the learner, and the significance of current knowledge and understanding in mediating learning, and the importance of teaching that provides an optimal level of guidance to learners. To derive pleasure from the art of discovery, as from the other arts, the consumerâ€"in this case the studentâ€"must be made to re-live, to some extent, the creative process. In other words, he must be induced, with proper aid and guidance, to make some of the fundamental discoveries of science by himself, to experience in his own mind some of those flashes of insight which have lightened its path. The traditional method of confronting the student not with the problem but with the finished solution, means depriving him of all excitement, [shutting] off the creative impulse, [reducing] the adventure of mankind to a dusty heap of theorems. Specific hands-on illustrations of this approach are available. Research in science education relies on a wide variety of methodologies, borrowed from many branches of science and engineering such as computer science, cognitive science, cognitive psychology and anthropology. Science education research aims to define or characterize what constitutes learning in science and how it is brought about. Bransford , et al. Therefore, it is essential that educators know how to learn about student preconceptions and make this a regular part of their planning. Knowledge Organization In order to become truly literate in an area of science, students must, " a have a deep foundation of factual knowledge, b understand facts and ideas in the context of a conceptual framework, and c organize knowledge in ways that facilitate retrieval and application. Some educators and others have practiced and advocated for discussions of pseudoscience as a way to understand what it is to think scientifically and to address the problems introduced by pseudoscience. One research study examining how cellphones are being used in post-secondary science teaching settings showed that mobile technologies can increase student engagement and motivation in the science classroom. If they wish to no longer study science, they can choose none of the branches. The science stream is one course up until year 11, meaning students learn in all of the branches giving them a broad idea of what science is all about. The National Curriculum Board of Australia stated that "The science curriculum will be organised around three interrelated strands: A major problem that has befallen science education in Australia over the last decade is a falling interest in science. Fewer year 10 students are choosing to study science for year 11, which is problematic as these are the years where students form attitudes to pursue science careers. China[edit] Educational quality in China suffers because a typical classroom contains 50 to 70 students. With over million students, China has the largest educational system in the world. Science education is given high priority and is driven by textbooks composed by committees of scientists and teachers. Science education in China places great emphasis on memorization, and gives far less attention to problem solving, application of principles to novel situations, interpretations, and predictions. Science education in England In

English and Welsh schools, science is a compulsory subject in the National Curriculum. All pupils from 5 to 16 years of age must study science. It is generally taught as a single subject science until sixth form, then splits into subject-specific A levels physics , chemistry and biology. However, the government has since expressed its desire that those pupils who achieve well at the age of 14 should be offered the opportunity to study the three separate sciences from September Other students who choose not to follow the compulsory additional science course, which results in them taking 4 papers resulting in 2 GCSEs, opposed to the 3 GCSEs given by taking separate science. United States[edit] In many U. This often leads teachers to rush to "cover" the material, without truly "teaching" it. In addition, the process of science, including such elements as the scientific method and critical thinking , is often overlooked. This emphasis can produce students who pass standardized tests without having developed complex problem solving skills. Although at the college level American science education tends to be less regulated, it is actually more rigorous, with teachers and professors fitting more content into the same time period. National Academy of Sciences of the U. National Academies produced the National Science Education Standards , which is available online for free in multiple forms. Its focus on inquiry-based science , based on the theory of constructivism rather than on direct instruction of facts and methods, remains controversial. Inquiry is central to science learning. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others. They identify their assumptions, use critical and logical thinking, and consider alternative explanations. In this way, students actively develop their understanding of science by combining scientific knowledge with reasoning and thinking skills. In recent years, business leaders such as Microsoft Chairman Bill Gates have called for more emphasis on science education, saying the United States risks losing its economic edge. Furthermore, in the recent National Curriculum Survey conducted by ACT, researchers uncovered a possible disconnect among science educators. In the National Academy of Sciences Committee on a Conceptual Framework for New K Science Education Standards developed a guiding framework to standardize K science education with the goal of organizing science education systematically across the K years. It emphasizes science educators to focus on a "limited number of disciplinary core ideas and crosscutting concepts, be designed so that students continually build on and revise their knowledge and abilities over multiple years, and support the integration of such knowledge and abilities with the practices needed to engage in scientific inquiry and engineering design. The committee that designed this new framework sees this imperative as a matter of educational equity to the diverse set of schoolchildren. Getting more diverse students into STEM education is a matter of social justice as seen by the committee. Developed by 26 state governments and national organizations of scientists and science teachers, the guidelines, called the Next Generation Science Standards , are intended to "combat widespread scientific ignorance, to standardize teaching among states, and to raise the number of high school graduates who choose scientific and technical majors in college An emphasis is teaching the scientific process so that students have a better understanding of the methods of science and can critically evaluate scientific evidence. Organizations that contributed to developing the standards include the National Science Teachers Association , the American Association for the Advancement of Science , the National Research Council , and Achieve, a nonprofit organization that was also involved in developing math and English standards. Young students use a microscope for the first time, as they examine bacteria a "Discovery Day" organized by Big Brother Mouse , a literacy and education project in Laos. Informal science education is the science teaching and learning that occurs outside of the formal school curriculum in places such as museums, the media, and community-based programs. The National Science Teachers Association has created a position statement [49] on Informal Science Education to define and encourage science learning in many contexts and throughout the lifespan. Research in informal science education is funded in the United States by the National Science Foundation. Examples of informal science education include science centers, science museums , and new digital learning environments e. Early examples of science education on American television included programs by Daniel Q. Posin , such as "Dr. Home education is encouraged through educational products such as the former Things of Science subscription service. People, Places, and Pursuits. This book makes valuable research accessible to those working in informal science:

Chapter 4 : The Art of Ed | An Online Resource for Art Teachers

Where the Art of Teaching Meets the Science of Learning Education, in all of its traditional and emerging forms, maintains a rich and complex spirit. In a continually changing landscape, teachers endure by adapting, improving, and overcoming challenges, all in an effort to encourage and inspire future generations.

Not a great deal. Alamy As a long-time maths teacher, the latest assessments by the Trends in International Mathematics and Science Study and Programme for International Student Assessment make for tough reading. They indicate that there is little evidence of real gains having been made in maths and science in England over the past four years. Almost silent on the issue so far, ministers in England might want to claim that these reports show the nation pretty much holding its own; but the real picture is more worrying. There were slight improvements in performance in maths, but not on the level of gains seen by Kazakhstan, pushing England down from 10th to 11th place. Released this week, the Pisa study saw pupils in England get lower scores than previously, but, because of variations in the participating nations, it was accompanied with a shift up in ranking. Not a great deal â€" and I believe that rather than pushing schools towards narrowing curricula to give more time to maths and science, ministers should be encouraging them to restore the arts to their proper place. In my own south-east London school there has been pressure to add more maths lessons. As a department we have resisted because we felt it right that the school continued to offer a broad and balanced curriculum, with music, art and drama given proper space in the timetable. With more time given to science and maths, instead of three years of art and different aspects of design technology, he gets two terms of each, spread over two years. Continuing to ask more from teachers, while giving them less to do it, is a recipe for disaster The focus on Stem was meant to deliver a narrowing of the achievement gap between UK pupils and those in the Pisa league-topping Asian countries like Singapore and South Korea. A typical day for a pupil in Singapore involves hours of intense private tuition late into the evening. This is an educational culture massively focused on Stem achievement, and one that creates very high stress and anxiety. In chasing this elite group at the top of the Pisa rankings, are we prepared to have our teenage suicide rate doubled to match theirs too? Of course, there are things we can learn from the way that maths and science are taught in high-performing nations. Yet the league table that few in the Department for Education are prepared to talk about is the one that shows the average UK teacher spending 4 days per year receiving professional development , while teachers in Shanghai receive 40 days annually. In terms of the time we are investing in helping teachers become more skilled professionals, we rank 30th out of 36 developed nations. Continuing to ask more from teachers, while giving them less to do it, is a recipe for disaster â€" not just for league table positions, but for the wellbeing and mental health of staff, and thus the progress of pupils too. If we really want our students to do better, we should invest properly in our teachers. Decisions on educational priorities are about the sort of nation we want to become. The UK already ranks second in the list of most Nobel laureates â€" with the majority of these prizes coming in science and medicine. In forcing an ever more efficient production line of high-performing school-level mathematicians and scientists, we risk strangling the creative arts. My hunch is that British strength in the arts is integral to understanding why we have so many Nobel prizes: We do need to reaffirm the significance of science and maths to our technological prowess; but we must never forget the huge importance of teaching the arts to our future economy and cultural heritage.

Chapter 5 : The New Art and Science of Teaching

Bachelor of Science in Art Education. The BS in Art Education is a professional degree program designed to train artists to teach art/art history, aesthetics and.

In our final instalment, Benjamin Miller and Fiona White examine the benefits of transdisciplinary skills. The arts and science are often thought of as polar opposites. Traditionally, students and universities view them as separate entities â€” you pick a degree in one or the other and stick to your side of the fence. Increasingly though, this way of doing things is not enough to prepare students for the data-drenched and volatile workplace of the twenty-first century. Combining arts and science in the curriculum could be the answer. From science, students learn about sound methods for testing hypotheses, and about interpreting and drawing valid conclusions from data. From arts, they will also learn about developing arguments, and about understanding, moving, and changing the minds of diverse audiences. There are double and combined degrees already on offer. The untapped potential of combining curricula In their study into the popularity of double degrees , higher education researchers Wendy Russell, Sara Dolnicar and Marina Ayoub suggested that: Transdisciplinary thinkers take a unique approach to solving problems. However, the way most combined and double degrees are established does not foster transdisciplinary learning. This is because the combination of degrees tends to create an administrative rather than pedagogical structure. This means that an arts-science student, for example, simply has access to subjects from arts and science faculties. Upon graduation, graduates would be able to perform skills essential to both speciality areas. But they have not necessarily developed transdisciplinary thinking. The rare double degrees that are pedagogically designed can unlock the potential of a combined curriculum. In such cases, arts-science graduates can also imaginatively develop unique research methods, or ethically interpret information systems, or persuade non-experts to change their behaviour based on scientifically informed debate. Model degrees, modern times Universities are increasingly considering different degree structures. Students complete any two degrees in four years from arts, social sciences, business, or science. But they are administrative combinations that rarely push students to experiment with approaches and practices from both degrees. In introducing their program, UNSW claims: UNSW students must complete between two and four subjects from outside their faculty. For example, a science graduate must have completed subjects taught by non-science faculties, such as education, arts, business, built environment, or law. Such a program appears to be more pedagogically driven than the standard double degree. The learning promoted here is a valuable kind of creative disciplinarity, but it is not transdisciplinary. We coordinate a new degree at the University of Sydney which has been designed to promote transdisciplinarity. The three-year Bachelor of Liberal Arts and Science BLAS offers students the administrative freedom to study in two faculties while mandating the completion of core units in critical thinking, ethics, and communication. BLAS students complete a major in arts or science, including up to 12 subjects in their chosen field. A further six to eight subjects are chosen from the other faculty. That is, an arts major must also complete six to eight science subjects. Finally, six liberal studies subjects must also be completed. Here in the physical and intellectual space of liberal studies subjects students from diverse disciplinary backgrounds collaborate to address problems of research, writing and ethics. An undisciplined world With improved learning and greater transdisciplinary skills, our experience with BLAS suggests that more innovative curricula and degree programs are needed. Why not have extended math curriculum which includes writing? Or an extended English curriculum which includes trigonometry? A curriculum can be defined narrowly as the content of a particular class or degree. Unfortunately, administrators and policy advisers often look too narrowly at the curriculum. They develop, for example, a policy for high school English, or a strategy for tertiary math instruction. An innovative approach to curriculum design would involve experts from various fields. They would collaborate to design a curricula space where students actively connect and extend the diverse aspects of their education. This is the eleventh and final part of our series Maths and Science Education.

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Chapter 6 : Why arts and science are better together

The art education program is designed to provide you with a challenging course of study that will focus on art to enhance your intellectual development, personal growth, and career satisfaction.

February Volume 70 Number 5 Creativity Now! Suppose you have a talented child with a profound interest in science. This child has a choice of going to an academically elite high school or to a high school where the curriculum focuses on training mechanics, carpenters, and designers. Where do you send her? To the academically elite high school. Except that Walter Alvarez, a doctor and physiologist of some renown, decided to send his scientifically talented son, Luis, to an arts and crafts school where Luis took industrial drawing and woodworking instead of calculus. Luis Alvarez won the Nobel Prize in physics in He attributed his success to an uncanny ability to visualize and build almost any kind of experimental apparatus he could imagine Alvarez, Suppose you have a baby Einstein. The question is, would you know it? After all, Einstein was certainly not a standout in his mathematics and physics classes. Yet he also ended up with a Nobel Prize. So what were his special talents? One was clearly an ability to visualize concepts in his mind, a talent that was fostered by Aargau Cantonal School in Switzerland, where he completed his secondary education. Another outcome was his facility with devices, which he developed further as a patent examiner and through several inventions of his own. Einstein also melded a talent for music with his thinking. As he put it, "The theory of relativity occurred to me by intuition, and music is the driving force behind this intuition. My parents had me study the violin from the time I was 6. My new discovery is the result of musical perception" Suzuki, , p. And what about the Swedish biochemist Hans von Euler-Chelpin? Amateur painters themselves, both Rood and Ostwald had discovered through their artistic avocations that many phenomena concerning the optical and chemical properties of colored materials were complete mysteries. Fascinated by the scientific questions involved, von Euler-Chelpin began taking chemistry and physics classes. Twenty years later, in , he won the Nobel Prize in chemistry. As exemplars of the highest order, Alvarez, Einstein, and von Euler-Chelpin highlight the often overlooked, yet unexpectedly widespread and profoundly important interactions that occur among the arts, crafts, and sciences. These scientists carry the banner for arts-infused science education. Arts and crafts develop such skills as observation, visual thinking, the ability to recognize and form patterns, and manipulative ability. They develop habits of thought and action that include practicing, persevering, and trial-and-error problem solving. They pose new challenges, such as those that intrigued Rood, Ostwald, and von Euler-Chelpin. And they provide novel structures, methods, and analogies that can stimulate scientific innovation. For all these reasons, finding ways to foster arts education alongside science educationâ€”and, even better, finding ways to integrate the twoâ€"must become a high priority for any school that wants to produce students capable of creative participation in a science-dominated society like ours. One of the skills that all science textbooks and curriculums nominally value is that of observing. Further, all types of sensory observation have applications to scientific practice. Although the application of musical, olfactory, and related skills to science training has yet to be developed in any comprehensive fashion, the web is full of classroom lessons exercising visual and aural observational skills through the arts. Visual Thinking Learning to observe through drawing and painting has another benefit for students studying the sciences and mathematics. It turns out that one of the best predictors of success in scientific subjects in grades Kâ€"16 is visual imaging ability. Conversely, students who have poor visual memory and imaging ability often do poorly in science and mathematics. As a rule, women and minorities are more likely than white males to display deficiency in these skills. However, many studies have shown that providing students who have visualizing deficits with drawing and painting classes improves their visual imaging and memory test scores. Recognizing and Forming Patterns Scientific thinking is almost synonymous with recognizing and forming patterns. Every hypothesis and theory is the discovery of a pattern within some set of observations. The father of the famous physicist Richard Feynman clearly understood this connection. He introduced his son to patterning games very much like those taught at such art schools as the Bauhaus when the boy was still a toddler. One of those games involved colored tiles like those used to make mosaics. Feynman senior would start a pattern and see whether Richard could finish it. Soon the boy was making up his own patterns and yet another pattern was set in motion Feynman, As an adult, Richard Feynman discovered many new patterns in physics, which later won him a Nobel Prize. Ned Seeman, one of the founders of the new science of nanotechnology the making of functional objects out of molecule-sized materials , was similarly inspired by M. Stumped by a problem concerning ways to make cubic structures out of DNA, Seeman realized that an Escher print that pictured a school of fish-like creatures swimming in three dimensions provided the solution Nadrian Seeman, n. Other scientists have also looked to the work of artistsâ€"or used their expressive formsâ€"to hunt for clues to hidden patterns. Physicists, for instance, have worked with choreographers to illuminate the movement patterns of electrons; microbiologists have square-danced their way through the processes of gene regulation. Some educators have likewise used creative movement in the science classroom. Although much remains to be done on a wider scale to bring the embodied understanding of patterns as accessed through visual art, dance, theater, and music into science instruction, certain initiatives, such as the John F. As fewer and fewer students take art, music, and crafts classes in school, with some students even failing to learn cursive writing, fine motor control and simple manipulative skills that were taken for granted 50 years ago are today increasingly absent. Many of our students are truly "all thumbs. This sad state of affairs is the result of a lack of appreciation of these skillsâ€"not among scientists, but among education "experts" who have lost contact with actual scientific practice. Blackett , rued the loss of craftsmanship and with it, the ability to performâ€"and here the artistic and musical connotations of that term are all too appropriateâ€"experimental procedures. We teachers need to remember that implementing knowledge, even in the information age, must still be accomplished through inventions first constructed by hand. Backed by Research There are real and measurable consequences to integrating arts and crafts education with science and mathematics education. Perhaps the most obvious and most startling has to do with the SATs. Our own informal analysis of the SAT results from reveals that four years of high school arts or music classes confer a point advantage over the average SAT score, whereas four years of science confer only a point advantage. James Catterall has demonstrated that this positive arts effect is not limited to schools in socioeconomically advantaged neighborhoods but is actually strengthened in the poorest neighborhoods. Arts, in short, have the greatest impact of any subject on standardized tests scores, even when those tests have nothing to do with arts-related material. These studies demonstrate loud and clear how important arts-related skills are for learning in general and mathematics in particular. Moreover, these arts benefits persist beyond high school. In quantitative as well as qualitative fashion, we have observed the effects of adult participation in arts and crafts, as well as continuous participation from childhood into adulthood, on various measures of success among individuals at work in the fields of science, technology, engineering, and mathematics STEM. Our data show that the more arts and crafts scientists, engineers, and entrepreneurs engage in across their lifetimes, the greater their likelihood of achieving important results in the workplace. Not only do the most successful STEM professionals engage in arts and crafts at rates significantly higher than the general population, but the top-performing, most successful members of these groups engage in arts hobbies at rates higher than their peers Root-Bernstein, Allen, et al. The idea that arts and crafts training enhances scientific ability, first advanced by J. Our own study of Nobel Prize winners indicates that these eminent scientists are 15 to 25 times more likely than the average scientist to engage as an adult in fine arts, such as painting, sculpting, and print making; in crafts, such as wood and metalworking; in performance arts, such as acting and dancing; and in creative writing and poetry Root-Bernstein, Allen, et al. In concert with a team of researchers at Michigan State University MSU , we have also recently studied several populations of engineers, STEM honors graduates, and STEM entrepreneurs and found that in these groups, too, sustained adult arts and crafts participation characterizes top performers LaMore et al. Engineers and inventors are also more likely to participate in various arts and crafts, especially photography and music, at higher levels than the public at large. Moreover, as in the case with scientists, individuals in these professions who produce creative capital for example, who publish papers and books, file copyrights, file and license patents, and establish companies are much more likely than their peers who do not produce creative capital to be involved in a sustained manner with one or more crafts or arts. This is especially true for avocations in photography, woodwork, mechanics, electronics, and dance. It appears that inventors in the STEM fields enjoy working with mind, body, and hands. We found that measures of family wealth did not correlate with either the presence of childhood arts and crafts hobbies or mature production of creative capital. Rather, arts and crafts participation started in childhood and sustained in maturity looks to be a leveler among individuals from diverse socioeconomic backgrounds. Childhood privilege in and of itself does not give a leg-up on entrepreneurship and innovation. Arts and crafts apparently do. STEM professionals understand and value the connections between their avocations and their work. Many report that the beneficial exercise of observing, visualizing, manipulating, and dealing with material and aesthetic concerns in arts and crafts hobbies builds creative capacity at work. Eighty-two percent of surveyed scientists and engineers answered yes to the question, "Would you recommend arts and crafts education as a useful or even essential background for a scientific innovator? Crossover creativity depends on sustained participation in arts or crafts, beginning in childhood and continuing into adulthood. Put another way, about 25 percent of those who take up an art or craft in childhood sustain that interest and immersion into maturity LaMore et al. By igniting in students an early passion for photography or music, woodworking or dance, educators can expect a significant return in lifetimes of creative practice and impact. Arts and crafts are essential investments in STEM research, discovery, and innovation that pay off in decades to come. In addition, as with any set of skills that must cross from one discipline to another, the crossover will be more likely if we emphasize the need for it, provide role models, and study exemplars. Arts and crafts, in short, are not luxuries that we can dispenseâ€”or dispense withâ€"as the mood strikes us. The skills, knowledge, techniques, models, concepts, and inventions that artists and craftspeople develop sculpt the imagination, making new sciences and technologies possible. The best scientists have always known this. Max Planck , a Nobel laureate as well as an extraordinary pianist, wrote in his autobiography, "The creative scientist needs an artistic imagination" p. Santiago Ramon y Cajal, perhaps the greatest neuroanatomist of all time, winner of the Nobel Prize in physiology or medicine, inventor of modern color photography, and painter of great talent, agreed. What they show is clearâ€"that the arts add value to the pursuit of science. Effect of instructions on spatial visualization ability in civil engineering students. International Education Journal, 3 1 , 1â€" Adventures of a physicist. The craft of experimental physics. Ivor Nicholson and Watson. Science, 68 , â€" Doing well by doing good by doing art:

Chapter 7 : Shrinking arts education is hitting science and medicine too, experts warn

Preface â€¢ xv Acknowledgments â€¢ xviii PART 1 THE ART OF TEACHING SCIENCE CHAPTER 1 The Art of Teaching Science: AReconnaissance â€¢ 3 CHAPTER 2 Science for All â€¢ 36 PART 2 THE GOALS AND THE.

Chapter 8 : Arts in Education | Harvard Graduate School of Education

Science is a systematic and precise body of knowledge in a particular field of the world. It seeks to discover the general laws regulating the phenomena in that field through observation and experiments. As per this definition, education must be taken as a science since it is a systematic body of.

Chapter 9 : Science education - Wikipedia

Art & Science: A Curriculum for K Teachers mines the treasures of the Getty Museum to explore the many intersections of the visual arts with scientific disciplines.. The curriculum was developed by Getty educators with museum conservators, curators, and scientists and a teacher advisory gr.