The purpose of this book is to reach out to teachers, parents, coaches, and students who may be hoping to, or just investigating the possibility of, how to get started with robotics. At the same time, we hope to leverage the efforts of those who have been hard at work and "play" in this massive movement for many years, applaud their efforts, and provide them with documentation, support, and additional resources to reach further into the possibilities they can help create for all of us in bringing the power and potential of learning through robotics to more students, to the classroom and beyond. Not only does this book provide resources and firsthand insight into this exciting field, but it also provides one-of-a-kind perspectives of curricular applications of robotics for student learning.

Robots are destined to be a major part of human society and will transform education, business, and everyday life. Learning how to build robots is a popular pastime that brings to bear many different skills. This book introduces readers to robotics clubs and instructs them on how to join one of the hundreds available across the United States and the globe. It also serves as a guidebook on how someone can even start and lead or manage one of their own clubs and serves as a technologically current update to the previous volume on such clubs.

A dive-right-in, quick-start guide for busy library professionals who want to build literacy, STEAM, and other 21st-century skills using simple robots in a fun, collaborative environment. • Provides the only guidebook currently available about robotics written by a librarian, for librarians—a simple, practical guide that virtually any librarian can use, no prior tech experience necessary • Guides librarians in using their knowledge of literacy, youth development, and guided-inquiry methodology to gain an accessible entry point to grow their technological skills alongside the youth they serve • Includes lesson plans and activity guides to help you start a simple robotics curriculum as quickly as possible • Supplies outcome measurement tools • Discusses funding ideas and sample budgets

The education system is constantly growing and developing as more ways to teach and learn are implemented into the classroom. Recently, there has been a growing interest in teaching computational thinking with schools all over the world introducing it to the curriculum due to its ability to allow students to become proficient at problem solving using logic, an essential life skill. In order to provide the best education possible, it is imperative that computational thinking strategies, along with programming skills and the use of robotics in the classroom, be implemented in order for students to achieve maximum thought processing skills and computer competencies. The Research Anthology on Computational Thinking, Programming, and Robotics in the Classroom is an all-encompassing reference book that discusses how computational thinking, programming, and robotics can be used in education as well as the benefits and difficulties of implementing these elements into the classroom. The book includes strategies for preparing educators to teach computational thinking in the classroom as well as design techniques for incorporating these practices into various levels of school curriculum and within a variety of subjects. Covering topics ranging from decomposition to robot learning, this book is ideal for educators, computer scientists, administrators, academicians, students, and anyone interested in learning more about how computational thinking, programming, and robotics can change the current education system.

Readers will learn what it takes to succeed as a petroleum engineer. The book also explains the necessary educational steps, useful character traits, and daily job tasks related to this career, in the framework of the STEAM, Science, Technology, Engineering, Art, and Math movement. Photos, a glossary, and additional resources are included.
Cyber-physical systems (CPS) are "engineered systems that are built from, and depend upon, the seamless integration of computational algorithms and physical components." CPS can be small and closed, such as an artificial pancreas, or very large, complex, and interconnected, such as a regional energy grid. CPS engineering focuses on managing interdependencies and impact of physical aspects on cyber aspects, and vice versa. With the development of low-cost sensing, powerful embedded system hardware, and widely deployed communication networks, the reliance on CPS for system functionality has dramatically increased. These technical developments in combination with the creation of a workforce skilled in engineering CPS will allow the deployment of increasingly capable, adaptable, and trustworthy systems. Engineers responsible for developing CPS but lacking the appropriate education or training may not fully understand at an appropriate depth, on the one hand, the technical issues associated with the CPS software and hardware or, on the other hand, techniques for physical system modeling, energy and power, actuation, signal processing, and control. In addition, these engineers may be designing and implementing life-critical systems without appropriate formal training in CPS methods needed for verification and to assure safety, reliability, and security. A workforce with the appropriate education, training, and skills will be better positioned to create and manage the next generation of CPS solutions. A 21st Century Cyber-Physical Systems Education examines the intellectual content of the emerging field of CPS and its implications for engineering and computer science education. This report is intended to inform those who might support efforts to develop curricula and materials; faculty and university administrators; industries with needs for CPS workers; and current and potential students about intellectual foundations, workforce requirements, employment opportunities, and curricular needs.

The book reports on advanced topics in interactive robotics research and practice; in particular, it addresses non-technical obstacles to the broadest uptake of these technologies. It focuses on new technologies that can physically and cognitively interact with humans, including neural interfaces, soft wearable robots, and sensor and actuator technologies; further, it discusses important regulatory challenges, including but not limited to business models, standardization, education and ethical–legal–socioeconomic issues. Gathering the outcomes of the 1st INBOTS Conference (INBOTS2018), held on October 16–20, 2018 in Pisa, Italy, the book addresses the needs of a broad audience of academics and professionals working in government and industry, as well as end users. In addition to providing readers with detailed information and a source of inspiration for new projects and collaborations, it discusses representative case studies highlighting practical challenges in the implementation of interactive robots in a number of fields, as well as solutions to improve communication between different stakeholders. By merging engineering, medical, ethical and political perspectives, the book offers a multidisciplinary, timely snapshot of interactive robotics.

These volumes of "Advances in Intelligent Systems and Computing" highlight papers presented at the "Third Iberian Robotics Conference (ROBOT 2017)". Held from 22 to 24 November 2017 in Seville, Spain, the conference is a part of a series of conferences co-organized by SEIDROB (Spanish Society for Research and Development in Robotics) and SPR (Portuguese Society for Robotics). The conference is focused on Robotics scientific and technological activities in the Iberian Peninsula, although open to research and delegates from other countries. Thus, it has more than 500 authors from 21 countries. The volumes present scientific advances but also robotic industrial applications, looking to promote new collaborations between industry and academia.

Through expanded intelligence, the use of robotics has fundamentally transformed the business industry. Providing successful techniques in robotic design allows for increased autonomous mobility, which leads to a greater productivity and production level.
Rapid Automation: Concepts, Methodologies, Tools, and Applications provides innovative insights into the state-of-the-art technologies in the design and development of robotics and their real-world applications in business processes. Highlighting a range of topics such as workflow automation tools, human-computer interaction, and swarm robotics, this multi-volume book is ideally designed for computer engineers, business managers, robotic developers, business and IT professionals, academicians, and researchers.

Presents an introduction to the framework of twenty-first century learning, covering the skills needed to thrive, including learning and innovations skills, digital literacy skills, and life and career skills.

At a time when ICTs are proliferating various facets of society and human interactivity, optimizing the use of these tools and technologies not only enhances learning but also transforms learning experiences all together, resulting in an increase of effectiveness and quality of education around the globe. As such, teachers are being challenged to implement a wide range of tools, such as mobile learning and augmented reality, to create smarter learning environments inside and outside of the classroom. Cases on Smart Learning Environments explores the potential of SLE tools for enhanced learning outcomes as experienced by educators, learners, and administrators from various learning institutions around the world. This publication presents cases on the real-world implementation of SLEs in 11 countries that span the continents of Asia, Africa, Europe, and North and South America. Featuring coverage on a broad range of topics such as learner engagement, teacher training, and intelligent agent technology, this book is ideally designed for academicians, instructors, instructional designers, librarians, educational stakeholders, and curriculum developers.

As humans interact more often and more intimately with computers, and as computational systems become an ever more important element of our society, playing roles in education, the production of culture and goods, and management, it is inevitable that we should seek to interact with these systems in ways that take advantage of our powerful emotional capabilities. Creating Synthetic Emotions through Technological and Robotic Advancements compiles progressive research in the emerging and groundbreaking fields of artificial emotions, affective computing, and sociable robotics that allow humans to begin the once impossible-seeming task of interacting with robots, systems, devices, and agents. This landmark volume brings together expert international researchers to expound upon these topics as synthetic emotions move toward becoming a daily reality.

In science, technology, engineering, and mathematics (STEM) education in pre-college, engineering is not the silent “e” anymore. There is an accelerated interest in teaching engineering in all grade levels. Structured engineering programs are emerging in schools as well as in out-of-school settings. Over the last ten years, the number of states in the US including engineering in their K–12 standards has tripled, and this trend will continue to grow with the adoption of the Next Generation Science Standards. The interest in pre-college engineering education stems from three different motivations. Designed to be a source of background and inspiration for researchers and practitioners alike, this volume includes contributions on policy, synthesis studies, and research studies to catalyze and inform current efforts to improve pre-college engineering education. The book explores teacher learning
and practices, as well as how student learning occurs in both formal settings, such as classrooms, and informal settings, such as homes and museums. This volume also includes chapters on assessing design and creativity.

This book gathers papers presented at the International Conference “Educational Robotics in the Maker Era – EDUROBOTICS 2018”, held in Rome, Italy, on October 11, 2018. The respective chapters explore the connection between the Maker Movement on the one hand, and Educational Robotics, which mainly revolves around the constructivist and constructionist pedagogy, on the other. They cover a broad range of topics relevant for teacher education and for designing activities for children and youth, with an emphasis on using modern low-cost technologies (including block-based programming environments, Do-It-Yourself electronics, 3D printed artifacts, intelligent distributed systems, IoT technology and gamification) in formal and informal education settings. The twenty contributions collected here will introduce researchers and practitioners to the latest advances in educational robotics, with a focus on science, technology, engineering, arts and mathematics (STEAM) education. Teachers and educators at all levels will find valuable insights and inspirations into how educational robotics can promote technological interest and 21st century skills – e.g. creativity, critical thinking, teamwork, and problem-solving – with a special emphasis on new making technologies.

One of the most hands-on and exciting hobbies and extracurricular activities for students interested in STEM is participating in robotics competitions. This book, newly updated to reflect the latest advances in amateur and professional robotics, including the exploding popularity of the Maker movement, gives readers all they need to enter this competitive and dynamic field. More importantly, readers learn the basics of how to build prize-winning robots, and how to find and enter contests, including local, regional, and national ones.

Establishing a student-centered classroom environment where learning puts students’ interests first is essential for middle school students to learn and thrive. Student success does not simply rely on instruction; it relies on external factors such as school and classroom climate, positive relationships with their teachers and other adults, and a strong sense of belonging with their peers. The young adolescent learner is at a turning point where the need for love, belonging, and acceptance is heightened. Research studies indicate that large percentages of students lack social-emotional competence and believe their teachers do not care about them. Social-emotional learning skills are vital for young adolescents, as are 21st century skills and competencies to prepare them for an information- and technology-driven world. Aligning Social-Emotional and 21st Century Learning in the Classroom: Emerging Research and Opportunities shows teachers practical ways to combine the skills that young adolescents need (social-emotional) and the 21st century skills that they learn to create a culture of success in their middle school classrooms. This book also provides examples of education technologies that teachers can use to promote 21st century learning in their classroom. Highlighting a wide range of topics such as communication skills, critical thinking, social media, and emotional intelligence, this book is crucial for teachers, school administrators, instructional designers, K-12 educators, curriculum developers, academicians, researchers, and students.

This book includes papers presented at the International Conference “Educational Robotics 2016 (EDUROBOTICS)”, Athens, November 25,
2016. The papers build on constructivist and constructionist pedagogy and cover a variety of topics, including teacher education, design of educational robotics activities, didactical models, assessment methods, theater robotics, programming & making electronics with Snap4Arduino, the Duckietown project, robotics driven by tangible programming, Lego Mindstorms combined with App Inventor, the Orbital Education Platform, Anthropomorphic Robots and Human Meaning Makers in Education, and more. It provides researchers interested in educational robotics with the latest advances in the field with a focus on science, technology, engineering, arts and mathematics (STEAM) education. At the same time it offers teachers and educators from primary to secondary and tertiary education insights into how educational robotics can trigger the development of technological interest and 21st century skills in STEAM education (creative thinking, team working, problem solving).

Advances in technology continue to alter the ways in which we conduct our lives, from the private sphere to how we interact with others in public. As these innovations become more integrated into modern society, their applications become increasingly relevant in various facets of life. Wearable Technologies: Concepts, Methodologies, Tools, and Applications is a comprehensive reference source for the latest scholarly material on the development and implementation of wearables within various environments, emphasizing the valuable resources offered by these advances. Highlighting a range of pertinent topics, such as assistive technologies, data storage, and health and fitness applications, this multi-volume book is ideally designed for researchers, academics, professionals, students, and practitioners interested in the emerging applications of wearable technologies.

This book constitutes the proceedings of the 11th International Conference on Informatics in Schools: Situation, Evolution and Perspectives, ISSEP 2018, held in St. Petersburg, Russia, in October 2018. The 29 full papers presented in this volume were carefully reviewed and selected from 74 submissions. They were organized in topical sections named: role of programming and algorithmics in informatics for pupils of all ages; national concepts of teaching informatics; teacher education in informatics; contests and competitions in informatics; socio-psychological aspects of teaching informatics; and computer tools in teaching and studying informatics.

The use of technology can significantly enhance educational environments for students. It is imperative to study new software, hardware, and gadgets for the improvement of teaching and learning practices. The Handbook of Research on Mobile Devices and Smart Gadgets in K-12 Education is a pivotal reference source featuring the latest scholarly research on the opportunities and challenges of using handheld technology devices in primary and secondary education. Including coverage on a wide variety of topics and perspectives such as blended learning, game-based curriculum, and software applications, this publication is ideally designed for educators, researchers, students, and technology experts seeking current research on new trends in the use of technology in education.

Over the last few years, increasing attention has been focused on the development of children’s acquisition of 21st-century skills and digital competences. Consequently, many education scholars have argued that teaching technology to young children is vital in keeping up with 21st-century employment patterns. Technologies, such as those that involve robotics or coding apps, come at a time when the demand for computing jobs around the globe is at an all-time high while its supply is at an all-time low. There is no doubt that coding with robotics is a wonderful tool for learners of all ages as it provides a catalyst to introduce them to computational thinking, algorithmic thinking, and project management. Additionally, recent studies argue that the use of a developmentally appropriate robotics curriculum can help to change negative stereotypes and ideas children may initially have about technology and engineering. The Handbook of Research on Using Educational Robotics to Facilitate Student Learning is an edited book that advocates for a new approach to computational thinking and
computing education with the use of educational robotics and coding apps. The book argues that while learning about computing, young people should also have opportunities to create with computing, which have a direct impact on their lives and their communities. It develops two key dimensions for understanding and developing educational experiences that support students in engaging in computational action: (1) computational identity, which shows the importance of young people’s development of scientific identity for future STEM growth; and (2) digital empowerment to instill the belief that they can put their computational identity into action in authentic and meaningful ways. Covering subthemes including student competency and assessment, programming education, and teacher and mentor development, this book is ideal for teachers, instructional designers, educational technology developers, school administrators, academicians, researchers, and students. Education is vital to the progression and sustainability of society. By developing effective learning programs, this creates numerous impacts and benefits for future generations to come. K-12 STEM Education: Breakthroughs in Research and Practice is a pivotal source of academic material on the latest trends, techniques, technological tools, and scholarly perspectives on STEM education in K-12 learning environments. Including a range of pertinent topics such as instructional design, online learning, and educational technologies, this book is an ideal reference source for teachers, teacher educators, professionals, students, researchers, and practitioners interested in the latest developments in K-12 STEM education.

This book describes recent approaches in advancing STEM education with the use of robotics, innovative methods in integrating robotics in school subjects, engaging and stimulating students with robotics in classroom-based and out-of-school activities, and new ways of using robotics as an educational tool to provide diverse learning experiences. It addresses issues and challenges in generating enthusiasm among students and revamping curricula to provide application focused and hands-on approaches in learning. The book also provides effective strategies and emerging trends in using robotics, designing learning activities and how robotics impacts the students’ interests and achievements in STEM related subjects. The frontiers of education are progressing very rapidly. This volume brought together a collection of projects and ideas which help us keep track of where the frontiers are moving. This book ticks lots of contemporary boxes: STEM, robotics, coding, and computational thinking among them. Most educators interested in the STEM phenomena will find many ideas in this book which challenge, provide evidence and suggest solutions related to both pedagogy and content. Regular reference to 21st Century skills, achieved through active collaborative learning in authentic contexts, ensures the enduring usefulness of this volume. John Williams Professor of Education and Director of the STEM Education Research Group Curtin University, Perth, Australia

In Cognitive Skills You Need for the 21st Century, Stephen Reed discusses a Future of Jobs report that contrasts trending and declining skills required by the workforce in the year 2022. Trending skills include analytical thinking and innovation, active learning strategies, creativity, reasoning, and complex problem solving. Part One on Acquiring Knowledge contains chapters on cognitive processes that are critical for learning. Part Two on Organizing Knowledge explains how matrices, networks, and hierarchies offer contrasting methods for visualizing organization. Part Three on Reasoning discusses visuospatial reasoning, reasoning from imperfect knowledge, and reasoning strategies. Part Four on Problem Solving focuses on the knowledge and strategies required to solve different types of problems, including those that involve design and dynamic changes. Part Five on Artificial Intelligence contains chapters on the Data Sciences, Explanatory Models, the Information Sciences, and General AI. Part Six on Education consists of three chapters on educating 21st century skills at all levels of instruction. Research in Cognitive Psychology, Education, and AI provides the foundation for acquiring these skills.
Makers of all ages are creating robots on their own. In this book, students learn more about this recent innovation through detailed explanations built to foster creativity and critical thinking. Fun, engaging text introduces readers to new ideas and builds on maker-related concepts they may already know. Additional tools, including a glossary and an index, help students learn new vocabulary and locate information.

The interdisciplinary field of robotics offers its practitioners many practical applications and makes it an exciting, dynamic, and cutting-edge pursuit, especially for young people embarking on their careers. This updated volume discusses the latest advances readers will need to be aware of in preparation for the professional positions of computer scientist, robotics engineer, and robotics technician. Readers will get detailed information and tips on what courses to take now and the ongoing advances in robotics that will determine their future study, internships, and more, including snapshots of luminaries in the field.

Once the subject of speculative fiction, robots are now reality in many spheres of life, including business, law enforcement, the military, the sciences, entertainment, and even in our homes. They will play bigger roles in the near and distant future. This book traces the development of robots from antiquity through the modern era and into the myriad possibilities of their future practical uses, including the exciting potential intersection of robots and artificial intelligence. A lively historical narrative and stimulating imagery of robots throughout the ages make this book a valuable resource for robot fans and casual readers alike.

Advances in technology continue to alter the ways in which we conduct our lives, from the private sphere to how we interact with others in public. As these innovations become more integrated into modern society, their applications become increasingly relevant in various facets of life. Wearable Technology and Mobile Innovations for Next-Generation Education is an authoritative reference source on the development and implementation of wearables within learning and training environments, emphasizing the valuable resources offered by these advances. Focusing on technical considerations, lessons learned, and real-world examples, this book is ideally designed for instructors, researchers, upper-level students, and policy makers interested in the effectiveness of wearable applications.

This book will offer ideas on how robots can be used as teachers' assistants to scaffold learning outcomes, where the robot is a learning agent in self-directed learning who can contribute to the development of key competences for today's world through targeted learning - such as engineering thinking, math, physics, computational thinking, etc. starting from pre-school and continuing to a higher education level. Robotization is speeding up at the moment in a variety of dimensions, both through the automation of work, by performing intellectual duties, and by providing support for people in
everyday situations. There is increasing political attention, especially in Europe, on educational systems not being able to keep up with such emerging technologies, and efforts to rectify this. This edited volume responds to this attention, and seeks to explore which pedagogical and educational concepts should be included in the learning process so that the use of robots is meaningful from the point of view of knowledge construction, and so that it is safe from the technological and cybersecurity perspective.

"This book describes and explains via theory and practice two approaches in designing, constructing and programming robots: 1) the use of educational robotics packages that are available in the market for the development of pre-fabricated robots and 2) the use of low-cost tools, materials and technologies available in our daily live activities for the development of robotics artefacts"--

A look at engineering education today? with an eye to tomorrow Engineering education is in flux. While it is increasingly important that engineers be innovative, entrepreneurial, collaborative, and able to work globally, there are virtually no programs that prepare students to meet these new challenges. Shaping Our World: Engineering Education for the 21st Century seeks to fill this void, exploring revolutionary approaches to the current engineering curriculum that will bring it fully up to date and prepare the next generation of would-be engineers for real and lasting professional success. Comprised of fourteen chapters written by respected experts on engineering education, the book is divided into three parts that address the need for change in the way engineering is taught; specific innovations that have been tested, why they matter, and how they can be more broadly instituted; and the implications for further changes. Designed to aid engineering departments in their transition towards new modes of learning and leadership in engineering education, the book describes how to put into practice educational programs that are aligned with upcoming changes, such as those proposed in the NAE's Engineer of 2020 reports. Addressing the need to change engineering education to meet the demands of the 21st century head on, Shaping Our World condenses current discussions, research, and trials regarding new methods into specific, actionable calls for change.

Readers will learn what it takes to succeed as a robotics engineer. The book also explains the necessary educational steps, useful character traits, and daily job tasks related to this career, in the framework of the STEAM, Science, Technology, Engineering, Art, and Math, movement. Photos, a glossary, and additional resources are included.

How to educate the next generation of college students to invent, to create, and to discover—filling needs that even the most sophisticated robot cannot. Driverless cars are hitting the road, powered by artificial intelligence. Robots can climb stairs, open doors, win Jeopardy, analyze stocks, work in factories, find parking spaces, advise oncologists. In the past, automation was considered a threat to low-skilled labor. Now, many high-skilled functions, including interpreting medical
images, doing legal research, and analyzing data, are within the skill sets of machines. How can higher education prepare students for their professional lives when professions themselves are disappearing? In Robot-Proof, Northeastern University president Joseph Aoun proposes a way to educate the next generation of college students to invent, to create, and to discover—to fill needs in society that even the most sophisticated artificial intelligence agent cannot. A “robot-proof” education, Aoun argues, is not concerned solely with topping up students' minds with high-octane facts. Rather, it calibrates them with a creative mindset and the mental elasticity to invent, discover, or create something valuable to society—a scientific proof, a hip-hop recording, a web comic, a cure for cancer. Aoun lays out the framework for a new discipline, humanics, which builds on our innate strengths and prepares students to compete in a labor market in which smart machines work alongside human professionals. The new literacies of Aoun's humanics are data literacy, technological literacy, and human literacy. Students will need data literacy to manage the flow of big data, and technological literacy to know how their machines work, but human literacy—the humanities, communication, and design—to function as a human being. Life-long learning opportunities will support their ability to adapt to change. The only certainty about the future is change. Higher education based on the new literacies of humanics can equip students for living and working through change.

In the Industrial Revolution Era 4.0, led by technological developments, education plays an essential role in preparing students with the skills required to survive. Pedagogical innovations in the pre-service teacher programme are necessary to encourage pre-service teachers with adequate abilities and skills in preparing classroom activities that enhance the essential skills. This book results from a one-year study examining a new approach to equip prospective mathematics teachers with 21st-century skills. The prospective teachers were involved in RoboSTE[M], a STEM-based approach that employs robotics in the classroom. The book contains articles that discussed Robotic and STEM education, followed by ready-to-used RoboSTE[M] students worksheets that prospective mathematics teachers produced.

This book includes papers presented at the International Conference "Educational Robotics in the Maker Era -- EDUROBOTICS 2020", Online, February 2021. The contributions cover a variety of topics useful for teacher education and for designing learning by making activities for children and youth, with an emphasis on modern low-cost technologies (including block-based programming environments, Do-It-Yourself electronics, 3D printed artifacts, the use of intelligent distributed systems, the IoT technology, and gamification) in formal and informal education settings. This collection of contributions (17 chapters and 2 short papers) provides researchers and practitioners the latest advances in educational robotics in a broader sense focusing on science, technology, engineering, arts, and mathematics (STEAM) education. Teachers and educators at any school level can find insights and inspirations into how educational robotics can promote
technological interest and 21st-century skills: creativity, critical thinking, team working, and problem-solving with special emphasis on new emerging making technologies.

"This book explores the theory and practice of educational robotics in the K-12 formal and informal educational settings, providing empirical research supporting the use of robotics for STEM learning"--Provided by publisher.

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