

Engineering Design Challenges In High School Stem Courses

"The next time you want to integrate engineering practices into your classes, consider this book your own personal idea-starter. The 13 units in *Creating Engineering Design Challenges* provide innovative ways to make science and math relevant to middle and high school students through challenge-based learning and the engineering design process. Content areas include biology, chemistry, physical science, Earth science, and environmental science. Topics range from developing a recipe for cement to implementing geocaching to calculating accurate aim with slingshots and water balloons. You can be sure the units are classroom-ready because they were contributed by the same teachers who developed, used, and revised them. The teachers were participants in the Cincinnati Engineering Enhanced Math and Science program, a project funded by the National Science Foundation. They provide detailed accounts of their units as well as lesson plans and handouts. The book also offers guidance on fostering professional development to support and grow your school's engineering education practice. *Creating Engineering Design Challenges* can help you change your classroom environment, empower students, and move toward a more student-centered classroom culture that leads to deeper learning"--

Since its inception in 1968, software engineering has undergone numerous changes. In the early years, software development was organized using the waterfall model, where the focus of requirements engineering was on a frozen requirements document, which formed the basis of the subsequent design and implementation process. Since then, a lot has changed: software has to be developed faster, in larger and distributed teams, for pervasive as well as large-scale applications, with more flexibility, and with ongoing maintenance and quick release cycles. What do these ongoing developments and changes imply for the future of requirements engineering and software design? Now is the time to rethink the role of requirements and design for software intensive systems in transportation, life sciences, banking, e-government and other areas. Past assumptions need to be questioned, research and education need to be rethought. This book is based on the Design Requirements Workshop, held June 3-6, 2007, in Cleveland, OH, USA, where leading researchers met to assess the current state of affairs and define new directions. The papers included were carefully reviewed and selected to give an overview of the current state of the art as well as an outlook on probable future challenges and priorities. After a general introduction to the workshop and the related NSF-funded project, the contributions are organized in topical sections on fundamental concepts of design; evolution and the fluidity of design; quality and value-based requirements; requirements intertwining; and adapting requirements practices in different domains.

This is a primary text project that combines sustainability development with engineering entrepreneurship and design to present a transdisciplinary approach to modern engineering education. The book is distinguished by extensive descriptions of concepts in sustainability, its principles, and its relevance to environment, economy, and society. It can be read by all engineers regardless of their disciplines as well as by engineering students as they would be future designers of products and systems. This book presents a flexible organization of knowledge in various fields, which allows to be used

as a text in a number of courses including for example, engineering entrepreneurship and design, engineering innovation and leadership, and sustainability in engineering design

Successful strategies for incorporating engineering design challenges into science, technology, engineering, and mathematics (STEM) courses in American high schools are presented in this paper. The developers have taken the position that engineering design experiences should be an important component of the high school education of all American youth. In most instances, these experiences in engineering design are infused into instruction programs in standards-based courses in science, technology, or mathematics. This paper is intended to provide guidelines for the development of authentic engineering design challenges, to describe instructional strategies for introducing engineering design experiences to high school students, and to offer suggestions for the assessment of the outcomes of engineering design activities. The information is intended to be useful in planning, organizing, and implementing the infusion of engineering design challenges in high school STEM courses. This paper is an exploration of the available research on the following questions dealing with the implementation of engineering design challenges in high school STEM courses: (1) Does the development of engineering habits of thought and action lead to improvements in problem solving abilities, systems thinking, integration of content, increased interest in engineering, and feelings of self-efficacy about pursuing additional engineering activities?; (2) What is the anatomy of the engineering design process and what are its essential components?; (3) What are the distinguishing characteristics of authentic engineering design challenges?; (4) In what ways do engineering design challenges fit into the national STEM scene and the high school STEM organizational structure?; (5) What are the content, context, and process elements of appropriate engineering design challenges for high school STEM courses?; (6) What instructional practices based upon engineering design challenges are effective in supporting student learning?; and (7) In what ways can teachers design and implement an authentic system for assessing student progress and completion of engineering design challenges? How can the assessment provide support for using engineering principles to solve design challenges in contrast to simple trial and error approaches? (Contains 10 figures.).

A guide to using the power of design flexibility to improve the performance of complex technological projects, for designers, managers, users, and analysts. Project teams can improve results by recognizing that the future is inevitably uncertain and that by creating flexible designs they can adapt to eventualities. This approach enables them to take advantage of new opportunities and avoid harmful losses. Designers of complex, long-lasting projects—such as communication networks, power plants, or hospitals—must learn to abandon fixed specifications and narrow forecasts. They need to avoid the “flaw of averages,” the conceptual pitfall that traps so many designs in underperformance. Failure to allow for changing circumstances risks leaving significant value untapped. This book is a guide for creating and implementing value-enhancing flexibility in design. It will be an essential resource for all participants in the development and operation of technological systems: designers, managers, financial analysts, investors, regulators, and academics. The book provides a high-level overview of why flexibility in design is needed to deliver significantly increased value. It

describes in detail methods to identify, select, and implement useful flexibility. The book is unique in that it explicitly recognizes that future outcomes are uncertain. It thus presents forecasting, analysis, and evaluation tools especially suited to this reality. Appendixes provide expanded explanations of concepts and analytic tools.

Explore STEM concepts through making and tinkering!

It is essential for today's students to learn about science and engineering in order to make sense of the world around them and participate as informed members of a democratic society. The skills and ways of thinking that are developed and honed through engaging in scientific and engineering endeavors can be used to engage with evidence in making personal decisions, to participate responsibly in civic life, and to improve and maintain the health of the environment, as well as to prepare for careers that use science and technology. The majority of Americans learn most of what they know about science and engineering as middle and high school students. During these years of rapid change for students' knowledge, attitudes, and interests, they can be engaged in learning science and engineering through schoolwork that piques their curiosity about the phenomena around them in ways that are relevant to their local surroundings and to their culture. Many decades of education research provide strong evidence for effective practices in teaching and learning of science and engineering. One of the effective practices that helps students learn is to engage in science investigation and engineering design. Broad implementation of science investigation and engineering design and other evidence-based practices in middle and high schools can help address present-day and future national challenges, including broadening access to science and engineering for communities who have traditionally been underrepresented and improving students' educational and life experiences. Science and Engineering for Grades 6-12: Investigation and Design at the Center revisits America's Lab Report: Investigations in High School Science in order to consider its discussion of laboratory experiences and teacher and school readiness in an updated context. It considers how to engage today's middle and high school students in doing science and engineering through an analysis of evidence and examples. This report provides guidance for teachers, administrators, creators of instructional resources, and leaders in teacher professional learning on how to support students as they make sense of phenomena, gather and analyze data/information, construct explanations and design solutions, and communicate reasoning to self and others during science investigation and engineering design. It also provides guidance to help educators get started with designing, implementing, and assessing investigation and design. Engineering Design and Mathematical Modelling: Concepts and Applications consists of chapters that span the Engineering design and mathematical modelling domains. Engineering design and mathematical modelling are key tools/techniques in the Science, Technology and Innovation spheres. Whilst engineering design is concerned with the creation of functional innovative products and processes, mathematical modelling seeks to utilize mathematical principles and concepts to describe and control real world phenomena. Both of these can be useful tools for spurring and hastening progress in developing countries. They are also areas where Africa needs to 'skill-up' in order to build a technological base. The chapters in this book cover the relevant research trends in the fields of both engineering design and mathematical modelling. This book was originally published as a special issue of the African Journal of Science,

Technology, Innovation and Development.

Effective design and manufacturing, both of which are necessary to produce high-quality products, are closely related. However, effective design is a prerequisite for effective manufacturing. This new book explores the status of engineering design practice, education, and research in the United States and recommends ways to improve design to increase U.S. industry's competitiveness in world markets.

Since its initial funding by the National Science Foundation in 2004, the National Center for Engineering and Technology Education (NCETE) has worked to understand the infusion of engineering design experiences into the high school setting. Over the years, an increasing number of educators and professional groups have participated in the expanding initiative seeking to acquaint all students with engineering design. While there is strong support for providing students with engineering design experiences in their high school science, technology, engineering, and mathematics (STEM) courses, the lack of consensus on purposes and strategies has become increasingly apparent as the work continues. In February, 2011, NCETE sought position statements from a small number of engineering educators, cognitive scientists, instructional designers, and professional development providers who have been engaged in long-term efforts to provide students with engineering design experiences in their high school STEM courses. Each of these experienced professionals was asked to provide brief descriptions of principles or guidelines that they consider to be most important in promoting effective infusion of authentic engineering design challenges into STEM courses for all high school students. This publication contains the following papers: (1) Design Problems for Secondary Students (David H. Jonassen); (2) Infusing Engineering Design into High School STEM Courses (Morgan Hynes, Merredith Portsmore, Emily Dare, Elissa Milto, Chris Rogers, and David Hammer); (3) Integrating Engineering Design Challenges into Secondary STEM Education (Ronald L. Carr and Johannes Strobel); (4) Design Principles for High School Engineering Design Challenges: Experiences from High School Science Classrooms (Christian Schunn); (5) Engineering Design Challenges in a Science Curriculum (Arthur Eisenkraft); and (6) A Possible Pathway for High School Science in a STEM World (Cary Sneider). (Individual papers contain figures, references and appendices.).

Science, engineering, and technology permeate nearly every facet of modern life and hold the key to solving many of humanity's most pressing current and future challenges. The United States' position in the global economy is declining, in part because U.S. workers lack fundamental knowledge in these fields. To address the critical issues of U.S. competitiveness and to better prepare the workforce, A Framework for K-12 Science Education proposes a new approach to K-12 science education that will capture students' interest and provide them with the necessary foundational knowledge in the field. A Framework for K-12 Science Education outlines a broad set of expectations for students in science and engineering in grades K-12. These expectations will inform the development of new standards for K-12 science education and, subsequently, revisions to curriculum, instruction, assessment, and professional development for educators. This book identifies three dimensions that convey the core ideas and practices around which science and engineering education in these grades should be built. These three dimensions are: crosscutting concepts that unify the study of science through their common application across science and engineering; scientific

and engineering practices; and disciplinary core ideas in the physical sciences, life sciences, and earth and space sciences and for engineering, technology, and the applications of science. The overarching goal is for all high school graduates to have sufficient knowledge of science and engineering to engage in public discussions on science-related issues, be careful consumers of scientific and technical information, and enter the careers of their choice. A Framework for K-12 Science Education is the first step in a process that can inform state-level decisions and achieve a research-grounded basis for improving science instruction and learning across the country. The book will guide standards developers, teachers, curriculum designers, assessment developers, state and district science administrators, and educators who teach science in informal environments.

How to engineer change in your high school science classroom With the Next Generation Science Standards, your students won't just be scientists—they'll be engineers. But you don't need to reinvent the wheel. Seamlessly weave engineering and technology concepts into your high school math and science lessons with this collection of time-tested engineering curricula for science classrooms. Features include: A handy table that leads you straight to the chapters you need In-depth commentaries and illustrative examples A vivid picture of each curriculum, its learning goals, and how it addresses the NGSS More information on the integration of engineering and technology into high school science education

Standards for technological literacy: content for the study of technology (referred to henceforth as Technology content standards) presents a vision of what students should know and be able to do in order to be technologically literate.

How do you create effective STEM classrooms that energize students, help them grow into creative thinkers and collaborators, and prepare them for their futures? This practical book from expert Anne Jolly has all the answers and tools you need to get started or enhance your current program. Based on the author's popular MiddleWeb blog of the same name, *STEM by Design* reveals the secrets to successful lessons in which students use science, math, and technology to solve real-world engineering design problems. You'll learn how to: Select and adapt quality existing STEM lessons that present authentic problems, allow for creative approaches, and engage students in meaningful teamwork; Create your own student-centered STEM lessons based on the Engineering Design Process; Assess students' understanding of basic STEM concepts, their problem-solving abilities, and their level of engagement with the material; Teach STEM in after-school programs to further build on concepts covered in class; Empower girls to aspire to careers in STEM and break down the barriers of gender bias; Tap into STEM's project-based learning style to attract and engage all students. Throughout this user-friendly book, you'll find design tools such as checklists, activities, and assessments to aid you in developing or adapting STEM lessons. These tools, as well as additional teacher resources, are also available as free downloads from the book's website, <http://www.stem-by-design.com>.

Can the United States continue to lead the world in innovation? The answer may hinge in part on how well the public understands engineering, a key component of the 'innovation engine'. A related concern is how to encourage young people--particularly girls and under-represented minorities--to consider engineering as a career option. *Changing the Conversation* provides actionable strategies and market-tested messages

for presenting a richer, more positive image of engineering. This book presents and discusses in detail market research about what the public finds most appealing about engineering--as well as what turns the public off. Changing the Conversation is a vital tool for improving the public image of engineering and outreach efforts related to engineering. It will be used by engineers in professional and academic settings including informal learning environments (such as museums and science centers), engineering schools, national engineering societies, technology-based corporations that support education and other outreach to schools and communities, and federal and state agencies and labs that do or promote engineering, technology, and science. Engineering skills and knowledge are foundational to technological innovation and development that drive long-term economic growth and help solve societal challenges. Therefore, to ensure national competitiveness and quality of life it is important to understand and to continuously adapt and improve the educational and career pathways of engineers in the United States. To gather this understanding it is necessary to study the people with the engineering skills and knowledge as well as the evolving system of institutions, policies, markets, people, and other resources that together prepare, deploy, and replenish the nation's engineering workforce. This report explores the characteristics and career choices of engineering graduates, particularly those with a BS or MS degree, who constitute the vast majority of degreed engineers, as well as the characteristics of those with non-engineering degrees who are employed as engineers in the United States. It provides insight into their educational and career pathways and related decision making, the forces that influence their decisions, and the implications for major elements of engineering education-to-workforce pathways.

Creating Engineering Design Challenges Success Stories from Teachers

The Cambridge Handbook of Engineering Education Research is the critical reference source for the growing field of engineering education research, featuring the work of world luminaries writing to define and inform this emerging field. The Handbook draws extensively on contemporary research in the learning sciences, examining how technology affects learners and learning environments, and the role of social context in learning. Since a landmark issue of the Journal of Engineering Education (2005), in which senior scholars argued for a stronger theoretical and empirically driven agenda, engineering education has quickly emerged as a research-driven field increasing in both theoretical and empirical work drawing on many social science disciplines, disciplinary engineering knowledge, and computing. The Handbook is based on the research agenda from a series of interdisciplinary colloquia funded by the US National Science Foundation and published in the Journal of Engineering Education in October 2006.

At the University of Pittsburgh, the author and his colleagues have been exploring a range of approaches to design challenges for implementation in high school science classrooms. In general, their approach has always involved students working during class time over the course of many weeks. So, their understanding of what works must be contextualized to that situation (i.e., without significant home support, by students enrolled in traditional classrooms, involving content that is connected to traditional science classrooms). However, their approach has been implemented with thousands of students in over 80 classrooms ranging from 9th grade biology or general science to 11th grade physics, from traditional mainstream science classrooms to elective Biology

II or Honors Chemistry, and from high needs urban classrooms to affluent suburban classrooms. In other words, there is some important generality to these experiences. They have also conducted a number of studies on students in these settings, to understand a range of factors that influence student learning and affect outcomes. This white paper provides a brief summary of principles that appear to guide successful experiences for students.

Make and test projects are used as introductory design experiences in almost every engineering educational institution world wide. However, the educational benefits and costs associated with these projects have been seldom examined. *Make and Test Projects in Engineering Design* provides a serious examination of the design of make and test projects and their associated educational values. A taxonomy is provided for the design of make and test projects as well as a catalogue of technical information about unconventional engineering materials and energy sources. Case studies are included based on the author's experience of supervising make and test projects for over twenty-five years. The book is aimed at the engineering educator and all those planning and conducting make and test projects. Up until now, this topic has been dealt with informally. *Make and Test Projects in Engineering Design* is the first book that formalises this important aspect of early learning in engineering design. It will be an invaluable teaching tool and resource for educators in engineering design.

This comprehensive introduction will help elementary educators integrate engineering into their classroom, school, or district in age-appropriate, inclusive, and engaging ways. Building on the work of a Museum of Science team that has spent 15 years developing elementary engineering curricula, this book outlines how engineering can be integrated into a broader STEM curriculum, details its pedagogical benefits to students, and includes classroom examples to help educators tailor instruction to engage diverse students. Featuring vignettes, case studies, videos, research results, and assessments, this resource will help readers visualize high-quality elementary engineering and understand the theoretical principles in context. Book Features: Frameworks to help teachers create curricula and structure activities. A focus on engaging the diversity of learners in today's classrooms. Experiences from the nation's leading elementary education curriculum that has reached 13.3 million children and 165,000 educators.

"Wondering how to infuse engineering into your teaching and curriculum? Here's the book for you!" —From the Foreword by Richard A. Duschl, Penn State University

"Schools or districts looking to introduce engineering in ways that enhance science and mathematics learning can use the inclusive teaching strategies in this book." —Linda Curtis-Bey, executive director of STEM, NYC Department of Education

"Dr. Cunningham lays out an innovative and achievable vision for elementary school engineering that engages all students." —Heidi Carlone, The University of North Carolina at Greensboro

How did somebody come up with the idea for bridges, skyscrapers, helicopters, and nightlights? How did people figure out how to build them? In *3D Engineering: Design and Build Your Own Prototypes*, young readers tackle real-life engineering problems by figuring out real-life solutions. Kids apply science and math skills to create prototypes for bridges, instruments, alarms, and more. Prototypes are preliminary models used by engineers—and kids—to evaluate ideas and to better understand how things work. Engineering design starts with an idea. How do we get to the other side of the river?

How do we travel long distances in short times? Using a structured engineering design process, kids learn how to brainstorm, build a prototype, test a prototype, evaluate, and re-design. Projects include designing a cardboard chair to understand the stiffness of structural systems and designing and building a set of pan pipes to experiment with pitch and volume. Creating prototypes is a key step in the engineering design process and prototyping early in the design process generally results in better processes and products. 3D Engineering gives kids a chance to figure out many different prototypes, empowering them to discover the mechanics of the world we know.

In order to achieve the revolutionary new defense capabilities offered by materials science and engineering, innovative management to reduce the risks associated with translating research results will be needed along with the R&D. While payoff is expected to be high from the promising areas of materials research, many of the benefits are likely to be evolutionary. Nevertheless, failure to invest in more speculative areas of research could lead to undesired technological surprises. Basic research in physics, chemistry, biology, and materials science will provide the seeds for potentially revolutionary technologies later in the 21st century.

From the very first day you use them, the design challenges in this compendium will spur your students, too, to jump right in and engage throughout the entire class. The activities reinforce important science content while illustrating a range of STEM skills. The 30 articles have been compiled from NSTAOCO's journals for elementary through high school. Next time you need an engaging STEM activity, you'll be glad you have this collection to help you blend meaningful and memorable experiences into your lessons."

Environmental engineers support the well-being of people and the planet in areas where the two intersect. Over the decades the field has improved countless lives through innovative systems for delivering water, treating waste, and preventing and remediating pollution in air, water, and soil. These achievements are a testament to the multidisciplinary, pragmatic, systems-oriented approach that characterizes environmental engineering. *Environmental Engineering for the 21st Century: Addressing Grand Challenges* outlines the crucial role for environmental engineers in this period of dramatic growth and change. The report identifies five pressing challenges of the 21st century that environmental engineers are uniquely poised to help advance: sustainably supply food, water, and energy; curb climate change and adapt to its impacts; design a future without pollution and waste; create efficient, healthy, resilient cities; and foster informed decisions and actions.

Next Generation Science Standards identifies the science all K-12 students should know. These new standards are based on the National Research Council's *A Framework for K-12 Science Education*. The National Research Council, the National Science Teachers Association, the American Association for the Advancement of Science, and Achieve have partnered to create standards through a collaborative state-led process. The standards are rich in content and practice and arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education.

The print version of Next Generation Science Standards complements the nextgenscience.org website and: Provides an authoritative offline reference to the standards when creating lesson plans Arranged by grade level and by core discipline, making information quick and easy to find Printed in full color with a lay-flat spiral binding Allows for bookmarking, highlighting, and annotating

The need for a scientifically literate citizenry, one that is able to think critically and engage productively in the engineering design process, has never been greater. By raising engineering design to the same level as scientific inquiry the Next Generation Science Standards' (NGSS) have signaled their commitment to the integration of engineering design into the fabric of science education. This call has raised many critical questions...How well do these new standards represent what actually engineers do? Where do the deep connections among science and engineering practices lie? To what extent can (or even should) science and engineering practices co-exist in formal and informal educational spaces? Which of the core science concepts are best to leverage in the pursuit of coherent and compelling integration of engineering practices? What science important content may be pushed aside? This book, tackles many of these tough questions head on. All of the contributing authors consider the same core question: Given the rapidly changing landscape of science education, including the elevated status of engineering design, what are the best approaches to the effective integration of the science and engineering practices? They answered with rich descriptions of pioneering approaches, critical insights, and useful practical examples of how embodying a culture of interdisciplinarity and innovation can fuel the development of a scientifically literate citizenry . This collection of work builds traversable bridges across diverse research communities and begins to break down long standing disciplinary silos that have historically often hamstrung well-meaning efforts to bring research and practice from science and engineering together in meaningful and lasting ways.

Video clip of a NASA film highlights the time delay in communication between Apollo astronauts and Houston.

Problem: You're eager to expand your physics curriculum and engage your students with engineering content but you don't know how. Solution: Use the approach and lessons in *Beyond the Egg Drop* to infuse engineering into what you're already teaching, without sacrificing time for teaching physics concepts. Since the inception of the National Center for Engineering and Technology Education in 2004, educators and researchers have struggled to identify the necessary components of a "good" engineering design challenge for high school students. In reading and analyzing the position papers on engineering design many themes emerged that may begin to form a narrative for engineering design in a high school setting. Before educators can provide a framework for engineering design in STEM courses, four questions need to be answered: (a) To what degree should engineering design challenges be open-ended or well-structured? (b) What are the relationships between engineering design

experiences and standards-based instruction in STEM courses? (c) What is an effective sequencing of age-appropriate engineering design challenges? and (d) To what extent should engineering habits of thought and action be employed in resolving the challenges? Collectively, the six position papers (Carr & Strobel, 2011; Eisenkraft, 2011; Hynes et al, 2011; Jonassen, 2011, Schunn, 2011; Sneider, 2011) provide an intriguing foundation for answering these questions and forming a framework for engineering design in high school STEM courses. This synthesis paper discusses the most pervasive themes of the papers and provides a narrative for answering the question, "What are the requirements for a good engineering design challenge?" The following emergent themes provide some guidance to finding answers for that question: (1) engineering design in the science curriculum; (2) assessing the engineering design experience; (3) sequencing the engineering design experiences; and (4) choosing engineering design challenges. By addressing these areas of contention, the education community can begin to lay the curricular and pedagogical groundwork needed to provide successful engineering experiences for high school students.

Engineering challenges are design problems that require students to identify needs, define problems, identify design criteria and constraints, develop solutions, and evaluate their solutions. In these activities, there are more than one "right" answer. The right design is usually one that meets the engineering criteria and is built within the materials budget. Students will design, construct, and test their engineering design solution and collect relevant data (if applicable). They will then evaluate the solution in terms of design and performance criteria, constraints, priorities, and trade-offs while also identifying possible design improvements. This easy and exciting time and work saving book was developed to help middle and high school teachers with no engineering background teach engineering. By using the Engineering Design Process, students begin to look at problems, issues and constraints from multiple viewpoints and in relationship to an assortment of situations and scenarios. Good engineering design considers people's needs to determine the best solution. By solving problems that consider the needs of people, the doors to creativity open wide and student engagement increases. As students build skills in using the Engineering Design Process, they no longer need to sit back and wait for instructions. Instead, they explore, create, design, innovate, imagine, test and evaluate their solutions.

This book shows educators how to encourage creativity, communication, innovation, and collaboration in students by incorporating engineering design process thinking into existing classwork. Strategies for supporting engineering practices that foster creative problem-solving and critical thinking are among the topics discussed.

Creativity, Technology, and Learning provides a comprehensive introduction to theories and research on creativity in education and, in particular, to the role of digital-learning technologies in enabling creativity across classroom learning environments. Topical coverage includes play, constructionism, multimodal

learning and project-/problem-based learning. Creativity is uniquely positioned throughout the book as an integral component of the educational process and also as a foundational aspect of self-actualization, thriving communities, and humane societies. Through in-depth, empirically based discussions of the philosophical, curricular and pedagogical elements of creativity, Sullivan demonstrates how creativity can be fostered across the curriculum through the use of digital-learning technologies in design, personal expression and problem-solving activities.

The Engineering Design Challenge addresses teaching engineering design and presents design projects for first-year students and interdisciplinary design ventures. A short philosophy and background of engineering design is discussed. The organization of the University of Wyoming first-year Introduction to Engineering program is presented with an emphasis on the first-year design challenges. These challenges are presented in a format readily incorporated in other first-year programs. The interdisciplinary design courses address the institutional constraints and present organizational approaches that resolve these issues. Student results are summarized and briefly assessed. A series of short intellectual problems are included to initiate discussion and understanding of design issues. Sample syllabi, research paper requirements, and oral presentation evaluation sheets are included.

In a broad sense, technology is any modification of the natural world made to fulfill human needs or desires. Although people tend to focus on the most recent technological inventions, technology includes a myriad of devices and systems that profoundly affect everyone in modern society. Technology is pervasive; an informed citizenship needs to know what technology is, how it works, how it is created, how it shapes our society, and how society influences technological development. This understanding depends in large part on an individual level of technological literacy. Tech Tally: Approaches to Assessing Technological Literacy determines the most viable approaches to assessing technological literacy for students, teachers, and out-of-school adults. The book examines opportunities and obstacles to developing scientifically valid and broadly applicable assessment instruments for technological literacy in the three target populations. The book offers findings and 12 related recommendations that address five critical areas: instrument development; research on learning; computer-based assessment methods, framework development, and public perceptions of technology. This book will be of special interest to individuals and groups promoting technological literacy in the United States, education and government policy makers in federal and state agencies, as well as the education research community.

Louis Gary Lamit's Moving from 2D to 3D CAD for Engineering Design: Challenges and Opportunities is a much-needed book that clearly explains the industry factors, the many advantages, and the product selection criteria for adopting 3D computer-aided design (CAD) for one's engineering design work.

Written by an experienced designer and instructor, the book is essential for any individual or team who wants to make the best product choices, and maximize their productivity with whatever 3D CAD design tools they choose.

To enhance the nation's economic productivity and improve the quality of life worldwide, engineering education in the United States must anticipate and adapt to the dramatic changes of engineering practice. The Engineer of 2020 urges the engineering profession to recognize what engineers can build for the future through a wide range of leadership roles in industry, government, and academia--not just through technical jobs. Engineering schools should attract the best and brightest students and be open to new teaching and training approaches. With the appropriate education and training, the engineer of the future will be called upon to become a leader not only in business but also in nonprofit and government sectors. The book finds that the next several decades will offer more opportunities for engineers, with exciting possibilities expected from nanotechnology, information technology, and bioengineering. Other engineering applications, such as transgenic food, technologies that affect personal privacy, and nuclear technologies, raise complex social and ethical challenges. Future engineers must be prepared to help the public consider and resolve these dilemmas along with challenges that will arise from new global competition, requiring thoughtful and concerted action if engineering in the United States is to retain its vibrancy and strength.

If you give a child a box, who can tell what will happen next? It may become a library or a boat. It could set the scene for a fairy tale or a wild expedition. The most wonderful thing is its seemingly endless capacity for magical adventure, a feature imaginatively captured in cardboardsque art and rhythmically celebrated in this poetic tribute. This board book edition of the popular 2016 picture book of the same name takes the literal shape of a box to bring an imaginative concept to life.

Engineering education in K-12 classrooms is a small but growing phenomenon that may have implications for engineering and also for the other STEM subjects--science, technology, and mathematics. Specifically, engineering education may improve student learning and achievement in science and mathematics, increase awareness of engineering and the work of engineers, boost youth interest in pursuing engineering as a career, and increase the technological literacy of all students. The teaching of STEM subjects in U.S. schools must be improved in order to retain U.S. competitiveness in the global economy and to develop a workforce with the knowledge and skills to address technical and technological issues. Engineering in K-12 Education reviews the scope and impact of engineering education today and makes several recommendations to address curriculum, policy, and funding issues. The book also analyzes a number of K-12 engineering curricula in depth and discusses what is known from the cognitive sciences about how children learn engineering-related concepts and skills. Engineering in K-12 Education will serve as a

reference for science, technology, engineering, and math educators, policy makers, employers, and others concerned about the development of the country's technical workforce. The book will also prove useful to educational researchers, cognitive scientists, advocates for greater public understanding of engineering, and those working to boost technological and scientific literacy.

[Copyright: b2795dab39496df704d978879bf1ba65](#)