Mathematics, Science & Technology

Resource Guide

INTRODUCTION

NOTE: This document is a work in progress. Parts II and III, in particular, are in need of further development, and we invite the submission of additional learning experiences and local performance tasks for these sections. Inquiries regarding submission of materials should be directed to: The Mathematics, Science, and Technology Resource Guide, Room 681 EBA, New York State Education Department, Albany, NY 12234 (tel. 518-474-5922).

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Teachers from many schools and districts served as pioneers by submitting their work for review in Part II. Although the work of each of these teachers may not appear in this edition, all are commended for their contributions. In addition, many teachers and educators contributed information for Parts I and III. Their names can be found with their contributions.

Foreword

New York State is engaged in a serious effort to raise standards for students. The strategy for raising standards, as clearly articulated by Commissioner Richard Mills, includes three elements:

1. Setting clear, high expectations / standards for *all* students and developing an effective means of assessing student progress in meeting the standards;
2. Building the local capacity of schools / districts to enable *all* students to meet standards; and
3. Making public the results of the assessment of student progress through school reports.

The learning standards approved by the Board of Regents reflect the intensive, collaborative work conducted over the past few years by the State Education Department and by national groups, such as the National Center for Restructuring Education, Schools and Teaching (NCREST), the Council of Chief State School Officers, and the New Standards Project.

Learning standards have two primary dimensions. **Content standards** describe what students should know, understand, and be able to do. **Performance standards** define levels of student achievement pertaining to content. However, the teaching and learning which takes place in between is the heart of the matter. This addressess **opportunity to learn standards** and is, perhaps, the most crucial element of the entire process.

Classroom teachers have a tremendous challenge. They must bring reality to the **teaching and learning** process in order to assure that *all* of their students will perform at higher levels. They also have a wonderful opportunity for both professional and personal growth. Numberless occasions are available for teachers to really examine their instructional practice, to share what it is they do each day with their students, to work in collaboration with other teachers and students and, thereby, to grow in their understanding of the craft of teaching. In his book, ***Teaching: Making Sense of an Uncertain Craft*** (Teacher's College Press,1992), Joseph McDonald states that:

> "Real teaching. . .happens inside a wild triangle of relations—among teachers, students, subject—and all points of the triangle shift continuously."

This Resource Guide has been developed to get inside this triangle and provide some clarity, to demonstrate concretely how colleagues across the State are tackling the job of standards-based teaching and learning, and to offer examples of resource / research materials which can serve to inform local curriculum development. The standards define the points of the triangle; they are the starting point. Assessments are simultaneously ends and beginnings; they serve both as benchmarks to ascertain what and how well students are learning and as springboards for further teaching and learning. Real teaching shifts continuously in response to the needs of students as they strive to understand the content and to demonstrate their understanding in a variety of assessment contexts.

The Board of Regents recognizes the diversity of students in New York State, including students with disabilities, students with limited English proficiency, gifted students, and educationally disadvantaged students, and has made a strong commitment to integrating the education of all students into the total school program. The standards in the framework apply to all students, regardless of their experiential background, capabilities, developmental and learning differences, interests, or ambitions. Aclassroom typically includes students with a wide range of abilities who may pursue multiple pathways to learn effectively, participate meaningfully, and work toward attaining the curricular standards. Students with diverse learning needs may need accommodations or adaptations of instructional strategies and materials to enhance their learning and/or adjust for their learning capabilities.

The ***Mathematics, Science, and Technology Resource Guide*** has been conceptualized using these philosophical bases. The content has been selected to address important aspects of the teaching and learning process. It is our hope that all the partners in all learning communities in New York State will find the document useful, practical, and informative.

Introduction

The *Mathematics, Science, and Technology Resource Guide* is the third of a series of resource guides to accompany the New York State Frameworks and Learning Standards documents. This resource guide: (1) **establishs connections** between State learning standards and classroom instruction and (2) suggests ways to plan grade level curriculum based on the State standards. It is the hope of all those who worked on the development of this resource guide that teachers and students will find the support they need to give students the opportunity to learn and achieve.

The guide has been developed with significant input from local districts, schools, and teachers who are currently working to align their instructional practices with State learning standards. The document is not comprehensive or exhaustive. Yet it provides teachers with information, strategies, learning experiences, sample assessments, research, and specific discipline materials which can be used in the curriculum development process within each school / district.

The *Mathematics, Science, and Technology Resource Guide* is divided into three major sections:

Part I: Planning a Standards-Based Curriculum: Curriculum Essentials

This section outlines the elements considered essential in planning a standards-based mathematics, science, and technology curriculum. It contains information on strategies for integrating mathematics, science, and technology at various grade levels, suggestions for creating equitable learning environments for all students, and examples of best mathematics, science, and technology practices from teachers around the State. Samples of locally developed curricula, scope and sequence materials, and assessments are also included.

Part II: Planning a Standards-Based Curriculum: Learning Experiences

This section presents standards-based learning experiences developed and reviewed by classroom teachers throughout New York State, including activities that teachers presently use to bring the learning standards to life in the classroom.

Part III: Planning a Standards-Based Curriculum: Assessment Models

Assessing student achievement of the learning standards is an on-going process. This section provides teachers with a variety of assessments which have been used in pilot situations, examples of mathematics, science, and technology integrated tasks, and assessment materials developed by teachers and administrators throughout the State.

This resource guide is not a final, complete document; rather, it represents a beginning. The guide will continually be updated and improved as educators throughout the State send locally developed curricular materials, assessments, or other resources for inclusion in subsequent editions.

The peer review process used to select the learning experiences included in the guide is a valuable and insightful staff development opportunity. The teachers who reveiwed and selected the learning experiences included in this draft of the guide hope that this process will be replicated in schools across the State to help teachers share their work with colleagues and receive

useful feedback to inform their own practice and to generate additional learning experiences for inclusion in future editions of this resource guide.

The final version of ***Mathematics, Science, and Technology Resource Guide*** will be available through your local school district. It will be available in hardcopy or on Compact Disc for use on CD Rom, It is now on the Internet at the following address:

http://www.nysed.gov

The New York State Systemic Initiative

The New York State Systemic Initiative is in the fourth year of a National Science Foundation funded program to improve mathematics, science, and technology teaching throughout New York State. In its early years, New York State Systemic Initiative worked in ten urban schools, known as Research and Demonstration Schools. The grant focused on helping teachers learn new and effective approaches to teaching mathematics, science, and technology.

Now the focus of the work is on implementing the mathematics, science, and technology learning standards in schools across the State. In Parts I and III of this Resource Guide, classroom activities from the ten State Systemic Initiative schools in New York are shared to convey what has been learned in these schools. Teachers, given opportunities to work together, have created dynamic classrooms where students demonstrate high levels of achievement.

As the philosophy of inquiry-based instruction espoused by the State Systemic Initiative expands to include more schools in New York State, greater numbers of students will be challenged to pose questions and search for solutions. Staff of the New York State Systemic Initiative which participated in the writing of this Resource Guide with New York State Education Department staff, believe that the examples of best practices shared here will inspire other teachers to develop habits of planning and teaching in order to guide students to deeper understanding of concepts and applications of knowledge.