Reviews of Collections of Programs, Curricula, Practices, Policies, and Tools: Evaluated According to Evidence

Compiled by Judy Smith-Davis, Ph.D

For more information, see: http://nirn.fpg.unc.edu/resources/reviews

This collection originated as part of the Results for Kids: Resources library of The IDEA Partnership, which transferred early contents to NIRN in 2009.

Mathematics, Science, Social Studies, and The Arts

A Meta-Analysis on Teaching Mathematics to Students with Significant Cognitive Difficulties (structured abstract)

Exceptional Children, 74(4), 407-432. (2008).
D. M. Browder, F. Spooner, L. Ahlgrim-Delzell, A. Harris, & S. Y. Wakeman.
Structured abstract by the National Dissemination Center for Children with Disabilities, Washington DC.

"This article reports on a comprehensive literature review and meta-analysis of 68 experiments on teaching mathematics to individuals with significant cognitive disabilities. Most of the studies in the review addressed numbers and computation or measurement. Within the computation studies identified, most focused on counting, calculation, or number matching. For the measurement studies, nearly all focused on money skills. Of the 54 single subject design studies, 19 were classified as having all quality indicators for research design (13 representing the National Council of Teachers of Mathematics Measurement standard and 6 representing the Numbers and Operations standard). These studies offer strong evidence for using systematic instruction to teach mathematics skills and for using in vivo settings" (real-life situations).

Read the structured abstract – A Meta-Analysis of Teaching Mathematics to Students with Significant Cognitive Disabilities

A Summary of Nine Key Studies: Multi-Tier Intervention and Response to Intervention for Students Struggling in Mathematics

Center on Instruction, RMC Research Corporation, Portsmouth, New Hampshire. (2009).
R. Newman, Gonchar, B. Clarke, & R. Gersten.

"This summary of nine studies provides information about evidence-based practices for Tier 2 interventions and how to use Response to Intervention (RTI) in mathematics. . . . (The authors) conducted a literature search in EBSCO Information Services, First Search, and PSYCHINFO databases. . . . Of the 541 studies listed, 72 studies were selected for further review based on the title and key words. Of these 72 studies, 33 were selected for possible inclusion. . . . To be included in the final bibliography, a study had to meet three criteria . . . (a) a defined screening process to identify students in need of intervention; (b) the delivery of a tier 2 intervention; and (c) a procedure to monitor student response to intervention. . . . (The authors) subdivided this report into several groups of studies based on their

themes. Those studies that examined the effectiveness or efficacy of Tier 2 interventions for first, second, and third graders are reported first. The studies that examined the overall impact of RTI on achievement are reported next, followed by those that assessed the use of RTI as a method for preventing and identifying mathematics difficulties. Several studies reported results on more than one theme; their results were separated and reported under the appropriate theme."

Full text -- A Summary of Nine Key Studies

A Synopsis of "A Synthesis of Empirical Research on Teaching Mathematics to Low-Achieving Students"

A 2007 Synopsis from the Center on Instruction, Portsmouth, New Hampshire,
from *The Elementary School Journal*, 103, 45-74 (2002). S. Baker, R. Gersten, & D. S. Lee.

"The purpose of this study was to synthesize research on the effects of interventions to improve the mathematics achievement of students considered low achieving or at risk for failure. Meta-analytic techniques were used to calculate mean effect sizes for 15 studies that met inclusion criteria. . . . Results indicated that different types of interventions led to improvements in the mathematics achievement of students experiencing mathematics difficulty, including the following: (a) providing teachers and students with data on student performance; (b) using peers as tutors or instructional guides; (c) providing clear, specific feedback to parents on their children's mathematics success; and (d) using principles of explicit instruction in teaching math concepts and procedures."

Synopsis – Teaching Mathematics to Low-Achieving Students

Achievement Effects of Four Early Elementary School Math Curricula: Findings for First and Second Graders

Institute of Education Sciences, U.S. Department of Education. (2010).
R. Agodini, B. Harris, M. Harris, R. Murphy, & L. Gallagher.

"This study examines whether some early elementary school math curricula are more effective than others at improving student math achievement in disadvantaged schools. . . . A randomized controlled trial involving 110 elementary schools was implemented to determine the relative effects of the study's four curricula -- (a) Investigations in Number, Data, and Space; (b) Math Expressions; (c) Saxon Math; and (d) Scott Foresman-Addison Wesley Mathematics. . . . The study's first report examined first-grade effects during the first year of curriculum implementation among 39 cohort-one schools. . . . The current report updates the first report in two ways. First, it examines first-grade effects during the first year of curriculum implementation among all study schools (cohort one and cohort two combined). . . . The other way in which the current report updates the previous one is by examining second-grade effects during the first year of implementation among the 71 cohort-two schools. . . . The study helps to answer two main research questions about the four curricula: (a) What are the relative effects of the study's four math curricula on math achievement of first and second graders in disadvantaged schools? and (b) Are the relative curriculum effects influenced by school and classroom characteristics, including teacher knowledge of math content and pedagogy?"

Full text -- Achievement Effects of Four Early Elementary School Math Curricula

Also see -- The first report on the effects of the four curricula on first graders in 39 schools

Arts Education in Public Elementary and Secondary Schools: 1999-2000 and 2009-2010

National Center for Education Statistics, U.S. Department of Education. (2012).
B. Parsad & M. Spiegelman.

"This Statistical Analysis Report presents selected findings from seven congressionally mandated arts in education surveys. These surveys were designed to provide national estimates of the characteristics of arts education in public K-12 schools for the 2009-10 school year and to allow comparison to selected estimates from an earlier study done in 1999-2000. This report provides national data about arts education for public elementary and secondary schools, elementary classroom teachers, and elementary and secondary music and visual arts specialists. . . . (One of the many findings is that) In the 2009-10 school year instruction designated specifically for music and visual arts differed by the concentration of poverty in the school, measured by the percent of students eligible for free or reduced-price school lunch. Eighty one percent of secondary schools with the highest poverty levels offered instruction in music, while 96 percent of secondary schools with the lowest poverty concentration offered music instruction. Similar differences by poverty level were observed for visual arts instruction (80 percent vs. 95 percent)."

Full text – Arts Education in Public Elementary and Secondary Schools

Assessments for Preschool Science Learning and Learning Environments

Early Childhood Research and Practice. (2011). K. Brenneman.

"Despite the increased interest and funding investment in early science education and the expectation that high-quality educational supports will result in improved school readiness and achievement in science and related domains, research and program evaluation efforts are limited by a lack of appropriate assessments for learning and classroom instructional quality in science. This article reports on a number of promising tools and approaches (with reference citations) for evaluating children's learning progress in science and the quality of instructional supports for this learning. The article discusses learning and knowledge assessments, which include (a) supporting and assessing science learning during everyday interactions; (b) performance-based assessments for individualized instruction, progress monitoring, and curricular evaluation; (c) direct assessments of science learning; and (d) assessments of science-relevant skills and dispositions. The article also discusses classroom quality measures related to science learning." An extensive reference list forms the basis for the paper.

Full text – Assessments for Preschool Learning and Learning Environments

Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools: IES Practice Guide

Institute of Education Sciences, U.S. Department of Education. (2009).
R. Gersten (Panel Chair), S. Beckmann, B. Clarke, A. Foegen, L. Marsh, J. R. Star, & B. Witzel.

"This guide provides eight specific recommendations intended to help teachers, principals, and school administrators use Response to Intervention (RtI) to identify students who need assistance in mathematics and to address the needs of these students through focused interventions. . . . The body of evidence the panel considered in developing these recommendations included evaluations of mathematics interventions for low-performing students and students with disabilities. The panel considered high-quality experimental and quasi-experimental studies, such as those meeting the criteria of the What Works Clearinghouse to provide the strongest evidence of effectiveness. . . . Each

recommendation receives a rating based on the strength of the research evidence that has shown the effectiveness of the recommendation."

Full text -- Assisting Students Struggling with Mathematics

Also see – Doing What Works: RTI in Elementary-Middle Math

Curriculum Summaries, Eighth Edition (mathematics)

The K-12 Mathematics Curriculum Center,
Education Development Center Inc, Newton, Massachusetts. (2005).

This document "compiles information about 12 comprehensive mathematics curriculum programs that were developed specifically to address the recommendations of the National Council of Teachers of Mathematics' Curriculum and Evaluation Standards for School Mathematics -- and that are well-aligned with the Principles and Standards for School Mathematics. Three of the programs described here are elementary programs, four are for middle school, and five are for high school." Studies and sources of impact data are shown.

Full text -- Curriculum Summaries: Mathematics
[Scroll down to K-12 Mathematics Curriculum Center]

Developing Effective Fractions Instruction for Kindergarten Through 8th Grade: IES Practice Guide

Institute of Education Sciences, U.S. Department of Education. (2010).
R, Siegler (Panel Chair), T. Carpenter, F. Fennell, D. Geary, J. Lewis, Y. Okamoto, L. Thompson, & J. Wray.

"This practice guide presents five recommendations intended to help educators improve students' understanding of fractions. Recommendations include strategies to develop young children's understanding of early fraction concepts and ideas for helping older children understand the meaning of fractions and the computations involved. The guide also highlights ways to build on students' existing strategies to solve problems involving ratios, rates, and proportions. . . . . The panel considers the relevance of individual studies to the recommendation and then discusses the entire evidence base, taking the following into consideration: (a) the number of studies; (b) the quality of studies; (c) whether the studies represent the range of participants and settings on which the recommendation is focused; (d) whether findings from the studies can be attributed to the recommended practice; and (e) whether findings in the studies are consistently positive."

Full text -- Developing Effective Fractions Instruction

Also see – Doing What Works: Developing Effective Fractions Instruction For K-8

Effective Programs for Elementary Science

Best Evidence Encyclopedia, Johns Hopkins University, Baltimore, Maryland. (2012).
R. E. Slavin, C. Lake, P. Hanley, & A. Thurston.

This review summarizes evidence on three types of programs designed to improve the science achievement of students in grades K–6: (a) inquiry-oriented programs without science kits; (b) inquiry-oriented programs with science kits; and (c) technology programs. . "The evidence from studies that met the review's inclusion criteria supports a view that improving outcomes in elementary science depends on improving teachers' skills in presenting lessons, engaging and motivating students, and integrating

science and reading. Technology applications that help teachers teach more compelling lessons and that use video to reinforce lessons also have promise."

Full text – Effective Programs for Elementary Science
[Click at the right]

Effective Programs in Middle and High School Mathematics: A Best Evidence Synthesis

Best Evidence Encyclopedia, Johns Hopkins University, Baltimore, Maryland (2008).
R. E. Slavin, C. Lake, & C. Groff.

"This review summarizes evidence on three types of programs designed to improve the mathematics achievement of students in grades 6-12: (a) mathematics curricula; (b) computer-assisted instruction; and (c) instructional process programs. . . . The reviews selected for inclusion in the Best Evidence Encyclopedia are meta-analyses or other quantitative syntheses that apply consistent, scientific standards to bodies of evidence that both meet high standards of methodological quality and evaluate realistic implementations of programs currently available to educators." Program ratings are included: (a) strong evidence of effectiveness; (b) moderate evidence; and (c) limited evidence.

Summary -- Programs in Middle and High School Mathematics
[Summary, key findings, and program ratings. Click at the right for the full report.]

Also see – Effective Programs in Elementary Mathematics

Effective Science Instruction: What Does the Research Tell Us? – Second Edition

Center on Instruction, RMC Research Corporation, Portsmouth, New Hampshire. (2010).
E. Banilower, K. Cohen, J. Pasley, & E. Weiss.

"This brief endeavors to distill the research on science learning to inform a common vision of science instruction and to describe the extent to which K-12 science education currently reflects this vision. A final section on implications for policymakers and science education practitioners describes actions that could integrate the findings from research into science education.". . . The science instruction model presented in the brief derives largely from the learning theory described in the National Research Council's volumes: (a) *How People Learn: Brain, Mind, Experience, and School* (2003); and (b) *How Students Learn: Science in the Classroom* (2005). . . . (The authors) expand on each element of effective instruction and provide classroom-based examples of them." Both of the source volumes are available from the National Academies Press.

Full text – Effective Science Instruction
[Click on the second title]

To access the source volumes at National Academies Press

Effective Strategies for Teaching Students with Difficulties in Mathematics: Effective Strategies Brief

National Council of Teachers of Mathematics, Reston, Virginia. (Circa 2006).

"This research brief focuses on evidence-based practices for teaching students with difficulties in mathematics. Most of the summary for this research brief is based on two meta-analyses (Baker, Gersten, and Lee, 2002, in the *Elementary School Journal*; Gersten et al. 2006, by the Center on Instruction/RG Research Group), as well as complementary work by Kroesbergen and van Luitt, 2003, in *Remedial and Special Education*. Together, the reviews encompass more than fifty studies, and although this is an emerging and substantial research base, it is far from definitive. As a composite, the studies reviewed present a picture of specific aspects of instruction that are consistently effective in teaching students who experience difficulties with mathematics. The principles that emerged from the research seem appropriate for instruction in a variety of situations and possible settings."

Full text – Effective Strategies

Effects of Teacher Professional Development Gains in Student Achievement: How Meta-Analysis Provides Evidence Useful to Education Leaders (pertains to science and math)

Council of Chief State School Officers (CCSSO), Washington DC. (2009).
R. K. Blank & N. de las Alas.

"CCSSO was awarded a grant from the National Science Foundation to conduct a meta analysis study with the goal of providing state and local education leaders with scientifically-based evidence regarding the effects of teacher professional development on improving student learning. The analysis focused on completed studies of effects of professional development for K-12 teachers of science and mathematics. The meta analysis results show important cross-study evidence that teacher professional development in mathematics does have significant positive effects on student achievement. The analysis results also confirm the positive relationship to student outcomes of key characteristics of design of professional development programs."

Full text - Effects of Teacher Professional Development Gains

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Encouraging Girls in Math and Science: IES Practice Guide

Institute of Education Science, U.S. Department of Education. (2007).
D. F. Halpern (Panel Chair), J. Aronson, N. Reimer, S. Simpkins, J. R. Star, & K. Wentzel.

"The goal of this practice guide is to formulate specific and coherent evidence-based recommendations that educators can use to encourage girls in the fields of math and science. The target audience is teachers and other school personnel with direct contact with students, such as coaches, counselors, and principals. The practice guide includes specific recommendations for educators and the quality of evidence that supports these recommendations. . . The panel considers the relevance of individual studies to the recommendation and then discusses the entire evidence base, taking the following into consideration: (a) the number of studies; (b) the quality of studies; (c) whether the studies represent the range of participants and settings on which the recommendation is focused; (d) whether findings from the studies can be attributed to the recommended practice; and (e) whether findings in the studies are consistently positive." Evidence is classified as strong, moderate, or low quality.

Full text – Encouraging Girls in Math and Science

Also see – Doing What Works: Encouraging Girls in Math and Science

Foundations for Success: The Final Report of the National Mathematics Advisory Panel

U.S. Department of Education. (2008). Under a contract with Widmeyer Communications, Washington DC, and Abt Associates Inc, Cambridge, Massachusetts.
L. R. Faulkner (Chair), C. P. Benbow (Vice Chair), D. L. Ball, A. W. Boykin, D. H. Clements, S. Embretson, F. S. Fennel, B. Fristedt, D. C. Geary, R. M. Gersten, T. Loveless, L. Ma, V. F. Reyna, W. Schmid, R. S. Siegler, J. H. Simons, S. Stotsky, V. Williams, & H-H. Wu.

In April 2006, "the President established the National Mathematics Advisory Panel via Executive Order 13398 in which he also assigned responsibility to the U.S. Secretary of Education. . . . While the presidential charge contains many explicit elements, there is a clear emphasis on the preparation of students for entry into and success in Algebra. . . . Over a period of 20 months, the Panel received public testimony. . . Each of five task groups carried out a detailed analysis of the available evidence in each area of the Panel's responsibility: (a) conceptual knowledge and skills; (b) learning processes; (c) instructional practices; (d) teachers and teacher education; and (e) assessment. Each of three subcommittees was charged with completion of a particular advisory function for the panel: (a) standards of evidence; (b) instructional materials; and (c) the Panel-commissioned National Survey of Algebra Teachers. Each task group and subcommittee produced a report supporting this document. . . . The Final Report represents findings and recommendations of the Panel as a whole."

Full text -- Report of the National Mathematics Advisory Panel

Also see -- National Math Panel: Critical Foundations for Algebra in *Doing What Works*, U.S. Department of Education

And see – National Math Panel: Major Topics in School Algebra in Doing What Works, U.S. Department of Education

And see A Road Map (a research brief on findings from the National Mathematics Panel, by the Center for Comprehensive School Reform and Improvement) Distributed by the Center on Instruction.

Improving Basic Mathematics Instruction: Promising Technology Resources for Students with Special Needs

Center for Implementing Technology in Education (CITEd), American Institutes for Research, Washington DC. (2007).
B. Murray, H. Silver-Pacuilla, F. I. Helsel.

"This Tech in Action monograph is a synthesis of the work completed by the CITEd research team in the use of technology to support mathematics instruction for students with special needs. Here, the emphasis is on practical classroom activities and tools in the areas of computational fluency, conceptual understanding, and problem solving. . . . Few students have isolated math disabilities. Most also have concomitant issues related to language processing and reading challenges. For example, many children with dyslexia have the same difficulty recognizing a math basic problem as they do a written word. That these problems are presented left to right (3 + 1 = 4) as well as top to bottom only adds to the difficulty. Students with language disorders often have difficulty in math because they must process the language before they can process the math problem. The use of inconsistent language (sum, add, total, plus, etc.) to describe the same operation can present additional challenges. Researchers have identified several practices that are effective in teaching mathematics to students with a range of learning needs."

Full text -- Improving Basic Mathematics Instruction

Improving Mathematical Problem Solving in Grades 4 Through 8: IES Practice Guide

Institute of Education Sciences (IES), U.S. Department of Education. (2012).
J. Woodward (Panel Chair), S. Beckmann, M. Driscoll, M. Franke, P. Herzig, A. Jitendra, K. R. Koedinger, & P. Obguehi.

"The goal of this practice guide is to offer educators specific, evidence-based recommendations that address the challenge of improving mathematical problem solving in grades 4 through 8. . . . The five recommendations in this guide can be used independently or in combination to help teachers engage students in problem solving on a regular basis. . . . The level of evidence assigned to each recommendation in this practice guide represents the panel's judgment of the quality of the existing research to support a claim that, when these practices were implemented in past research, positive effects were observed on student outcomes. After careful review of the studies supporting each recommendation, panelists determined the level of evidence for each recommendation using the criteria in Table 1."

Full text – Improving Mathematical Problem Solving

K-8 Screen-Based Technology to Support Mathematics: Literature Review

Center for Implementing Technology in Education (CITEd), American Institutes for Research, Washington DC. (Circa 2005).

"Screen-based technologies (i.e., those technologies that are presented on a computer screen) have evolved rapidly over the past two decades. Research on these evolving technologies is quite robust, but few screen-based educational technology practices have a research base sufficient to call them evidence-based. Additionally, although technology is generally thought of as particularly helpful for students with disabilities, technology rarely aligns with the needs of students with disabilities or is used for motivational rather than academic purposes. . . . CITEd's review and synthesis of research in K-8 screen-based technology revealed seven educational technology practices: (a) multimedia embedded supports; (b) games/drill and practice; (c) screen-based manipulatives; (d) cooperative learning; (e) enhanced anchored instruction; (f) computer-based feedback; and (g) web-based activities."

Full text -- K-8 Screen-Based Technology to Support Mathematics

Latino/a and Black Students and Mathematics

Students at the Center, Jobs for the Future, Boston, Massachusetts. (2012).
R. Gutierrez & S. E. Irving.

"Starting with mathematics as a social activity (as opposed to a set of skills that schools need to impart on students) may also better connect with the kinds of interdisciplinary learning that individuals will face in life. . . . This paper examines four categories of research: (a) ethnomathematics (e.g., cultural practices seen as unique to a particular group); (b) adults and others learning to use mathematics (e.g., for professional development in their careers; as part of their everyday practices); (c) students learning in afterschool contexts; and (d) social justice mathematics (e.g., math as a tool for addressing injustices). The purpose of this literature review is to broaden popular conceptualizations of mathematics achievement of Latino/a and black students. By doing so, it aims to inform and inspire mathematics

practitioners to craft innovative pedagogies to better support Latino/a and black youth."

Full text and executive summary – Latino and Black Students and Mathematics

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Math and Science in Preschool: Policies and Practice (Policy Brief)

National Institute for Early Education Research (NIEER), Rutgers, State University of New Jersey. (2009).
K. Brenneman, J. Stevenson-Boyd, & C. Frede.

"High-quality preschool experiences can positively affect later math achievement, and mathematics skills at school entry are correlated with academic achievement in later grades. Although science is recognized as important content for preschool learners, there is not yet a clear picture of the ways that early science knowledge and skills influence later outcomes. This policy brief reviews research that addresses the development of mathematics and science knowledge in preschool children, identifies areas that require further study, and outlines recommendations for early education policy in these domains."

Full text – Math and Science in Preschool

Math Publications and Resources

What Works Clearinghouse, Institute of Education Sciences, U.S. Department of Education. (Continuing Collection).

This resource "which looks at the evidence of effectiveness of curriculum-based interventions and instructional programs that are designed to organize and deliver content and monitor student progress – focuses on math content and skills. Items reviewed are intended to improve outcomes in mathematics achievement. Grade/Age Range – PreK-12. Population: All." Contents cover Intervention Reports, Single Study Reviews, Practice Guides, Reference Resources, and Multimedia.

Full texts: Math Publications and Resources

Mathematics Instruction for Students with Learning Disabilities or Difficulty Learning Mathematics: A Synthesis of the Intervention Research

Center on Instruction, RMC Research Corporation, Portsmouth, New Hampshire. (2008).
R. Gersten, D. J. Chard, M. Jayanthi, S. K. Baker, P. Morphy, & J. Flojo.

"This meta-analysis synthesizes experimental and quasi-experimental research on instruction that enhances the mathematics performance of students in grades 1-12 with learning disabilities. . . . In the analysis, (the authors) included only randomized controlled trials and quasi-experimental designs with clear evidence of pretest comparability." Findings are discussed on the following approaches to instruction and/or curricular design: (a) explicit instruction; (b) student verbalization of their mathematical reasoning; (c) visual representations; (d) range and sequence of examples; (e) multiple and heuristic strategies; (f) giving teachers ongoing formative assessment data and feedback on students' math performance; (g) providing data and feedback to LD students on their math performance; and (h) peer-assisted math instruction.

Full text – Mathematics Instruction for Students with LD

Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity

National Academies Press, Washington DC. (2009). C. T. Cross, T. A. Woods, & H. Schweingruber.

"Relying on a comprehensive review of the research, *Mathematics Learning in Early Childhood* lays out the critical areas that should be the focus of young children's early mathematics education, explores the extent to which they are currently being incorporated in early childhood settings, and identifies the changes needed to improve the quality of mathematics experiences for young children. This book serves as a call to action to improve the state of early childhood mathematics. It will be especially useful for policy makers and practitioners-those who work directly with children and their families in shaping the policies that affect the education of young children."

Full text – Mathematics Learning in Early Childhood
[Click on READ under "Free Resources"—and click at the right for the PDF summary]

Organizing Instruction and Study to Improve Student Learning: IES Practice Guide (content instruction, including social studies, science, and math)

Institute of Education Science, U.S. Department of Education. (2007).
H. Pashier (Chair), P. M. Bain, B. A. Bottge, A. Graesser, K. Koedinger, M. McDaniel, & J. Metcalfe.

"This guide includes a set of concrete actions relating to the use of instructional and study time that are applicable to subjects that demand a great deal of content learning, including social studies, science, and mathematics. The guide was developed with some of the most important principles to emerge from research on learning and memory in mind." Evidence for each practice is described as (a) strong, (b) moderate, or (c) minimal.

Full text -- Organizing Instruction and Study to Improve Student Learning

Also see – Doing What Works: How to Organize Your Teaching

Peer Learning in Primary School Science: Theoretical Perspectives and Implications for Classroom Practice

Electronic Journal of Research in Educational Psychology. (2007).
A. Thurston, K. Van de Keere, K. J. Topping, W. Kosack, S. Gatt, J. Marchal, N. Mestdagh, D. Schmeinck, W. Sidor, & K. Donnert.

"This article examines cognitive models of peer learning in school and the implications that these models have for the teaching of science in primary schools. . . . It reviews literature and examines the models developed to exemplify Piagetian and Vygotskian cognitive models of peer learning. The role that metacognition and affective development play in the peer learning process is explored. Research regarding the implementation of peer learning in school contexts is reviewed and recommendations are made as to a critical typology for the organization and structure of peer learning in primary school science. The article provides a link between cognitive models of peer learning in primary school science and the classroom implementation of such models. The implications for continuing professional development of teachers in respect to the use of peer learning in science are explored and recommendations in this respect are made."

Full text – Peer Learning in Primary School Science

Full text en Espanol

Project-Based Learning in Middle School Mathematics: Research Summary

Association for Middle Level Education (formerly NMSA), Westerville, Ohio. (2008).
Z. E. Yetkiner, H. Anderoglu, & R. M. Capraro.

"A number of terms are used to describe inquiry- and project-focused teaching and learning that is supported by best practices and research-based approaches. Project-based learning typically begins with an understanding of a clearly defined end product. This is in contrast to problem-based learning, which is focused on a problem students are expected to solve in idiosyncratic ways and is subsumed under project-based learning. . . . The focus of this research summary is (a) to foster an understanding of project-based learning (PBL), particularly in mathematics education; (b) to explain the factors for making a conscious decision to implement PBL in middle grades mathematics classrooms; and (c) to provide insights about the possible realized effects when mathematics-based PBL is implemented."

Full text – Project-Based Learning in Middle School Math

Reinvesting in Arts Education: Winning America's Future Through Creative Schools

President's Committee on the Arts and Humanities, The White House. (2011).

"Over the past 18 months the President's Committee on Arts and the Humanities has conducted an in-depth review of the current condition of arts education, surveying recent research about its documented benefits and identifying potential opportunities for advancing arts education. . . . Decades of research show strong and consistent links between high-quality arts education and a wide range of impressive educational outcomes. This is true even though, as in most areas where learning is complex, the research base does not yet establish causal proof. Arts integration models (the practice of teaching across classroom subjects in tandem with the arts) have been yielding some particularly promising results in school reform and closing the achievement gap. Most recently, cutting-edge studies in neuroscience have been further developing our understanding of how arts strategies support crucial brain development in learning."

Full text -- Reinvesting in Arts Education

Research-Based Practices for Creating Access to the General Curriculum in Science for Students with Significant Intellectual Disabilities

Council of Chief State School Officers, Washington DC. (2009).
L. Ahlgrim-Delzell, V. F. Knight, & B. A. Jimenez.

"The objective of this monograph is to increase teacher understanding of creating access to the general curriculum in science for students with significant intellectual disabilities through an extensive literature review pertaining to the teaching practices for science instruction for students with significant intellectual disabilities. The monograph reviews the seven content areas of the National Science Education Standards and reviews the current research findings for students with significant intellectual disabilities, including students who may have physical and sensory impairments. . . . . The literature review attempted to locate the most recent research (quantitative, qualitative, correlational) from peer-reviewed journals in special education, psychology, and research in which a science skill was taught to at least one individual with significant cognitive disabilities. . . . Both an electronic and hand search were

conducted to determine articles for review. . . Six articles located in four different publications met the inclusion criteria. . . . Eight important teaching practices were identified from the current review on teaching science to students with significant disabilities. For each of the eight identified teaching practices, a description of the practice and evidence from the literature supporting the practice is provided."

Full text -- Access to the General Curriculum in Science

Also see – Research-Based Practices for Creating Access to the General Curriculum in Mathematics

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Review of Evaluation Studies of Mathematics and Science Curricula and Professional Development Models

The Urban Institute, Washington DC. (2005).
B. C. Clewell, C. C. de Cohen, P. B. Campbell, & L. Perlman, with N. Deterding, S. Manes, L. Tsui, S. N. S. Rao, B. Branting, L. Hoey, & R. Carson.

"This report presents the findings of a review of about four hundred studies evaluating mathematics and science curricula and professional development models for middle school and high school. As requested by the GE Foundation, the main goal of this review was to identify . . . mathematics and science curricula as well as professional development models that had been deemed effective, based on their success in increasing student achievement. The GE Foundation's interest in these findings stems from its desire to initiate a program of funding to foster sustainable improvement in academic achievement of underrepresented and disadvantaged populations. . . . The document describes the methodology used to conduct the review, presents findings, and ends with a summary of conclusions. . . . Studies of six curricula found that students who used the curriculum being tested scored higher than comparison students on a majority of standardized and/or state tests used, as well as on a majority of the curriculum-based tests used: (a) Cognitive Tutor; (b) Connected Mathematics;" (c) Interactive Mathematics Program; (d) Tools for Success; (e) Saxon Math; and (f) University of Chicago School Mathematics Project (UCSMP).

Full text -- Review of Evaluation Studies of Mathematics and Science Curricula

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Science Instruction for Students with Learning Disabilities: A Meta-analysis

Learning Disabilities Research and Practice. (2011).
W. J. Therrien, J. C. Taylor, J. L. Hosp, E. R. Kaldenberg, & J. Gorsh.

“This meta-analysis evaluates the effectiveness of instructional strategies in science for students with LD. Twelve studies were examined, summarized, and grouped according to the type of strategy implemented. Effect sizes were calculated for each study. Across all studies, a mean effect size of .78 was obtained indicating a moderate positive effect on students’ with LD science achievement. Findings also align with past reviews of inquiry-based instruction for students with special needs indicating that students with LD need structure within an inquiry science approach in order to be successful. Additionally, results suggest mnemonic instruction is highly effective at increasing students’ with LD acquisition and retention of science facts.”

Abstract – Science Instruction for Students with Disabilities
[Full text for purchase]

Science Publications and Resources

What Works Clearinghouse, Institute of Education Sciences, U.S. Department of Education. (Continuing Collection).

This resource "focuses on science interventions, including curriculum-based interventions, instructional techniques, and products that deliver content and monitor student progress. Items reviewed are intended to improve outcomes in science achievement. Grade/Age Range -- Kindergarten through High School. Population – All." Contents cover Intervention Reports, Single Study Reviews, Practice Guides, and Reference Resources.

To search publications and resources

Screening for Mathematics Difficulties in K-3 Students (Second Edition)

Center on Instruction, RMC Research Corporation, Portsmouth, New Hampshire. (2011).
R. Gersten, B. S. Clarke, K. Haymond, & N. C. Jordan.

"This second edition of *Screening for Mathematics Difficulties in K-3 Students,* which was originally published in 2007, updates the document with new research in the assessment field in developing valid and reliable screening measures for early mathematics difficulties. It focuses on valid and reliable screening measures for students in kindergarten and first grade but also examines data on screening tests for second and third graders, since the goal of screening is to identify students who might struggle to learn mathematics during their initial school years. This document supports using screening data to identify students struggling in mathematics for implementation of School Improvement Grants (SIG) requirements.

Full text – Screening for Mathematics Difficulties

Selecting Mathematics Instructional Materials: An Annotated Bibliography

The K-12 Mathematics Curriculum Center (circa 2010).
Education Development Center Inc, Newton, Massachusetts.

This publication "is a resource for curriculum leaders involved in all phases of the selection process. Whether preparing for an upcoming textbook adoption, actively involved in choosing materials, or preparing to launch the implementation of a recently selected text, this publication provides annotations to articles that offer insight into these topics. . . . The articles in this bibliography are organized to mirror the phases of the adoption process and fall into three primary categories: (a) preparation for selection and implementation, (b) effectiveness studies, and (c) implementation of instructional materials. . . . In gathering resources for this publication, the K–12 Mathematics Curriculum Center staff reviewed articles from a comprehensive set of peer-reviewed journals. The following criteria were used to determine inclusion in this publication: -- relevance for curriculum leaders involved in materials selection or implementation' accessibility for curriculum leaders (e.g., readability); peer-reviewed; specific connection to instructional materials; and published in 2000 or later. In a few cases, slight exceptions were made to this list of criteria. For example, a handful of articles published prior to the year 2000, were identified as seminal pieces in the field."

Full text, browse, and search – Selecting Mathematics Instructional Materials

STEM Learning in Afterschool: An Analysis of Impact and Outcomes (science, technology, engineering, math)

Afterschool Alliance, Washington DC. (2011).

"This document summarizes evaluation reports from afterschool STEM programs across the United States and identifies common trends and strengths that afterschool learning brings to STEM education. Like many programs nationwide, several of the programs highlighted in this paper were designed specifically to provide services to underrepresented populations in STEM fields, and many also focus on providing girls with exposure to science and female role models. . . . Evaluations presented here were collected by casting a wide net to solicit reports from afterschool programs across the country through various communication channels as well as searching through evaluation databases." Programs are described in the text and also on a table beginning on page 13 that provides additional detail.

Full text – STEM Learning in Afterschool
[Also see related publications on this page]

STEMWORKS Database

Change the Equation (CTEq), Washington DC. A nonpartisan CEO-led initiative that is mobilizing the business community to improve the quality of science, technology, engineering and math learning in the U.S. (Continuing Collection).

This "database aims to be a critical resource for funders, program developers, and STEM advocates alike. Funders can find programs that maximize the return on their investment. Those who develop STEM learning programs can benchmark their work against successful exemplars. Advocates can point to excellent programs as they make the case for quality. The programs in this database have to clear a high bar. WestEd, an independent non-profit research, development, and service organization, rigorously reviews all of them against Change the Equation's Design Principles for Effective STEM Philanthropy and an accompanying Rubric. Only programs that perform well against the principles are admitted. STEMworks is itself a work in progress. The programs in this database are by no means the only excellent STEM learning programs in the country. Rather, they are the first in what is a growing list of effective programs." Each entry provides an overview and you can click on FULL DETAILS for (a) program description; (b) strengths and impacts; (c) funders/partners; (d) contact information; and (e) the website.

Search the STEMWORKS Database

The Arts and Achievement in At-Risk Youth: Findings from Four Longitudinal Studies

National Endowment for the Arts, Washington DC. (2012).
J. Catterall with S. A. Dumais & G. Hampden-Thompson.

"This report examines the academic and civic behavior outcomes of teenagers and young adults who have engaged deeply with the arts in or out of school. . . . The report examines arts-related variables from four large datasets -- three maintained by the U.S. Department of Education and one by the Department of Labor -- to understand the relationship between arts engagement and positive academic

and social outcomes in children and young adults of low socioeconomic status (SES). . . . The researchers decided to focus their analysis on teenagers and young adults who came from lower SES backgrounds. . . . The analyses show that achievement gaps between high- and low-SES groups appear to be mitigated for children and young adults who have arts-rich backgrounds."

Full text – The Arts and Achievement in At-Risk Youth
[Click at the right]

Also see "The Arts and Human Development: Framing a National Research Agenda for the Arts, Lifelong Learning, and Individual Well-Being"

The Effect of ICT Teaching Activities on Science Lessons on Students' Understanding of Science Ideas (ICT = Information and Communication Technology)

Evidence for Policy and Practice Information (EPPI Centre), Social Science Research Unit, Institute of Education, University of London. (2006).
S. Hogarth, J. Bennett, F. Lubben, B. Campbell, & A. Robinson.

For this study, "557 scientific papers on the use of ICT in science lessons, published in English in the period 2000–2005 were screened. These were narrowed down to 37 studies from 10 countries that focused on ICT and scientific ideas. As the most frequent type of ICT used was simulations (53%), the in-depth review question was: What evidence is there from controlled trials of the effects of simulations on the understanding of science ideas demonstrated by students aged 11-16? . . . There were nine evaluation studies on the use of simulation to teach the understanding of science ideas that included a control and pre and post testing of achievement in the in-depth review. Seven of these were rated medium high or medium quality studies. Simulations fell into two main categories: (a) simulation of specific experiments and (b) simulations of a wider scientific situation, commonly known as virtual environments, which could include experimental simulations. Both types of simulation can improve students' understanding compared to non-ICT/traditional teaching and learning activities. (Other findings include the following). Students' use of ICT simulations helped them to improve their understanding of science ideas more effectively compared to the use of non-ICT teaching activities. Students' use of ICT simulations was more effective than using non-ICT teaching activities for improving basic science ideas including science understanding and the scientific approach. However the improvement of higher levels of understanding (for example, the transfer of scientific knowledge from one situation to another and experimental design) can equally well be achieved when students use traditional (non-ICT) teaching approaches. The gains in students' learning when using ICT simulations were further enhanced when teachers actively scaffolded or guided students through the ICT simulations."

Overview -- The Effect of ICT Teaching Activities on Science Lessons on Students' Understanding of Science Ideas

The Effects of Music Instruction on Emergent Literacy Among Preschool Children: A Literature Review

Early Childhood Research & Practice. (2008). J. Bolduc.

"Many researchers have observed that the learning of music contributes to preschool-age children's awakening to different subject matters, particularly to reading and writing. Several studies have established significant correlations between the treatment of musical and linguistic information in early childhood. They indicate that young children who obtain superior results in melodic perception tasks also obtain higher results in phonological awareness and pre-reading tests. Quasi-experimental studies also show that children who participate in musical and first-language interdisciplinary programs develop phonological awareness, word recognition, and invented spelling abilities more efficiently than their classmates who do not participate in such programs. In fact, it seems that musical activities promote the development of auditory perception, phonological memory, and metacognitive knowledge — three components that are equally involved in the development of linguistic abilities. In order to clarify the music-language relationship as understood in the early childhood pedagogy, this article presents a review of the main correlational and quasi-experimental studies published in the past 20 years2 that have dealt with music education and the acquisition of written language in children 4 to 6 years of age."

Full text – The Effects of Music Instruction

The Magnitude, Destinations, and Determinants of Mathematics and Science Teacher Turnover

Consortium for Policy Research in Education. (2010). University of Pennsylvania and partner institutions.
R. M. Ingersoll & H. May.

The data for this study "are from the National Center for Education Statistics' nationally representative Schools and Staffing Survey and its longitudinal supplement, the Teacher Follow-up Survey. Analyses show that rates of mathematics and science teacher turnover, both those moving between schools and those leaving teaching altogether, have increased over the past two decades, but have not been consistently different than those of non-mathematics/science teachers. . . . The data also show that, like other teachers, there are large school-to-school differences in mathematics and science turnover. High poverty, high minority, and urban public schools have among the highest mathematics and science turnover levels. . . . (The authors') multivariate analyses showed that a number of key organizational characteristics and conditions of schools accounted for these school differences in turnover. The strongest factors for mathematics teachers were the degree of individual classroom autonomy held by teachers, the provision of useful professional development, and the degree of student discipline problems. For science teachers, the strongest factors were the maximum potential salary offered by school districts, the degree of student discipline problems in schools, and useful professional development."

Full text – The Magnitude, Destinations, and Determinants

The Qualities of Quality: Understanding Excellence in Arts Education

Project Zero, Harvard Graduate School of Education. (2009). Commissioned by The Wallace Foundation with additional support from the Arts Education Partnership.
S. Siedel, S. Tishman, E. Winner, L. Hetland, & P. Palmer.

In this paper, the authors "focused on formal, intentional arts learning experiences – in classes,

workshops, studios, and projects. (They) tried to capture the full breadth of these settings in the study, including arts education opportunities in and out of school and in rural, urban, and suburban settings. (They) also included all of the major art forms – dance, theater, music, and visual arts, alone, in combination, and extending to such contemporary and emerging forms as documentary film or radio and spoken word. (They) sought a wide range of settings, including schools, museums, folk art, and community arts contexts. . . . (They) pursued three strands of inquiry – (a) a literature review, (b) a series of one-on-one interviews with experts in the field, and (c) a series of site visit-interviews to programs in diverse settings across the U.S. The goal was to explore theoretical, research, and practical perspectives on quality and then to triangulate from these perspectives to identify significant convergences and divergences."

Full text – The Qualities of Quality

Using Interdisciplinary Arts Education to Enhance Learning

National Association of Elementary School Principals, Alexandria, Virginia. (2009). M. R. Lorime.

"When carefully planned, interdisciplinary arts education has the potential to provide a relevant and developmentally responsive curriculum (i.e., a curriculum that engages the physical, social, and cognitive needs) that ultimately enhances learning for all). . . . Drawing from a body of research, including a recent study of middle-level schools, this article presents strategies and benefits related to using interdisciplinary arts education as a foundation for presenting the visual and performing arts as integral components in educating the whole child."

Full text – Using Interdisciplinary Arts Education to Enhance Learning

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Using Technology to Support Struggling Students in Science

Center for Implementing Technology in Education (CITEd), American Institutes for Research, Washington DC. (2010). A. Brann, T. Gray, P. J. Piety, & H. Silver-Pacuilla..

"This report discusses how struggling students can be supported in science education and how accessible and assistive technologies can help. Following a background introduction to the topic and challenges, the report is organized into five sections, each addressing an important dimension of K–12 science education within the context of 21st century skills. Each section presents research findings and strategies to guide educators in implementing science education that is inclusive." These five sections are (a) Physically Doing Science or 'Getting a Mechanical Grip' on the Natural World; (b) Visualization, Representing, and Modeling; (c) Science Literacy, Vocabulary, and Discourse; (d) Questions, Argumentation, and Use of Evidence; and (e) Student Engagement and Identity with Science.

Full text – Using Technology to Support Struggling Students in Science

[Scroll down and click under Research Papers]

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