EDUCATION RESEARCH: IS WHAT WE DON'T KNOW HURTING OUR CHILDREN?

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INTRODUCTION

Good afternoon Mr. Chairman and members of the Subcommittee. I am Dr. Reid Lyon, Chief of the Child Development and Behavior Branch of the National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health (NIH). I am pleased to have been asked to address your Subcommittee on the current state of educational research and the impact of recent developments in neuroscience, cognition, and developmental psychology on education, as well as the contributions of NICHD to the Interagency Education Research Initiative (IERI). The NICHD considers that teaching and learning in today's schools is not only a critical educational and social issue, but also is a significant public health issue. Research has shown that if children do not learn how use language to communicate ideas and perspectives, to read and write, to calculate and reason mathematically, and to solve problems, their opportunities for a fulfilling and rewarding life are seriously compromised. Specifically, in our NICHD longitudinal studies, we have learned that school failure has devastating consequences with respect to selfesteem, social development, and opportunities for advanced education and meaningful employment.

NICHD RESEARCH EFFORTS RELEVANT TO EDUCATION, TEACHING AND SCHOOL LEARNING

The NICHD has developed and supports a large research network consisting of 42 sites in North America, Europe, and Asia that are working in a concerted multidisciplinary fashion to identify:

(1) the critical environmental, experiential, cognitive, genetic, neurobiological, and instructional conditions that foster strong reading and writing development;
(2) the risk factors that predispose children to difficulties in learning to read and write; and
(3) the instructional approaches and procedures that foster optimal reading development, as well as practices and procedures for preventing and remediating reading and writing difficulties.

This research effort has been sustained over the past 34 years, since its inception in 1965, and has been designed to ensure: programmatic coherence and communication among scientists at all 42 sites, accumulation of converging evidence using multiple research methodologies to inform assessment and instructional efforts in an optimal fashion, testing of specific theories and assumptions that guide educational practices, and the translation of basic research findings to classroom settings and practices. Because many of the studies conducted by scientists in the NICHD Reading and Learning Disabilities Research Network have been devoted to understanding conditions critical to the normal development of oral language, reading, and

written language skills, 21,860 children with robust reading and writing skills have been studied, some for as long as 13 years. Likewise, significant programmatic effort has also been deployed to understand why many children have difficulties learning to read and write. To address this issue, 12,641 individuals with reading and writing difficulties and disorders have been studied, many also for as long as 13 years. Moreover, in 1985, the NICHD, building on the knowledge gained from studies addressing reading development and disorders, designed an initiative to develop and apply early identification methods to pinpoint those children during kindergarten and the first-grade who are at risk for reading failure. These studies have provided the foundation for several ongoing prevention, early dentification, and instructional studies under way at 12 sites in North America. Since 1985, 7,669 children (including 1,423 good readers) have participated in these reading instruction studies, and 3,600 youngsters are currently enrolled in longitudinal intervention studies in Texas, Washington, Georgia, Massachusetts, New York, Florida, Colorado, California, North Carolina, and Washington, D.C. These studies involve the participation of 1,012 classroom teachers, working in 266 schools and 985 classrooms. Mr. Chairman, I would be pleased to submit a more detailed summary of the NICHD Reading Research Program for inclusion in the hearing record.

This year, the NICHD designed and initiated a systematic research effort to identify the instructional conditions under which children whose first language is Spanish are most likely to succeed in developing English oral language, reading, and literacy skills. Similar to the studies conducted in the English language Reading Research Program, this initiative incorporates a multidisciplinary approach utilizing concepts and methodologies from neuroscience, cognitive and developmental psychology, educational psychology, and reading instruction. The Office of Education Research and Improvement (OERI) within the Department of Education is collaborating with the NICHD in this effort. In the past five years, the NICHD has also developed a similar initiative to identify critical cognitive, linguistic, neurobiological, experiential, and instructional factors and conditions critical to the development of mathematics calculation and mathematics reasoning skills. We anticipate that this initiative will utilize collaborations with both OERI and the National Science Foundation.

CONCEPTUAL AND METHODOLOGICAL CHARACTERISTICS OF THE NICHD RESEARCH PROGRAMS RELEVANT TO EDUCATION, TEACHING AND LEARNING

Extensive and Long-term Collaborations With the Scientific Community -- The research initiatives described above were developed and designed in close collaboration with scientists in education, psychology, linguistics, special education, pediatrics, neurology, genetics, neuroscience, reading and written language, mathematics, demographics/epidemiology, and quantitative and qualitative research methodologies. The purpose of these collaborations is to identify critical gaps in the scientific knowledge base concerned with (1) oral language, reading, writing, and mathematics development, (2) difficulties and disorders in acquiring these academic skills, (3) the development and application of efficacious instructional-teaching approaches, methods, and strategies, and (4) the development of research designs that enhance both basic and applied research in these complex educational areas. Scientists from the external research community meet on a formal basis with NICHD program scientists to determine what is known, what is not known, and how best to study critical educational targets to close the knowledge gaps. These collaborations typically result in the setting of a formal research agenda and the publication of a solicitation to stimulate the necessary research.

AN EMPHASIS ON PROGRAMMATIC, COORDINATED, AND SUSTAINED RESEARCH PROGRAMS

The NICHD employs programmatic mechanisms to develop multi-site, multidisciplinary, and multimethodology research networks that conduct research on a sustained, longitudinal basis. This particular emphasis has consistently resulted in the necessary replication of studies, the accumulation of converging evidence to inform practice and policies, the promotion of essential collaboration across sites, and the integration of critical information about development, learning, and instruction that are informed by multiple disciplines. For example, studies are now under way that incorporate educational, psychological, and neurobiological methods and concepts to determine which teaching approaches are most beneficial for children with reading difficulties and to further determine how brain physiology changes in response to instruction and improvements in reading behavior.

THEORETICALLY BASED AND HYPOTHESIS DRIVEN

NICHD supported research requires that the specific research questions, hypotheses and analytic methods be derived from a carefully considered set of ideas and supporting evidence. The research plan must be exquisitely designed and clear linkages must exist across theoretical elements, hypotheses, measures, and data analytic methods.

MEASUREMENT QUALITY

Standardized tests, laboratory tasks, observational measures, interview schedules, and other assessment/ observational procedures (e.g., dynamic assessments, case studies, ethnographic studies) must be selected for the proposed research on the basis of known reliability, validity, trustworthiness, and appropriateness to the sample(s) under study. Moreover, NICHD initiatives relevant to education also require the measurement of cognitive, linguistic, and academic growth over time to capture changes in development under a variety of conditions and across a variety of settings.

LONGITUDINAL PERSPECTIVE

A major goal of the NICHD research programs relevant to education is to provide long-term improvement in the development of critical cognitive and academic skills. In order to determine if different types of instructional approaches and strategies produce any perceived benefits, it is essential that children be studied over time. Longitudinal research has to be the cornerstone of any effort examining cause and effect and the long-term outcome of a range of influences on children's cognitive, behavioral, and academic abilities. Longitudinal designs have enabled us to determine the effects of different reading instructional strategies applied with children differing in cognitive, academic, and sociocultural characteristics, and to apply these findings to classroom practice and policy with confidence. Within the reading domain, longitudinal designs are providing us with the means to determine if different types of interventions that show a positive effect on reading development during preschool, kindergarten, and the primary grades are maintained over time. This is critical given that educational trends and policies, as well as teacher preparation course content, are frequently based upon research that measures the effects of a particular reading instructional strategy at only one point in a child's life and offers absolutely no information about the maintenance and generalizability of the effects of that strategy as youngsters develop and change instructional settings.

AN EMPHASIS ON CLEAR DEFINITIONS OF SAMPLES, METHODS, AND TREATMENT/INSTRUCTIONAL PROCEDURES

NICHD supported educational research must be conducted on samples of individuals who are clearly defined so that independent replication of the study can be accomplished. Specifically, all participants selected for study must be defined with respect to age, grade level (if applicable), gender, ethnicity, socioeconomic status, geographic region, previous and concurrent educational placements and programs, and cognitive, linguistic, and instructional characteristics. Likewise, instructional studies must include rigorous definitions of the exact instructional components, instructional procedures, and instructional settings to ensure that complete and independent replication is possible.

THE USE OF WELL-DEVELOPED AND OBJECTIVE PEER (EXPERT) REVIEW PROCEDURES

A hallmark of NIH and NICHD supported research is the emphasis that is placed on the objective and rigorous review and assessment of the quality of the science that is proposed. This same care and quality of review is applied to the NICHD programs of research that are relevant to education. The review process is critical to the development and improvement of research initiatives, and serves these functions by providing extensive feedback to investigators via written critiques that serve to hone and elevate the quality of the science.

CONSISTENT AND REGULAR REFLECTION ON WHAT HAS BEEN LEARNED AND WHAT NEW RESEARCH NEEDS TO BE CONDUCTED

The NICHD program planning process provides a consistent opportunity to evaluate the products derived from ongoing research and to rapidly adapt to scientific opportunities uncovered by the research in progress. In addition, the NICHD research programs relevant to education require that investigators from each of the sites in the research networks meet at least once a year, and frequently several times a year, to evaluate progress, identify common methodological and measurement issues that require modification, and identify critical new areas of research.

SELECTED FINDINGS DERIVED FROM NICHD RESEARCH RELEVANT TO EDUCATION AND THEIR IMPACT ON PRACTICE AND POLICIES

Major advances in our knowledge about reading development, reading difficulties, and reading instruction have been derived from the NICHD supported research initiatives described earlier. Specifically, over the past 34 years a great deal of converging evidence has improved our understanding of how children learn to read, what factors impede reading development, and which instructional approaches are most beneficial at different stages of reading development. We have learned that the development of skilled reading abilities requires the integration of phonological skills, phonics skills, the development of accurate and fluent textual reading capabilities, and the development and application of reading comprehension strategies. We have learned that early language and literacy experiences from birth onward are extremely important in fostering these specific foundational skills. We have developed inexpensive screening and assessment methods to identify children in kindergarten and first grade who are at-risk for reading failure. This is a significant development given that we have also learned that children after the age of nine have an extremely difficult time improving their reading abilities. We have learned that girls are as likely as boys to have difficulties learning to read, but are frequently overlooked in the assessment process and are not likely to receive appropriate specialized instruction. We have learned that some instructional approaches, methods, and philosophies are clearly not appropriate for certain children, but continue to be employed in classrooms due to a lack of adequate teacher preparation in colleges of education. We have also learned that instructional approaches that are designed on the basis of the converging research findings work remarkably

well with children who have had difficulties learning to read as long as well trained teachers provide the instruction early enough in the youngsters school tenure.

These research findings have now had some influence on instructional reading practices as well as on Federal and State educational policies and initiatives. The NICHD reading research was relied upon heavily in the development of the Reading Excellence Act and in state educational initiatives in California, Texas, Nebraska, and several other states. However, we have learned that it is extremely difficult to utilize research findings to inform practices in school settings and classrooms. This appears to be due to many factors, including inadequate teacher preparation, the tendency for educational practices and policies to be guided by philosophical and ideological factors rather than scientific factors, and the persistent poor quality of much of the educational research conducted to date. We have found that many teachers and administrators who could benefit from converging research evidence do not yet trust the idea that educational research can inform their teaching. When asked why, they typically report that the research lacks authority, is frequently of poor quality, is not easily accessible, is not practical, and is usually communicated in an incomprehensible manner. Further, many teachers and administrators report that educational research is frequently used to tout a particular instructional magic bullet, which typically fails to accomplish what was expected and then is replaced by the next innovation. Analysis of these magic bullets almost always reveals that they are based upon assumptions that have either never been adequately tested or have been assessed using weak research methodology.

THE STATE OF EDUCATIONAL RESEARCH

In 1997, Congress requested that the Director of the NICHD, in consultation with the Secretary of the Department of Education, convene a National Reading Panel (NRP) to determine from existing research the most effective approaches for teaching children to read. While the work of this Panel is still ongoing, their initial efforts have indicated that educational research is in need of improvement. This conclusion has been reached by many others, but the initial NRP findings are instructive. The NRP has organized its activities to ensure a rigorous and objective evaluation of the quality of research efforts that have been undertaken to inform the reading community about the best approaches for teaching the reading skills of decoding, word recognition, reading fluency, and reading comprehension. The NRP is also evaluating the extant research relevant to teacher preparation and the use of technology to teach reading. The Panel developed a research evaluation methodology and a set of criteria to assess individual studies with respect to (1) whether the study participants are carefully described; (2) whether the instructional methods/ procedures are described in sufficient detail to permit independent replication; (3) whether the fidelity of the instruction being delivered was assessed; (4) whether there was a full description of outcome measures; and (5) whether there was an appropriate control or contrast group included in the study. The initial data indicate that the majority of existing studies reported in the educational literature could not be used in a meta-analysis because of a lack of sufficient information or design flaws. The lack of rigor in traditional educational research is of course due to many complex factors. There appears to be a growing consensus that research carried out within the educational academic community should take place within a more rigorous context, be based on well developed scientific principles, should encourage the integration of multiple disciplines and methodologies, and incorporate an expert peer review system to assess the scientific quality of proposed research. Moreover, for educational research to realize its full potential, a sustained programmatic emphasis must be established to ensure continuity, the analysis of children's learning and response to different forms of instruction over time and across settings, and to provide opportunities for replication. In addition, research training opportunities must be developed and improved in order to equip both researchers in training and education faculty

members with a solid foundation in the inquiry skills that are necessary to address well defined gaps in the current knowledge base relevant to teaching and learning.

THE INTERAGENCY EDUCATION RESEARCH INITIATIVE

The goal of the Interagency Education Research Initiative (IERI) is to develop interdisciplinary knowledge and research methods that allow for the implementation and evaluation of large-scale educational interventions, the results of which will inform both educational policy and practice. Of critical interest is the validation of instructional procedures and approaches to enhance reading, mathematics, and science knowledge, and the application of validated approaches on a scale that reflects the complexity of classroom and school system settings and interactions. Within this context, the NICHD has worked closely with the NSF and the OERI to develop the initial solicitation and peer review procedures, and is continuing to work closely with these agencies to prepare a second solicitation for applications. We are confident that initiatives such as the IERI can help to improve the quality of education research by requiring outstanding scientific merit, innovation, and proposed ideas and methods that are capable of testing the applicability of concepts and principles derived from small-scale and highly controlled studies to actual classroom and school system settings. This goal can only be realized through the development of a focused programmatic and sustainable research initiative that is based on the highest scientific standards and the most rigorous peer review process. Moreover, this initiative must continually be refined and improved to ensure that the research that is supported is clearly of a different scope and magnitude than research currently funded by NICHD, OERI, and NSF.

SUMMARY AND CONCLUSIONS

It must be concluded that too little education research conducted over the past century has been based on scientific principles that have proven successful in expanding our knowledge in other arenas critical to child health and development. Indeed, much of the educational research conducted over the past 20 years has been predicated on the notion that scientific findings are relative--in the eyes of the beholder--and that science is not the process of discovering the ultimate truth of nature, but rather a social construction that changes over time. These types of anti-scientific ideologies and philosophical positions have been expressed within a culture of post-modern thinking where a major premise is that there is no genuine scientific method, but rather a sense that anything and everything goes. This is unfortunate. The scientific process has proven itself in every scientific discipline including physics, biology, chemistry, psychology, neuroscience, medicine, and even reading development, reading disorders, and reading instruction. Educational research is at a crossroads. The educational academic community can choose to be part of the modern scientific community or it can isolate itself and its methods from mainstream scientific thought and progress. The scientific method has been adapted to study and understand the most complex of physical, biological, social, and behavioral systems and interactions. Surely, the teaching and learning process deserves no less. In order to develop the most effective instructional approaches and interventions, we must clearly define what works, the conditions under which it works, and what may not be helpful. This requires a thoughtful integration of experimental, quasi-experimental and qualitative/descriptive methodologies.

Education research can be strengthened by beginning to define an exact set of conditions--variables that can be quantified and manipulated--and determine what happens in the presence and absence of theseconditions. These observations, no doubt, must be enriched with qualitative insights that add ecological context to the quantitative scaffold. Education research must be open to taking the next step of formulating specific hypotheses that can be tested and confirmed or refuted. By careful experimentation, we now understand and can treat complex conditions that

reflect a confluence of biology and environment. If educational research is to participate in, and contribute to the scientific community and the lives of our children, leaders within the academic educational establishment must be willing to show the next generation of educational researchers the way. I am confident it can be done, and hopeful that it will occur in the near future. I would be pleased to respond to any questions you may have.