Science Teachers Perceptions Of Stem Education

Data were collected from 32 teachers using mixed methods to investigate teachers' perceptions of online professional development (PD) offered through a school-community partnership. The partnership between multiple school districts nationwide and National Aeronautics and Space Administration (NASA) provided teachers with an online Science, Technology, Engineering and Mathematics (STEM) PD course called MicroGX. A thorough analyses of data from two surveys, observations, and documents were used to answer the primary questions: 1) What components of MicroGX are deemed effective from the teachers' perspective? 2) How does the effectiveness of MicroGX compare with other online PD from the teachers' perspective? The data from this study provide evidence that subjects perceive MicroGX as a positive experience with many effective components that are more effective than participation in other online PD. Survey data show a majority of the subjects feel the MicroGX course was more of a positive than negative experience. All subjects would recommend this course to another teacher and overall, subjects were most satisfied with the interaction with others, resources, support, content, and content delivery. Ninety-seven percent of subjects were satisfied with the course. Ninety-four percent of subjects would participate in the course again and consider participating in more online PD offered by NASA. Seventy-one percent of subjects feel that MicroGX was more effective than other online PD in which they have participated. Effective components include content knowledge, student impact, resources, and support. All subjects agree this experience has inspired them to bring NASA content into the classroom, influenced them to make changes to their teaching activities, do not disagree they can immediately apply what they learned from this experience to their teaching about STEM, and do not disagree they will be more effective in teaching STEM introduced in this experience. All subjects do not disagree that the resources will be effective in increasing their students' interest in STEM topics and that this experience provided ideas for encouraging student exploration, discussion and participation. Based on the finding of this study, recommendations were made to aid future development of online PD and assist K-12 leaders in selecting future PD for their teachers. The electronic version of this dissertation is accessible from http://hdl.handle.net/1969.1/152542

"If you are interested in STEM education, policies, programs or practices, or you work on STEM in some capacity at any level, The case for STEM education will prove to be valuable reading. Author Rodger W. Bybee has written this book to inspire individuals in leadership roles to better understand and take action on STEM initiatives. The book's 10 chapters accomplish several tasks: Put STEM in context by outlining the challenges facing STEM education, drawing lessons from the Sputnik moment of the 1950s and 1960s, and contrasting contemporary STEM with other education reforms; Explore appropriate roles for the federal government, as well as states, districts, and individual schools; Offer several ideas and recommendations you can use to develop action plans for STEM. With an emphasis on both thinking and acting, The case for STEM education is a must-read for leaders at all levels: national and state policy makers, state-level educators responsible for STEM initiatives, college and university faculty who educate future STEM teachers, local administrators who make decisions about district and school programs, and teachers who represent STEM disciplines." - Back cover.

This book looks at the purpose and pedagogy of STEM teaching and explores the ways in which STEM subjects can interact in the curriculum to enhance student understanding, achievement and motivation. By reaching outside their own classroom, teachers can collaborate across STEM subjects to enrich learning and help students relate school science, technology and maths to the wider world. Packed with ideas and practical details for teachers of STEM subjects, the new revised edition of this book: ? considers what the STEM subjects contribute separately to the curriculum and how they relate to each other in the wider education of secondary school students; ? describes and evaluates different curriculum models for STEM; ? suggests ways in which a critical approach to the pedagogy of the classroom, laboratory and workshop can support and encourage all pupils to engage fully in STEM; ? addresses the practicalities of introducing, organising and sustaining STEM-related activities in the secondary school; ? looks to ways schools can manage and sustain STEM approaches in the long-term. This new revised edition is essential reading for trainee and practising teachers, those engaged in further professional development and all who wish to make the learning of science, technology, engineering and mathematics an interesting, motivating and exciting experience for their students.

Girls lose interest in science and math and other STEM disciplines (science, technology, engineering, and math) during the middle school years. This loss of interest has affected girls and the representation of women in STEM careers. The purpose of the study was to investigate the role that middle school science and math teachers have in shaping girls' attitudes and motivation, and their perception of girls. This study gathered data through a mixed-methods approach. Instruments used in this study included a Google survey consisting of Likert scale questions and individual interviews with participants. The study asked three research questions: 1. In suburban middle schools, is there a gender difference among students in STEM activities or subjects? 2. Do middle school teachers treat boys differently from girls in reinforcing their self-image of ability in math and science? 3. Are there gender differences in middle school students' perceptions of their abilities in math and science? The results of this study indicate that middle school girls do not have a negative perception towards STEM, science, or math as perceived by their teachers. Middle school girls are participating in science and math, often take the initiative when working in groups, and pursue leadership roles in groups. This study also has proven that girls are called upon just as much as boys in these subject areas, and girls do not shy away from challenging work as compared to boys. Girls are also more likely to finish their assignments in an organized and efficient way. Teachers are cognizant of the role that they play in helping their students reach their true potential in STEM subjects, especially girls. Teachers in the study encouraged all their students to take risks in the classroom when completing challenging STEM related lessons, and participation among boys and girls were mostly the same at this age level, with only a slight variation. Responses from middle school teachers suggested that they provide substantial support

and encouragement to girls in STEM, a finding that is very different from other studies and research that has previously been conducted.

More and more young people are learning about science, technology, engineering, and mathematics (STEM) in a wide variety of afterschool, summer, and informal programs. At the same time, there has been increasing awareness of the value of such programs in sparking, sustaining, and extending interest in and understanding of STEM. To help policy makers, funders and education leaders in both school and out-of-school settings make informed decisions about how to best leverage the educational and learning resources in their community, this report identifies features of productive STEM programs in out-of-school settings. Identifying and Supporting Productive STEM Programs in Out-of-School Settings draws from a wide range of research traditions to illustrate that interest in STEM and deep STEM learning develop across time and settings. The report provides guidance on how to evaluate and sustain programs. This report is a resource for local, state, and federal policy makers seeking to broaden access to multiple, high-quality STEM learning opportunities in their community.

Socioscientific issues require individuals to use moral and ethical considerations to help in their evaluation of evidence and decision making, entailing controversial scientific phenomena. Such issues include genetic engineering and biotechnology. Socioscientific issues pedagogy has the potential to enhance students' overall conceptual understanding of scientific phenomena that affect the daily lives of people across the globe. Socioscientific Issues-Based Instruction for Scientific Literacy Development is a critical scholarly publication that examines the development of a research-based integrated socioscientific issues pedagogy for use in the K-12 system, teacher education preparation, and informal education centers. The publication focuses on science education researchers and pre-service and in-service teachers' abilities to design and implement meaningful learning opportunities for students to use rationalistic, intuitive, and emotive perspectives as they engage in information reasoning on scientific topics, such as climate change and CRISPR, that are of utmost importance. Teachers in the K-12 system and informal education settings will be able to use this text to enhance scientific literacy among their students. Instructors in teacher preparation programs will be able to use this research-based text to improve pre-service and in-service teachers' abilities to use socioscientific issues pedagogy to enhance scientific literacy among K-12 students. Additionally, audiences including researchers, administrators, academicians, policymakers, and students will find this book beneficial for their studies.

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. First, from a workforce pipeline or pathway perspective, researchers and practitioners are interested in understanding precursors, influential and motivational factors, and the progression of engineering thinking. Second, from a general societal perspective, technological literacy and understanding of the role of engineering and technology is becoming increasingly important for the general populace, and it is more imperative to foster this understanding from a younger age. Third, from a STEM integration and education perspective, engineering processes are used as a context to teach science and math concepts. This book addresses each of these motivations and the diverse means used to engage with them.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.

Engineering Instruction for High-Ability Learners in K-8 Classrooms is an application-based practitioners' guide to applied engineering that is grounded in engineering practices found in the new Next Generation Science Standards (NGSS) and the Standards for Engineering Education. The book provides educators with information and examples on integrating engineering into existing and newly designed curriculum. The book specifies necessary components of engineering curriculum and instruction, recommends appropriate activities to encourage problem solving, creativity, and innovation, and provides examples of innovative technology in engineering curriculum and instruction. Additionally, authors discuss professional development practices to best prepare teachers for engineering instruction and provide recommendations to identify engineering talent among K-8 students. Finally, the book includes a wealth of resources, including sample lesson and assessment plans, to assist educators in integrating engineering into their curriculum and instruction.

Digital integration is the driving force of teaching and learning at all levels of education. As more non-traditional students seek credentialing, certification, and degrees, institutions continue to push the boundaries of innovative practices to meet the needs of diverse students. Programs and faculty have moved from merely using technology and learning management systems to unique and innovative ways to engage learners. The Handbook of Research on Innovative Digital Practices to Engage Learners is an essential scholarly publication that offers theoretical frameworks, delivery models, current guidelines, and digital design techniques for integrating technological advancements in education contexts to enforce student engagement and positive student outcomes. Featuring a wide range of topics such as gamification, wearable technologies, and distance education, this book is ideal for teachers, curriculum developers, instructional designers, principals, deans, administrators, researchers, academicians, education professionals, and students.

African American female representation in science, technology, engineering, and mathematics (STEM) fields, has not significantly increased during the years, despite a number of educational initiatives and reforms promoting participation in the STEM pipeline. As the underrepresentation of African American females' interest in science increases, major intervention strategies must be implemented to ensure STEM education access, retention, persistence, and completion. African American females can be equally competent in the sciences if they have all the tools required to be successful. To help reverse the trend, research supports early exposure to science beginning in elementary school. The purpose of this qualitative research was to explore elementary teachers' perceptions of instructional techniques and strategies to

promote African American female students as science learners. Delgado and Stefancic's Critical Race Theory and critical race feminism theoretical frameworks were used to guide this research. A semi-structured interview protocol was used to collect data for this study. The problem addressed was the perception of instructional strategies and techniques used by teachers to increase African American females' interest in science in elementary school and how to ensure sustained interest to college graduation completion. The themes in this study identified perceptions of effective instructional strategies and techniques that can be effective in increasing African American females' interest in science. The recommendations provide practical use for planning, professional development and use of strategic actions to minimize the barriers faced by African American females in STEM. Future research should focus on the impact early exposure to science has on the continued interest of African American females in science to gain greater insight and understanding about the research problem, purpose, and questions.

Following a 2011 report by the National Research Council (NRC) on successful K-12 education in science, technology, engineering, and mathematics (STEM), Congress asked the National Science Foundation to identify methods for tracking progress toward the report's recommendations. In response, the NRC convened the Committee on an Evaluation Framework for Successful K-12 STEM Education to take on this assignment. The committee developed 14 indicators linked to the 2011 report's recommendations. By providing a focused set of key indicators related to students' access to quality learning, educator's capacity, and policy and funding initiatives in STEM, the committee addresses the need for research and data that can be used to monitor progress in K-12 STEM education and make informed decisions about improving it. The recommended indicators provide a framework for Congress and relevant deferral agencies to create and implement a national-level monitoring and reporting system that: assesses progress toward key improvements recommended by a previous National Research Council (2011) committee; measures student knowledge, interest, and participation in the STEM disciplines and STEM-related activities; tracks financial, human capital, and material investments in K-12 STEM education at the federal, state, and local levels; provides information about the capabilities of the STEM education workforce, including teachers and principals; and facilitates strategic planning for federal investments in STEM education and workforce development when used with labor force projections. All 14 indicators explained in this report are intended to form the core of this system. Monitoring Progress Toward Successful K-12 STEM Education: A Nation Advancing? summarizes the 14 indicators and tracks progress towards the initial report's recommendations.

This is a research study to explore how elementary teachers feel about integrating STEM educztion into their classrooms. Although the school district website provided some useful and relevant information about the STEM program, the skill competencies of the K-5 teachers and the challenges they faced in implementing the STEM curriculum was unknown. The researcher conducted a descriptive case study with a sample of 12 elementary teachers purposefully selected from a pool of K-5 teachers from two area schools focused on the teachers' perceptions of STEM education, their competencies, and professional development. Data collection consisted of interviews, document analysis, and field notes. The researcher analyzed data using the qualitative method. Findings from the study suggested that (a) teachers had different perceptions of STEM education based on prior experience, (b) most teachers lacked confidence in their knowledge and abilities to effectively integrate STEM, (c) teachers felt a need for STEM hands-on training and professional development, and (d) teachers did not have enough time, leadership, and proper guidance to integrate STEM effectively. The findings have broad implications for the field of educational technology and future research. The researcher recommends skilled STEM leadership that can drive curriculum development, as well as teacher preparation that supports STEM programs.

The goal of this study was to assess the value and feasibility of developing and implementing content standards for engineering education at the K-12 level. Content standards have been developed for three disciplines in STEM education--science, technology, and mathematic--but not for engineering. To date, a small but growing number of K-12 students are being exposed to engineering-related materials, and limited but intriguing evidence suggests that engineering education can stimulate interest and improve learning in mathematics and science as well as improve understanding of engineering and technology. Given this background, a reasonable question is whether standards would improve the quality and increase the amount of teaching and learning of engineering in K-12 education. The book concludes that, although it is theoretically possible to develop standards for K-12 engineering education, it would be extremely difficult to ensure their usefulness and effective implementation. This conclusion is supported by the following findings: (1) there is relatively limited experience with K-12 engineering education in U.S. elementary and secondary schools, (2) there is not at present a critical mass of teachers qualified to deliver engineering instruction, (3) evidence regarding the impact of standards-based educational reforms on student learning in other subjects, such as mathematics and science, is inconclusive, and (4) there are significant barriers to introducing stand-alone standards for an entirely new content area in a curriculum already burdened with learning goals in more established domains of study.

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 second edition of Project-Based Learning (PBL) presents an original approach to Science, Technology, Engineering and Mathematics (STEM) centric PBL. We define PBL as an "ill-defined task with a well-defined outcome," which is consistent with our engineering design philosophy and the accountability highlighted in a standards-based environment. This model emphasizes a backward design that is initiated by well-defined outcomes, tied to local, state, or national standard that provide teachers with a framework guiding students' design, solving, or completion of ill-defined tasks. This book was designed for middle and secondary teachers who want to improve engagement and provide contextualized learning for their students. However, the nature and scope of the content covered in the 14 chapters are appropriate for preservice teachers as well as for advanced graduate method courses. New to this edition is revised and expanded coverage of STEM PBL, including implementing STEM PBL with English Language Learners and the use of technology in PBL. The book also includes many new teacher-friendly forms, such as advanced organizers, team contracts for STEM PBL, and rubrics for assessing PBL in a larger format.

Now more than ever, as a worldwide STEM community, we need to know what pre-collegiate teachers and students explore, learn, and implement in relation to computer science and engineering education. As computer science and engineering education are not always "stand-alone" courses in pre-collegiate schools, how are pre-collegiate teachers and students learning about these topics? How can these subjects be integrated? Explore six articles in this book that directly relate to the currently hot topics of computer science and engineering education as they tie into pre-collegiate science, technology, and mathematics realms. There is a systematic review article to set the stage of the problem. Following this overview are two teacher-focused articles on professional development in computer science and entrepreneurship venture training. The final three articles focus on varying levels of student work including pre-collegiate secondary students' exploration of engineering design technology, future science teachers' (collegiate students) perceptions of engineering, and pre-collegiate future engineers' exploration of environmental radioactivity. All six articles speak to computer science and engineering education in pre-collegiate forums, but blend into the collegiate world for a look at what all audiences can bring to the conversation about these topics.

Science, technology, engineering, and mathematics (STEM) are cultural achievements that reflect our humanity, power our economy, and constitute fundamental aspects of our lives as citizens, consumers, parents, and members of the

workforce. Providing all students with access to quality education in the STEM disciplines is important to our nation's competitiveness. However, it is challenging to identify the most successful schools and approaches in the STEM disciplines because success is defined in many ways and can occur in many different types of schools and settings. In addition, it is difficult to determine whether the success of a school's students is caused by actions the school takes or simply related to the population of students in the school. Successful K-12 STEM Education defines a framework for understanding "success" in K-12 STEM education. The book focuses its analysis on the science and mathematics parts of STEM and outlines criteria for identifying effective STEM schools and programs. Because a school's success should be defined by and measured relative to its goals, the book identifies three important goals that share certain elements, including learning STEM content and practices, developing positive dispositions toward STEM, and preparing students to be lifelong learners. A successful STEM program would increase the number of students who ultimately pursue advanced degrees and careers in STEM fields, enhance the STEM-capable workforce, and boost STEM literacy for all students. It is also critical to broaden the participation of women and minorities in STEM fields. Successful K-12 STEM Education examines the vast landscape of K-12 STEM education by considering different school models, highlighting research on effective STEM education practices, and identifying some conditions that promote and limit school- and student-level success in STEM. The book also looks at where further work is needed to develop appropriate data sources. The book will serve as a guide to policy makers; decision makers at the school and district levels; local, state, and federal government agencies; curriculum developers; educators; and parent and education advocacy groups. Currently, many states are adopting the Next Generation Science Standards (NGSS) or are revising their own state standards in ways that reflect the NGSS. For students and schools, the implementation of any science standards rests with teachers. For those teachers, an evolving understanding about how best to teach science represents a significant transition in the way science is currently taught in most classrooms and it will require most science teachers to change how they teach. That change will require learning opportunities for teachers that reinforce and expand their knowledge of the major ideas and concepts in science, their familiarity with a range of instructional strategies, and the skills to implement those strategies in the classroom. Providing these kinds of learning opportunities in turn will require profound changes to current approaches to supporting teachers' learning across their careers, from their initial training to continuing professional development. A teacher's capability to improve students' scientific understanding is heavily influenced by the school and district in which they work, the community in which the school is located, and the larger professional communities to which they belong. Science Teachers' Learning provides guidance for schools and districts on how best to support teachers' learning and how to implement successful programs for professional development. This report makes actionable recommendations for science teachers' learning that take a broad view of what is known about science education, how and when teachers learn, and education policies that directly and indirectly shape what teachers are able to learn and teach. The challenge of developing the expertise teachers need to implement the NGSS presents an opportunity to rethink professional learning for science teachers. Science Teachers' Learning will be a valuable resource for classrooms, departments, schools, districts, and professional organizations as they move to new ways to teach science.

A New Era of Science EducationScience Teachers' Perceptions and Classroom Practices of Science, Technology, Engineering and Mathematics (STEM) IntegrationTeacher Perceptions of Inquiry and STEM Education in Bangladesh

This book provides a platform for international scholars to share evidence for effective practices in integrated STEM education and contributes to the theoretical and practical knowledge gained from the diversity of approaches. Many publications on STEM education focus on one or two of the separate STEM disciplines without considering the potential for delivering STEM curriculum as an integrated approach.This publication analyzes the efficacy of an integrated STEM curriculum and instruction, providing evidence to examine and support various integrations. The volume focuses on the problems seen by academics working in the fields of science, technology, engineering and mathematics (STEM) and provides valuable, high quality research outcomes and a set of valued practices which have demonstrated their use and viability to improve the quality of integrated STEM education.

In higher education, the United States is the preeminent global leader, dominating the list of the world’s top research universities. But there are signs that America’s position of global leadership will face challenges in the future, as it has in other realms of international competition. American Universities in a Global Market addresses the variety of issues crucial to understanding this preeminence and this challenge. The book examines the various factors that contributed to America’s success in higher education, including openness to people and ideas, generous governmental support, and a tradition of decentralized friendly competition. It also explores the advantages of holding a dominant position in this marketplace and examines the current state of American higher education in a comparative context, placing particular emphasis on how market forces affect universities. By discussing the differences in quality among students and institutions around the world, this volume sheds light on the singular aspects of American higher education.

Professional development of educators is an complex process through which teachers strive continuously for pedagogical improvement. In that sense, professional growth benefits learners and teachers while also promoting the quality of the schools, colleges, and academic departments where it takes place. Innovative Professional Development Methods and Strategies for STEM Education is an authoritative publication featuring the latest scholarly research on a wide range of professional advancement topics in STEM education with special emphasis on content, process, implementation, and impact, as well as on the implications for teachers, educators, and administrators. Highlighting comprehensive research across a broad scope of relevant issues including, but not limited to, teacher training, development models, and the implementation of leadership practices, this book is a seminal reference source for STEM professionals working in schools, colleges, and various science and mathematics departments at secondary and post-

secondary institutions.
STEM Road Map: A Framework for Integrated STEM Education is the first resource to offer an integrated STEM curricula encompassing the entire K-12 spectrum, with complete grade-level learning based on a spiraled approach to building conceptual understanding. A team of over thirty STEM education professionals from across the U.S. collaborated on the important work of mapping out the Common Core standards in mathematics and English/language arts, the Next Generation Science Standards performance expectations, and the Framework for 21st Century Learning into a coordinated, integrated, STEM education curriculum map. The book is structured in three main parts—Conceptualizing STEM, STEM Curriculum Maps, and Building Capacity for STEM—designed to build common understandings of integrated STEM, provide rich curriculum maps for implementing integrated STEM at the classroom level, and supports to enable systemic transformation to an integrated STEM approach. The STEM Road Map places the power into educators' hands to implement integrated STEM learning within their classrooms without the need for extensive resources, making it a reality for all students.
This dissertation reports lower secondary science teachers perceptions of current practice in Dhaka, Bangladesh concerning inquiry and STEM Education in order to establish a baseline of data for reform of science education in Bangladesh. Bangladesh has been trying to incorporate inquiry-based science curricula since the 1970s. Over time, the science curricula also aligned with different international science education movements such as Science for All, Scientific Literacy, Science, Technology, and Society. Science, Technology, Engineering, and Mathematics (STEM) is the most recent science education movement in international science education. This study explored current practices and perceptions of lower secondary science teachers in order to establish a baseline of current practice so that future reform recommendations may be pursued and recommendations made for Bangladesh to overcome the inquiry-based challenges and to incorporate new STEM-based science education trends happening in the US and throughout the world. The study explored science teachers perceptions and readiness to transform their science classrooms based on self-reported survey. The survey utilized Likert-type scale with range 1 (very strongly disagree) to 6 (very strongly agree) among four hundred lower secondary science teachers, teacher training college faculty, and university faculty. The data is presented in four different categories: curriculum, instruction, assessment, and professional development. Results indicated that the participants understand and practice a certain level of inquiry in their science classrooms, though they do not have adequate professional development. Participants also stated that they do not have sufficient instructional materials and the curriculum is not articulated enough to support inquiry. On the other hand, the participants reported that they understand and practice a certain degree of inquiry and STEM-based science education, but they also state that the current curriculum and instructional materials are not sufficient to practice inquiry nor to integrate more than one or two disciplines with science as is required in STEM integrated teaching. Finally, this study recommends a framework for science education reform for Bangladesh based upon a combination of successful international science education reformation practices.
Towards Inclusion of All Learners through Science Teacher Educationserves as a resource for teachers and teacher educators wishing to understand how to educate students with exceptionalities in science by connecting their experiences to leading experts
This book argues that modelling should be a component of all school curricula that aspire to provide 'authentic science education for all'. The literature on modelling is reviewed and a 'model of modelling' is proposed. The conditions for the successful implementation of the 'model of modelling' in classrooms are explored and illustrated from practical experience. The roles of argumentation, visualisation, and analogical reasoning, in successful modelling-based teaching are reviewed. The contribution of such teaching to both the learning of key scientific concepts and an understanding of the nature of science are established. Approaches to the design of curricula that facilitate the progressive grasp of the knowledge and skills entailed in modelling are outlined. Recognising that the approach will both represent a substantial change from the 'content-transmission' approach to science teaching and be in accordance with current best-practice in science education, the design of suitable approaches to teacher education are discussed. Finally, the challenges that modelling-based education pose to science education researchers, advanced students of science education and curriculum design, teacher educators, public examiners, and textbook designers, are all outlined.
STEM Education for High-Ability Learners: Designing and Implementing Programming focuses on the rigorous articulation of quality STEM education programming to develop STEM talent among high-ability and gifted learners. The intent of this book is to provide a comprehensive resource for educators designing and implementing each of the supports within STEM education by providing a discussion of each critical component for inclusion in a planned, coherent, and high-quality sequenced system. This edited volume provides a cutting-edge discussion of best practices for delivering STEM education by experts in the field. The contributing authors provide a differentiated discussion and recommendations for the learning experiences of gifted students in STEM education programs.
The delivery of quality education to students relies heavily on the actions of an institution's administrative staff. Effective leadership strategies allow for the continued progress of modern educational initiatives. Educational Leadership and Administration: Concepts, Methodologies, Tools, and Applications provides comprehensive research perspectives on the multi-faceted issues of leadership and administration considerations within the education sector. Emphasizing theoretical frameworks, emerging strategic initiatives, and future outlooks, this publication is an ideal reference source for educators, professionals, school administrators, researchers, and practitioners in the field of education.
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.

This book provides key insights into how educational leaders can successfully navigate the turbulence of political debate surrounding leading student assessment and professionalised practice. Given the highly politicised nature of assessment, it addresses leaders and aspiring leaders who are open to being challenged, willing to explore controversy, and capable of engaging in informed critical discourse. The book presents the macro concepts that these audiences must have to guide optimal assessment policy and practice. Collectively, the chapters highlight important assessment purposes and models, including intended and unintended effects of assessment in a globalised context. The book provides opportunities to explore cultural similarities and particularities. It invites readers to challenge taken-for-granted assumptions about ourselves and colleagues in other settings. The chapters highlight the cultural clashes that may occur when cross-cultural borrowing of assessment strategies, policies, and tools takes place. However, authors also encourage sophisticated critical analyses of potential lessons that may be drawn from other contexts and systems. Readers will encounter challenges from authors to deconstruct their assessment values, beliefs, and preconceptions. Indeed, one purpose of the book is to destabilise certainties about assessment that prevail and to embrace the assessment possibilities that can emerge from cognitive dissonance.

Research on talent development and gifted education has made enormous strides over the past decades. Yet, much of the actual talent development and gifted education work being done fails to live up to the field's promise. This book highlights recent theoretical approaches and discusses empirical research conclusions which have yet to receive the attention they deserve. It also considers possibilities for harnessing these insights for current talent development and gifted education efforts. (Series: Talent Encouragement - Development of Expertise - Performance Excellence - Vol. 11)

This theory-to-practice guide offers leading-edge ideas for wide-scale curriculum reform in sciences, technology, engineering, the arts, and mathematics--the STEAM subjects. Chapters emphasize the critical importance of current and emerging digital technologies in bringing STEM education up to speed and implementing changes to curricula at the classroom level. Of particular interest are the diverse ways of integrating the liberal arts into STEM course content in mutually reshaping humanities education and scientific education. This framework and its many instructive examples are geared to ensure that both educators and students can become innovative thinkers and effective problem-solvers in a knowledge-based society. Included in the coverage: Reconceptualizing a college science learning experience in the new digital era. Using mobile devices to support formal, informal, and semi-formal learning. Change of attitudes, self-concept, and team dynamics in engineering education. The language arts as foundational for science, technology, engineering, art, and mathematics. Can K-12 math teachers train students to make valid logical reasoning? Moving forward with STEAM education research. Emerging Technologies for STEAM Education equips educators, education researchers, administrators, and education policymakers with curricular and pedagogical strategies for making STEAM education the bedrock of accessible, relevant learning in keeping with today's digital advances.

This book presents a contemporary focus on significant issues in STEM teaching, learning and research that are valuable in preparing students for a digital 21st century. The book chapters cover a wide spectrum of issues and topics using a wealth of research methodologies and methods.

Reflecting the very latest theory on diversity issues in science education, including new dialogic approaches, this volume explores the subject from a range of perspectives and draws on studies from around the world. The work discusses fundamental topics such as how we conceptualize diversity as well as examining the ways in which heterogeneous cultural constructs influence the teaching and learning of science in a range of contexts. Including numerous strategies ready for adoption by interested teachers, the book addresses the varied cultural factors that influence engagement with science education. It seeks answers to the question of why increasing numbers of students fail to connect with science education in schools and looks at the more subtle impact that students' individually constructed identities have on the teaching and learning of science. Recognizing the diversity of its audience, the book covers differing levels and science subjects, and examines material from a range of viewpoints that include pedagogy, curricula, teacher education, learning, gender, religion, and ICT, as well as those of in-service and trainee teachers at all levels.

In a world where advanced knowledge is widespread and low-cost labor is readily available, U.S. advantages in the marketplace and in science and technology have begun to erode. A comprehensive and coordinated federal effort is urgently needed to bolster U.S. competitiveness and pre-eminence in these areas. This congressionally requested report by a pre-eminent committee makes four recommendations along with 20 implementation actions that federal policy-makers should take to create high-quality jobs and focus new science and technology efforts on meeting the nation's needs, especially in the area of clean, affordable energy: 1) Increase America's talent pool by vastly improving K-12 mathematics and science education; 2) Sustain and strengthen the nation's commitment to long-term basic research; 3) Develop, recruit, and retain top students, scientists, and engineers from both the U.S. and abroad; and 4) Ensure that the United States is the premier place in the world for innovation. Some actions will involve changing existing laws, while others will require financial support that would come from reallocating existing budgets or increasing them. Rising Above the Gathering Storm will be of great interest to federal and state government agencies, educators and schools, public decision makers, research sponsors, regulatory analysts, and scholars.

The Handbook of Research on STEM Education represents a groundbreaking and comprehensive synthesis of research and presentation of policy within the realm of science, technology, engineering, and mathematics (STEM) education. What distinguishes this Handbook from others is the nature of integration of the disciplines that is the founding premise for the work – all chapters in this book speak directly to the integration of STEM, rather than discussion of research within the individual content areas. The Handbook of Research on STEM Education explores the most pressing areas of STEM within an international context. Divided into six sections, the authors cover topics including: the nature of STEM, STEM learning, STEM pedagogy, curriculum and assessment, critical issues in STEM, STEM teacher education, and STEM policy and reform. The Handbook utilizes the lens of equity and access by focusing on STEM literacy, early childhood STEM, learners with disabilities, informal STEM, socio-scientific issues, race-related factors, gender equity, cultural-relevancy, and parental involvement. Additionally, discussion of STEM education policy in a variety of countries is included, as well as a focus on engaging business/industry and teachers in advocacy for STEM education. The Handbook's 37 chapters provide a deep and meaningful landscape of the implementation of STEM over the past two decades. As such, the findings that are presented within provide the reader with clear directions for future research into effective practice and supports for integrated STEM, which are grounded in the literature to date.

The purpose of this quantitative study was to investigate teacher perception of technology integration in STEM and non-STEM classrooms of high school teachers of gifted and talented students and the relationship of those perceptions to actual technology use in their classrooms. This study measured teacher perception of technology integration utilizing a survey designed by combining two standardized survey tools. Data was collected through a web-based, anonymous survey. Descriptive as well as inferential statistics were analyzed. The study examined four research questions that focused on identifying the difference, if any, between STEM and nonSTEM teachers in regards to their perceptions of technology for use in their classroom and if there was a relationship between the subject a teacher is teaching and the teacher's perception of the value of technology as an instructional tool. The study also investigated years of teaching experience and teacher perception of technology integration as well as the effect of teacher perceptions of technology integration on teacher's actual use of technology. Data analysis concluded teacher perceptions of technology for use in their classrooms was not significantly different based on the subject taught. There was not a statistically significant relationship between teachers' experience and their perception of the value of technology as an instructional tool, and teacher perceptions of technology integration did not predict their actual use of technology in the classroom. The results of this study contribute to the field of gifted and talented as well as STEM pedagogy.

Carol Ann Tomlinson and Tonya R. Moon take an in-depth look at assessment and show how differentiation can improve the process in all grade levels and subject areas. After discussing differentiation in general, the authors focus on how differentiation applies to various forms of assessment--pre-assessment, formative assessment, and summative assessment--and to grading and report cards. Readers learn how differentiation can --Capture student interest and increase motivation --Clarify teachers' understanding about what is most important to teach --Enhance students' and teachers' belief in student learning capacity; and --Help teachers understand their students' individual similarities and differences so they can reach more students, more effectively Throughout, Tomlinson and Moon emphasize the importance of maintaining a consistent focus on the essential knowledge, understandings, and skills that all students must acquire, no matter what their starting point. Detailed scenarios illustrate how assessment differentiation can occur in three realms (student readiness, interest, and learning style or preference) and how it can improve assessment validity and reliability and decrease errors and teacher bias. Grounded in research and the authors' teaching experience, Assessment and Student Success in a Differentiated Classroom outlines a common-sense approach that is both thoughtful and practical, and that empowers teachers and students to discover, strive for, and achieve their true potential.

STEM Integration in K-12 Education examines current efforts to connect the STEM disciplines in K-12 education. This report identifies and characterizes existing approaches to integrated STEM education, both in formal and after- and out-of-school settings. The report reviews the evidence for the impact of integrated approaches on various student outcomes, and it proposes a set of priority research questions to advance the understanding of integrated STEM education. STEM Integration in K-12 Education proposes a framework to provide a common perspective and vocabulary for researchers, practitioners, and others to identify, discuss, and investigate specific integrated STEM initiatives within the K-12 education system of the United States. STEM Integration in K-12 Education makes recommendations for designers of integrated STEM experiences, assessment developers, and researchers to design and document effective integrated STEM education. This report will help to further their work and improve the chances that some forms of integrated STEM education will make a positive difference in student learning and interest and other valued outcomes.