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Global Approaches to Early Learning Research and Practice: Integrative Commentary

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Abstract

This commentary presents highlights from the seven articles in this volume, along with a synthesis of take-home points that can be used to inform policy and practice. Across each article there is a story of both successes and the challenges of ongoing work that seeks to enhance children's development in diverse and challenging environments across the globe. Although the topics covered in this volume range from development of early self-regulation and executive function to the use of technology to aid literacy acquisition in remote areas, each points to the need for systems-level coordination and sustained commitment to reach children at risk. © *2017 Wiley Periodicals, Inc.*

Early childhood experience has sustained impact on every aspect of growth and development, and there is great need to understand both the impediments to growing up healthy and the protective factors. Across the globe, there is vast diversity in the early experiences of children. These diverse experiences, including the nature and number of languages spoken in the home, the parenting styles of caregivers, and early schooling experiences interact in complex ways that can be understood only through careful observation and experimentation. Although substantial progress has been made in improving children's health and learning outcomes over the past 3 decades, there is still a need for further understanding and improvement, both in terms of implementation science and basic science. The papers in this volume illustrate (a) the successes and challenges of ongoing work, (b) how the usage of technology as a delivery system may offer a way to effectively intervene in hard-to-reach areas, and (c) areas of opportunity and need in terms of basic research.

Successes and Challenges of Ongoing Work

Currently worldwide there are many programs being implemented in a number of countries; in this issue, articles by Young and by Gove et al. describe several of these programs in diverse countries and some of the challenges of this work. Young begins by identifying a critical factor in global early learning—the importance of *investing* in early child development (ECD), which must begin at birth and focus not only on the child but also on the mother and family. Such investments must be sustained; short infusions of time, energy, or funds cannot bring about lasting change. Young highlights a World Bank report that concludes that inequality is the key obstacle to ending poverty, and notes that the World Health Organization puts forth healthy early development as a powerful way to end this inequality. All of this is strongly supported by scientific evidence from interventions (e.g., the Carolina Abecedarian project; Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002) that demonstrate that the only way to substantially improve outcomes for children is to take a systemic approach; that is, education, health, nutrition, income, equality, etc. cannot be considered independently. Young specifically recommends (a) developing a common language for discussing EDC; (b) improving global understanding of the biological and behavioral outcomes of ECD; (c) adopting an accepted metric of children's development and outcomes; (d) identifying high-quality practitioners and caregivers; (e) expanding existing ECD programs, especially in the developing world; and (f) supporting translational research on risk factors and intervention outcomes, to provide a knowledge basis for prevention and intervention policies.

Gove and colleagues describe the specific challenges associated with implementation of programs in Africa (teacher training, access to materials) as well as successful approaches (attention to dosage, use of feedback to

modify instruction), and include country case studies. Findings are mixed, with less success in Ethiopia, Malawi, and Tanzania, but more success in Kenya, Liberia, and Uganda. In Ethiopia, despite massive efforts over 5 years to provide new materials and teacher training, the majority (70%) of students in grades 2 and 3 failed the reading comprehension assessment. Further observations revealed that the instructors may have been resistant to changes in practice, and new plans for increased monitoring and evaluation of students and teachers have been put in place. In Malawi, initial efforts to expand free education met with limited success: although enrollment more than doubled, lack of support for teachers and schools to handle this increase ultimately resulted in very poor student performance (72% of grade 2 students could not read a single word of a basic story). As in Malawi, Tanzanian students have failed to show expected improvement in learning and literacy despite large-scale efforts that have increased student enrollment in primary school. Findings from Kenya, however, are more promising; after implementation of large-scale changes to teaching methods, tools, and technologies, including some focused on ECD (preschool), longitudinal study findings revealed increased learning and literacy rates for both English and Kiswahili. In Liberia, gains were made by one cohort after 2 years, but not another, which could be attributed to the Ebola outbreak, combined with the short duration (2 years) of the intervention. In Uganda, where policy has shifted from enhancing enrollment to improving quality, along with external program funding for literacy, which supported the development of orthographies for local languages and preservice teacher curriculum, improvements have been notable (e.g., grade 3 students were 1.5 to 9 times more likely to be reading 40 or more words per minute compared to control learners).

In summary, despite the diverse sociolinguistic climates across countries and contexts, some clear conclusions can be made. Systemic approaches that support teachers, students, schools and communities are the most successful. Further, consideration of the language spoken by students is key for early reading instruction; these studies suggest that reading instruction is more successful when conducted in a language that the majority of students in a classroom speak and understand, even if this involves the creation of new texts. A focus on quality of training and materials rather than simply increasing enrollment is also essential, and programs need sustained financial and social commitment to produce strong and lasting impacts.

Technology as a Tool

Gottwald et al. provide important context for how to reach those in most desperate need of the basic skill that unlocks the ability to learn: being able to read. She and her team have tackled the onerous task of reaching those who have little access to the modern world. Through their electronic

tablet program they attempt to create a "supply chain" for teaching literacy skills. Specifically, Gottwald and colleagues have used mobile devices and internet resources through Curious Learning (CL) to facilitate self-directed literacy education for children in remote or unsafe areas that limit travel outside the home. Although the prevailing view among both governments and nongovernmental organizations is that school-based learning is the only method for improving literacy education, research shows that as many as 50% of children in low-income nations who have spent at least 4 years in school cannot read a single word (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2014). Although high-quality school-based learning may indeed be the best approach, high absenteeism because of illness, family needs at home, and conflict keep many children from regular attendance. The CL platform (Wolf, Gottwald, Galyean, & Morris, 2013) provides a compilation of language and literacy development apps based on principles derived from evidence-based reading instruction and intervention programs (e.g., Lovett et al., 2017). CL can be used on many mobile devices (though initial piloting has been done on an Android tablet), it works without an internet connection and is available for <$70 USD. Thus far the tablets have been used in remote communities of Ethiopia, underresourced schools in South Africa, in rural U.S. and Ugandan preschools, and in after-school programs in India. Initial findings are promising—in the United States, findings show significant correlations between time spent using the apps and number of letters named by preschool studies. In South Africa, children attending schools with tablets scored higher on letter naming and decoding than children in schools without the tablets, and in Ethiopia >50% of children using the tablets could read 50% of a random selection of English words. Future directions will expand beyond the dedicated Android apps to make the technology more widely available (e.g., on personal smart phones) and content development will expand to additional languages. Thus, Gottwald et al. offer a potential solution for the mechanisms of delivery of high-quality literacy instruction.

Basic Research

Four articles describe basic research needs, outline work that ranges from brain development to intervention, and then with more granularity, the impacts of orthography on developing interventions. Haft and Hoeft as well as Pakulak et al. offer insights as to the toll of poverty on the developing brain and how implementing interventions can alter the impact of economic vulnerability. Haft and Hoeft consider the role of poverty on children's learning through its worldwide impact on executive functions (EFs), a collection of goal-oriented skills (e.g., working memory, cognitive flexibility, inhibitory control, and planning) critical for cognitive, emotional, and social development. Unfortunately, these skills are most at risk for children living in poverty (e.g., Raver, Blair, & Willoughby, 2013), which threatens health

development across domains. Research into the neurobiological basis of these effects links elevated levels of cortisol (caused by stress) to impaired neural regulation, particularly in the prefrontal cortex. Children in poverty may also be predisposed to the impacts of chronic stress through epigenetic mechanisms (e.g., maternal stress impacts genetic regulatory factors in the fetus). Haft and Hoeft review factors that can mediate these effects and are thus potential targets for intervention. Parental responsiveness and guided learning are positive mediating factors; however, in contexts where parents are more constrained (e.g., the developing world), the impact of parenting style may be reduced. A stimulating environment, such as those that include books and educational technology, which of course are harder to come by in the developing world, can also promote EF resilience (cf. Obradović, Yousafzai, Finch, & Rasheed, 2016). In addition to modifications to the cognitive environment, research shows a direct relationship between malnourishment and EF (Rockers et al., 2016), implicating another straight-forward opportunity for intervention.

Ongoing research is actively exploring ways to track neurobiological correlates of EF that would complement behavioral methodologies. Structural and functional magnetic resonance imaging measures have been successfully used, though these can be difficult to obtain in the developing world. Moreover, encephalography has been used successfully, e.g., increased gamma power seems to be a reliable measure of EF in both the developed and developing world (Brito, Fifer, Myers, Elliott, & Noble, 2016; Tarullo et al., 2017). These methods not only complement behavioral measures by providing brain–behavior links but also can be used with very young children, in whom behavior may be difficult to assess, and those suffering from developmental disabilities which limit communicative function and also put them at further risk.

Pakulak and colleagues discuss cultural adaptation of a two-generation intervention informed by neuroplasticity and designed to enhance attention and self-regulation in at-risk children through parent–child interaction. Using the cultural adaptation process (CAP) model (Domenech Rodriguez & Wieling, 2004) the intervention was first designed for use with Latino families in Oregon and then adapted for use in an international community in Colombia. Prior to implementing the intervention in Colombia, modification to accommodate cultural and environmental differences including language, varying caregiver roles and parenting practices, and a more urban setting was needed. One noted adaptation involved the use of metaphors to help convey the utility and acceptability of making changes to parenting practices that may differ from cultural norms. Although outcome findings are currently being analyzed, both the Oregon and Colombia interventions have received positive feedback from family participants.

Picking up the theme of the importance of language of instruction raised by Young and Gove et al., the articles by Joshi et al. and Tseng et al. draw our attention to the importance of considering the psycholinguistic

and neurobiological properties of individual languages, particularly in terms of teaching bi- or trilingual literacy. Joshi and colleagues focus specifically on literacy acquisition in India; after an introduction to akshara (the basic unit of writing in the Indic writing system), they present preliminary findings on akshara instruction and assessment. India contains the largest number of illiterate individuals (∼300 million; UNESCO, 2015), and within rural schools with active reading instruction the average reading level across all grades is second grade. With over 1.2 billion people, India is socially, economically, and linguistically diverse, which presents substantial challenges to the provision of uniform high-quality reading education. All school-going children must learn to read and write three languages, two of which must be Hindi and English. Substantial differences in the orthographies that support these languages add further challenges. For example, in the Indic writing system, the akshara orthography is highly transparent but quite complex (many syllabographs and visual-spatial complexity of the orthography). Indeed, neuroimaging studies have shown that reading ashkara requires coordinated activation of a large set of brain regions that may prolong the acquisition of reading expertise (i.e., Rao & Singh, 2015). Interestingly, although studies that have examined phonics-based instruction techniques for English and Kannada (one of the 22 languages spoken in South India) have shown that knowledge of letter–sound correspondences in a first language assists in learning a second, this approach has not been widely adopted. The scope of the problem of literacy instruction in India can be more readily recognized when one considers that a child needs to learn three languages all of which have distinct orthographies and that instruction is not always approached in ways that are most optimal (phonics).

Tseng and colleagues turn our attention to the biological underpinnings of reading and reading disability from a broader cross-language perspective. Neurobiological studies have revealed a broad but largely left lateralized network that is characteristically under activated or noisy in poor readers, and studies with prereaders who go on to have reading difficulties show anomalies in these same regions before instruction begins (e.g., Hancock, Pugh, & Hoeft, 2017; Pugh et al. 2001; Raschle, Zuk, & Gaab, 2012). Tseng and colleagues note that early studies of the "cross-language" neural systems for reading have typically considered single languages in isolation, which may have resulted in the identification of spurious differences across languages given confounding factors (e.g., task demands). However, more recent work, either through direct comparison of multiple languages in the same study, or use of activation likelihood estimation (ALE) meta-analysis, reveals a largely common circuitry for many languages regardless of factors such as orthographic depth (e.g., Rueckl et al. 2015; Zhao, Fan, Liu, Wang, & Yang, 2017). These findings have important implications for instruction and intervention; broadly speaking, evidence-based approaches for one language should transfer to others with appropriate modifications. However, as Tseng et al. astutely note, this activation of overlapping regions

during reading does not necessarily imply that identical computations are used to read in each language. These initial studies have laid the foundation for a universal network for reading, but follow-up work will need to consider the time course of activation and the nature of the interactions among regions during reading to pinpoint potentially important differences that underlie the psycholinguistic uniqueness of each language.

Across both the brain research reviewed by Haft and Hoeft, Pakulak et al.'s and Joshi et al.'s intervention studies and the call for consideration of orthographic differences (Joshi et al. and Tseng et al.), linguistic and culturally sensitive metrics emerge again as important variables to consider. Haft and Hoeft propose that enhanced tracking and analyses (e.g., mediation analyses) would help solve chicken–egg dilemmas associated with correlational designs that are, at present, the foundation of our knowledge base on the impacts of poverty. Such findings would contribute some basic but important research on understanding the developing brain in the context of the developing world. Pakulak and colleagues' research findings offer a much more granular level of intervention than described by Gove et al. and highlight all of the intricacies that need to be considered in implementing interventions. Finally, Joshi et al. and Tseng et al. highlight the importance of considering the specific psycholinguistic and neurobiological properties of individual languages and orthographies, particularly in bilingual literacy acquisition environments. In fact, Joshi and colleagues cite the need for systematic investigation of instruction in other languages (in their case, akshara instruction), and greater teacher training in language and literacy and in bi- and trilingual education. Although there is much research to be done, these articles collectively offer some important "next directions" in better understanding the impact of poverty on brain development and the development of interventions that consider both cultural and linguistic contexts. Those able to synthesize the multiple suggestions of these authors may be those who can forge progress in improving early childhood development *and* learning!

Concluding Thoughts

Together, the articles in this issue paint a picture of the opportunities and challenges in attaining optimal learning environments in the developing world. At the most basic level, we need a better understanding of cross-linguistic mechanisms, impacts of poverty on the brain and how to mitigate these impacts, and focal studies that develop high-quality interventions and determine best teaching approaches in various languages. However, even if we understand all these basic research components, we still have the substantial practical difficulty of how to deliver information, implement programs, and scale up programs to the level that is needed in many developing countries. Simply understanding the best ways to move this information is a needed research project in and of itself. Here is where we propose

that organizations focusing on service delivery can benefit from examining how other systems (e.g., business, health) build supply chains to produce or move products and deliver and administer medical supplies (e.g., vaccines). In the case of literacy and education, the "products" are professional education and intervention approaches in literacy or early childhood programs. Strategic partnerships with socially responsible businesses could be an opportunity in this case, and of course the use of technology may be one important piece (Gottwald et al., this issue). Additionally, coordination between various entities needs to be a priority in order for agencies to implement research-based programs. For example, the U.S. Agency for International Development (USAID) has an enormous reading implementation program, but rarely are researchers involved. Leveraging what they are doing and then studying it (i.e., studying logistics to determine better delivery systems) would be an optimal direction and would make optimal use of the money that USAID puts into programs to facilitate more rapid progress. One step could be to arrange a summit between governmental agencies—the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, Institute of Education Sciences, USAID, and UNESCO. Finally, policy changes are needed in order to fully capitalize on what we know, and what we will be learning, about early childhood health and development and learning. For example, Young provides specific recommendations to facilitate such change, including adoption of common terminology and metrics and better approaches to data aggregation and long-term tracking.

In order to achieve these policy changes, we will need some of the challenges described here to be very seriously considered. For example, establishing better coordination between agencies and supply chains (logistics) will enable policy changes to have optimal impact. And, of course, the more we know about proven interventions and the impacts of poverty on the brain, the more finely tuned approaches can be implemented. In summary, we know a lot, but we need to know more; but, as Young sagely reminds, even with more data, we must consistently make tough political and social choices to take greater action (Doryan, Gautam, & Foege, 2002).

References

Brito, N. H., Fifer, W. P., Myers, M. M., Elliott, A. J., & Noble, K. G. (2016). Associations among family socioeconomic status, EEG power at birth, and cognitive skills during infancy. *Developmental Cognitive Neuroscience*, *19*, 144–151.

Campbell, F. A., Ramey, C. T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian Project. *Applied Developmental Science*, *6*(1), 42–57.

Domenech Rodriguez, M. M., & Wieling, E. (2004). Developing culturally appropriate, evidence-based treatments for interventions with ethnic minority populations. In M. Rastogi & E. Wieling (Eds.), *Voices of color: First-person accounts of ethnic minority therapists* (pp. 313–331). Thousand Oaks, CA: Sage.

Doryan, E. A., Gautam, K. L., & Foege, W. H. (2002). The political challenge: Commitment and cooperation. In M. E. Young (Ed.), *From early child development to human development* (pp. 375–391). Washington, DC: World Bank.

Hancock, R., Pugh, K. R., & Hoeft, F. (2017). Neural noise hypothesis of developmental dyslexia. *Trends in Cognitive Sciences*, *21*, 434–448.

Lovett, M. W., Frijters, J. C., Wolf, M., Steinbach, K. A., Sevcik, R. A., & Morris, R. D. (2017). Early intervention for children at risk for reading disabilities: The impact of grade at intervention and individual differences on intervention outcomes. *Journal of Educational Psychology*. Advance online publication. https://doi.org/10.1037/edu0000181

Obradović, J., Yousafzai, A. K., Finch, J. E., & Rasheed, M. A. (2016). Maternal scaffolding and home stimulation: Key mediators of early intervention effects on children's cognitive development. *Developmental Psychology*, *52*(9), 1409–1421.

Pugh, K. R., Mencl, W. E., Jenner, A. R., Katz, L., Frost, S. J., Lee, J. R., … Shaywitz, B. A. (2001). Neurobiological studies of reading and reading disability. *Journal of Communication Disorders*, *34*(6), 479–492.

Rao, C., & Singh, N. C. (2015). Visuospatial complexity modulates reading in the brain. *Brain and Language*, *141*, 50–61.

Raschle, N. M., Zuk, J., & Gaab, N. (2012). Functional characteristics of developmental dyslexia in left-hemispheric posterior brain regions predate reading onset. *Proceedings of the National Academy of Sciences*, *109*(6), 2156–2161.

Raver, C. C., Blair, C., & Willoughby, M. (2013). Poverty as a predictor of 4-year-olds' executive function: New perspectives on models of differential susceptibility. *Developmental Psychology*, *49*(2), 292–304.

Rockers, P. C., Fink, G., Zanolini, A., Banda, B., Biemba, G., Sullivan, C., … Hamer, D. H. (2016). Impact of a community-based package of interventions on child development in Zambia: A cluster-randomised controlled trial. *BMJ Global Health*, *1*(3), e000104.

Rueckl, J. G., Paz-Alonso, P. M., Molfese, P. J., Kuo, W. J., Bick, A., Frost, S. J., … Lee, J. R. (2015). Universal brain signature of proficient reading: Evidence from four contrasting languages. *Proceedings of the National Academy of Sciences*, *112*(50), 15510–15515.

Tarullo, A. R., Obradović, J., Keehn, B., Rasheed, M. A., Siyal, S., Nelson, C. A., & Yousafzai, A. K. (2017). Gamma power in rural Pakistani children: Links to executive function and verbal ability. *Developmental Cognitive Neuroscience*, *26*, 1–8.

United Nations Educational, Scientific and Cultural Organization. (2014). *Global Monitoring Report: Teaching and learning: Achieving quality for all*. Paris: Author. Retrieved from http://unesdoc.unesco.org/images/0022/002256/225660e.pdf

United Nations Educational, Scientific and Cultural Organization. (2015). *Global Monitoring Report: Achievements and challenges*. Paris: Author. Retrieved from http://unesdoc.unesco.org/images/0023/002322/232205e.pdf

Wolf, M., Gottwald, S., Galyean, T., & Morris, R. (2013). Global literacy and socially excluded peoples. In *Proceedings from the Socially Excluded Peoples Meeting, Pontifical Academy of Social Sciences*. Vatican City.

Zhao, R., Fan, R., Liu, M., Wang, X., & Yang, J. (2017). Rethinking the function of brain regions for reading Chinese characters in a meta-analysis of fMRI studies. *Journal of Neurolinguistics*, *44*, 120–133.

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