



# **SCIENTIFICALLY BASED RESEARCH: A GUIDE FOR EDUCATION PUBLISHERS & DEVELOPERS**



A PUBLICATION OF THE  
**Software & Information  
Industry Association**

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# **Scientifically Based Research: A Guide for Education Publishers and Developers**

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# PREFACE

A number of factors, including passage of the No Child Left Behind Act (NCLB) in January 2002, have combined to drive increased national attention to issues of educational research and effectiveness. As a result, publishers and other developers of educational materials and programs are faced with increasing demands to demonstrate the effectiveness of their products and services. While many developers of educational materials have routinely engaged in evaluation and qualitative research to ensure that their products serve educational needs, they have typically lacked the capacity necessary to design and conduct “scientific research,” as defined by NCLB, on product effectiveness.

In response to developers’ questions about how to demonstrate the education validity and effectiveness of their products, the Software & Information Industry Association (SIIA) commissioned *Scientifically Based Research: A Guide for Educational Publishers and Developers*. The purpose of the *Guide* is to assist companies in the development and validation of educational interventions, with an emphasis on curricular materials, software, and related products, services, and tools. To that end, the *Guide* includes the following components, which together provide a research primer for corporate decision makers, paying particular attention to the requirements of NCLB relative to scientifically based research (SBR):

- a definition and explanation of NCLB’s use of SBR
- principles and procedures underlying SBR
- guidance for (1) developing products that are grounded in SBR; (2) communicating the un-

derlying, scientific basis of existing products; and (3) using SBR methods to substantiate claims of product effectiveness

- sample research designs
- practical solutions for many of the research challenges facing educational publishers and developers
- answers to specific key questions culled from the authors’ conversations with members of the publishing and product development industry
- a planning tool and checklists that provide step-by-step processes by which companies can plan their SBR-related efforts
- resources and references for further reading

Because there are no single best approaches to conducting scientifically based research, companies need a basic understanding of major research issues in order to answer the practical business questions that involve research. Hence, the *Guide* seeks to provide a primer on research definitions and methodologies while also responding to the practical issues and questions that are important to publishers and developers. In addition to the main text, a number of text boxes are included to succinctly highlight information that is provided in greater detail throughout the text. Appendixes are also included to guide readers through specific processes such as the development of a research report. While the total *Guide* provides comprehensive information for developing and testing research-based products and services, sections of it may certainly be used on an as-needed basis. In short, it may best be viewed as a resource.

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## EDITOR'S NOTE

The nation's K-12 schools continue to make significant investments in technology-based products and services in their attempt to address educational needs and goals and to ensure students achieve to high standards. However, particularly since the passage of the No Child Left Behind Act (NCLB) in early 2002, a number of factors have combined to drive increased attention to educational research and effectiveness, including for all educational programs, products, and services.

While publishers and developers have long engaged in various research and development efforts, educators are demanding increased evidence of product effectiveness as a result of several educational, regulatory, and budget demands. These include accountability requirements at both state and federal levels, the scientifically based research (SBR) requirements of NCLB, and pressures for a proven return on investment for technology and other budget items. Companies, therefore, have ever-increasing incentive to demonstrate the research base and proven effectiveness of their educational products and services. Over time, those unable to meet such demands may lose sales opportunities, while those responding are most likely to gain a competitive advantage in the educational marketplace.

While it is most useful to think of SBR within a broad context that extends beyond the specific requirements of NCLB, it is evident that NCLB serves as a primary catalyst in focusing attention on research. Federal involvement in SBR grew out of the view among federal leaders that educational decisions and practices are too often based on fad and anecdote, and that too little high-quality research exists to assist educators in determining “what works” for whom and under what circumstances. To help address this “research gap,” Congress included SBR definitions and requirements in NCLB. In addition to overseeing SBR implementation, the U.S. Department of Education has commissioned a *What Works Clearinghouse* (WWC) to review research and determine

the evidence of effectiveness for specific educational approaches and interventions.

Although it is not the authors' intent to focus solely on the SBR requirements of NCLB, it is useful to consider the role of those requirements at the outset. NCLB includes more than 100 references to “scientifically based research.” NCLB's definition of SBR essentially provides criteria for what constitutes high-quality research, but the definition is somewhat broad and open to interpretation with regard to determining whether a study would meet these criteria. Although NCLB emphasizes rigorous studies capable of demonstrating causation, it does not require that all research studies be experimental in design.

The term *scientifically based research* appears throughout NCLB relative to most core grant programs and places conditions on the decision-making processes used to select programs, practices, and products for which NCLB funds may be used. While the SBR definition is constant throughout the law, the term's specific use varies so that its practical impact changes based on the specific context. For example, many uses simply require that decisions be made “based on a review of SBR,” thus requiring identification of existing scientifically based research that supports the principles on which a particular intervention (or product) is based.

Other SBR provisions require that funds be used only for interventions demonstrated to be effective (using SBR techniques), and to produce the desired or claimed results. A review of the law can help stakeholders identify where and how SBR applies to various NCLB programs. An analysis of NCLB's SBR requirements and their practical impact is provided in SIIA's 2002 document on understanding and implementing SBR (SIIA, 2002).

The NCLB Act puts the onus on educators to determine what qualifies as SBR. Just as there are no simple answers for publishers and developers about what constitutes evidence that is “scientific

enough,” there are no simple answers for educators. As such, implementation and impact may vary widely by district, state, federal program, and educational issue. While educators, like publishers and developers, are currently lacking in specific details of federal requirements relative to SBR, increasing demands to document the extent to which programs and services are grounded in SBR will likely contribute to increasing awareness and sophistication on the part of education decision makers and consumers. In turn, this will affect educators’ expectations for SBR information from publishers and developers about their products and services.

Given that federal officials have noted a dearth of SBR in most content areas outside of reading, strict compliance with the letter of the law would seem not generally possible at this time. Recognizing this dilemma, guidance from the U.S. Department of Education is helping to put the notion of SBR into greater perspective. For example, the term “evidence-based education” (EBE) is being used to suggest that educators rely on the best *available* research evidence in conjunction with their professional judgment. According to Dr. Grover “Russ” Whitehurst, director of the U.S. Department of Education’s Institute for Education Sciences (IES), “Evidence-based education is the integration of professional wisdom with the best available empirical evidence [including evidence yielded by SBR] in making decisions about how to deliver instruction” (Whitehurst, 2001).

The U.S. Department of Education is taking a number of steps to help fill the gap in determining what educational programs and products are proven effective through high-quality research. For example, it has issued guidance on SBR related to several programs, including Reading First, Comprehensive School Reform and Teacher Quality. Perhaps most significantly, the Department has also established the federal What Works Clearinghouse (WWC; <http://www.w-w-c.org>). Scheduled for launch in Spring 2003, it will identify various educational topics and issues, identify related approaches and interventions, review studies making claims about the effectiveness of the identified approaches and interventions, and synthesize the research findings.

Through its development and use of standards to evaluate the rigor of research, the WWC will likely have both a direct and indirect impact on education and educational research. WWC standards will emphasize experimental and quasi-experimental designs that demonstrate causation and control for alternative explanations. Experimental designs will be the WWC’s “gold standard” for determining effectiveness. And, while the WWC is only a source of information and is not binding or otherwise connected to the SBR requirements of NCLB, it will likely be promoted and used as a key resource for educators seeking to meet SBR requirements. However, due to resource and other limitations, it will not be comprehensive in its holdings, at least not for several years. Hence, it cannot be a sole source of SBR information for educators.

Ultimately, federal policymakers believe that SBR requirements and related efforts will help drive the demand for, and conduct of, high-quality research that allows educators to better meet the learning needs of students. The SBR requirements expressed in NCLB, like all educational policies, are subject to change over time and across locations in the face of evolving forces. And, like all reform efforts, NCLB’s SBR “vision” will be tempered by a number of practical realities, including other NCLB requirements. As educators, and companies that serve them, engage in ongoing efforts to balance a myriad of perspectives, goals, needs, and requirements, SBR will not trump them but will simply add to the increasingly complex equation.

This document is devoted to providing information and strategies for drawing on SBR methodologies to demonstrate the research basis of products, verify the effectiveness of existing products, and improve the process for developing new products. It is our intent that this *Guide* provides sound and practical principles on which companies can make and justify related decisions.

*Mark Schneiderman*  
*Software & Information Industry Association*  
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# I. INTRODUCTION

For publishers and developers of instructional products and programs, the federal No Child Left Behind Act (NCLB), enacted in 2002, has complicated the business calculus. Given NCLB's focus on programs and services that are based in scientific research and that provide scientific evidence of effectiveness, publishers and developers can well expect changes in the environment in which educational enterprises, such as school districts, make purchase decisions. As never before, publishers and developers face critical business decisions about documenting the scientific basis for their products and building a scientific body of evidence in support of product and program effectiveness.

The purpose of this *Guide* is to provide publishers and developers with basic information and decision-making tools concerning scientifically based research. While some readers may choose to read it from cover to cover, doing so is not necessary. In fact, readers are encouraged to use the *Guide* as a resource or reference document, using the information that they need when they need it. Therefore, the body of the *Guide* is formatted to include text boxes of key, succinct information that is amplified throughout the body of the text. Detailed technical information, such as descriptions of various data analysis techniques, are separated from the text into a series of appendixes. Readers are encouraged to peruse the Table of Contents to identify the information most pertinent to their needs.

## KEY ASSUMPTIONS AND ISSUES

This *Guide* was written with publishers and developers in mind, and is designed to help inform decisions they are facing relative to scientifically based research (SBR). However, other audiences may also find the *Guide* useful, especially potential purchasers of educational software and other curriculum materials or aids. Throughout the *Guide*, issues are considered from two perspectives:

1. the educational research community and its established standards of research
2. the publisher/developer community and the business realities it faces

Based on the authors' interviews with representatives of the publisher/developer community, there seem to be at least four key issues:

1. **Under what circumstances and to what extent should publishers and developers invest time and money into conducting product effectiveness research?** The section of the *Guide* following this Introduction, "Investing in Product Effectiveness Research," provides practical guidelines for making these important business decisions.
2. **Once a decision is made to invest in product effectiveness research, what research approaches are particularly useful and appropriate for achieving specified research goals?** Much of the information contained in this *Guide* provides background information needed for sound decision making. Usually, research-related decisions will be made in collaboration or consultation with in-house or contracted research experts. The *Guide* also contains a planning tool that provides guidance relative to important decisions such as what kinds of research to conduct and when.
3. **Besides conducting product effectiveness research, what can be done to build a case for the scientific basis of products?** The *Guide* includes guidelines for crafting product research white papers and portfolios (see Appendix A). Also included are strategies for building the best case possible that product designs are supported by SBR, even when specific product effectiveness research has not yet been conducted.
4. **How can product design processes incorporate the findings from existing SBR so that the products are more likely to be effective with students?** Incorporation

of SBR principles from the outset can help publishers and developers create effective products and demonstrate product effectiveness. The *Guide* references product development facets of SBR throughout.

The intent of this *Guide* is to provide publishers and developers with sufficient information to address issues of SBR in ways that make sense for their particular circumstances, customers, or products. It should be clear that in many cases, there is no single best approach. That is because the “best” approach, while based in principles of best research practice, must also be relevant and tailored to specifically address the research question at hand. Hence, this *Guide* describes principles of best SBR practice as well as specific scenarios of how these principles may play out differently across purposes and situations.

### INVESTING IN PRODUCT EFFECTIVENESS RESEARCH

This *Guide* assumes that most publishers and developers are interested in demonstrating that their products are effective for a broad range of students across the country. In the post-NCLB education market climate, if time and money were no object, it would probably make sense for developers and publishers to invest in nationwide effectiveness research for all of their educational products. If one vendor could support product claims with SBR and another vendor could not, it is quite certain which vendor most education customers, especially those dependent upon federal funds, would choose.

In reality, many developers and publishers cannot afford to invest in broad-scale effectiveness research for every product. When such is the case, companies will need to prioritize their approach, focusing on products that are

- mission critical to the company’s business
- core and comprehensive to education
- designed to directly affect student achievement in core academic subjects, especially reading and math, since NCLB holds schools

accountable in reading and math, with science coming online in the 2007-2008 school year

- sold at the district, region, or state levels rather than to individual teachers or schools
- likely to be purchased with federal funds, particularly funds that place a premium on scientifically based research (e.g., Title I programs)
- competing against products for which SBR effectiveness studies have been completed or are underway

Related issues for consideration are put forward elsewhere in the *Guide*, including under both “Practical Considerations” and “Technical Considerations.” However, a lack of SBR research and findings in support of a specific product’s effectiveness does not relieve publishers and developers of the responsibility for providing the best available evidence in support of the theoretical and research-based principles upon which the product is based. At a minimum, companies should be prepared to initially

- complete a review of product-relevant SBR literature
- prepare a document (e.g., a white paper) that summarizes the results of the review of SBR literature and its relationship to the design of a particular product or suite of products. Details regarding the preparation of research white papers and portfolios are provided in Appendix A.

A note of caution is warranted. As is explained in detail in the following sections of the *Guide*, the decision to conduct product effectiveness research carries with it a commitment to rigorous scientific scrutiny. However, products that are well designed, accurately implemented, and carefully researched may, in fact, yield results that are not in the desired direction or of the desired magnitude. Hence, publishers and developers must be prepared that no matter the expense or rigor of the research, it cannot guarantee positive findings or an advantage in the marketplace. Therefore, research should also be designed to reveal evidence that can be used to improve the product.

For products still in the design and development phase, findings from existing SBR can have a significant impact on product quality. Strategies for building products on SBR are included in the “Practical Considerations” section of this *Guide*. There is also opportunity to hedge the investment on effectiveness research by designing it to also reveal information that can be used to improve existing products. Strategies for such research approaches are also included in the “Practical Considerations” section.

Once products have been selected for submission to effectiveness research, an appropriate approach to the research will need to be planned, usually in collaboration with staff researchers and/or contract research experts. Engaging in such planning requires an understanding of the meaning of *scientifically based research*, as the term is used by professional researchers and as it is described in NCLB. That is the focus of the following section.