A holistic (or “whole child”) educational approach has been defined as attending to the cognitive, social, emotional, physical, and talent development of children and youth from diverse backgrounds (ASCD, 2012). A holistic education framework embodies relational and bioecological principles of child development. Despite the promise of holistic education for improving educational outcomes and reducing disparities, a recent ten-country study suggests that there is a substantial gap between what is known about the benefits of holistic education and its consistent and effective implementation in schools. Fortunately, innovations in the science of learning and development can build our understanding of which holistic educational approaches are most effective for children of different ages and backgrounds, and innovations in implementation science can tell us how to make these approaches work in classrooms.

Children Develop Holistically, Within an Ecological Context

Children and youth develop and experience the world through cultural and linguistic lenses as well as through the webs of relationships and contexts in which they participate. Their individual attributes, which interact dynamically, include their genetic make-up; neurobiology; social, emotional, cognitive, physical, and ethical characteristics and competencies; temperament and personality; attitudes, values and mindsets; cultural and linguistic background; accumulated experience and knowledge; and how they perceive and make sense of world (Cantor, Osher, Berg, Steyer, & Rose, 2018). Although these factors interact to influence child and youth development, so do the qualities of the social and physical environments that children and youth experience, particularly those that they experience repeatedly over time, such as their family, their school, and the other organizational settings in which they participate regularly. These settings can be characterized by the extent to which they provide developmentally appropriate and culturally responsive conditions and opportunities for learning and development (Osher, Kendziora, Spier, & Garibaldi, 2014). These kinds of conditions are characterized by a positive social and emotional climate; sensitivity to trauma; emotional, intellectual, and physical safety; social, emotional, and cognitive support; challenge and engagement; meaningful learning opportunities; and interactions with adults and peers who are socially and emotionally competent and intellectually engaged (Osher, Kidron, DeCandia, Kendziora, & Weissberg, 2016). Opportunities provided by these settings include chances to develop healthy relationships with adults and peers; creativity, self-expression; social, emotional, and cognitive competencies; engagement, recognition, and leadership roles (Osher & Berg, 2018; Osher, Cantor, Berg, Steyer, & Rose, 2018).
Although many schools focus on cognitive development as if it were the only target of interest, such an approach is problematic for three reasons. First, there is an inextricable relationship between social, emotional, cognitive, and physical development; growth in one area is best facilitated by growth in all three (Cantor et al., 2018; Jones, Barnes, Bailey, & Doolittle, 2017; Osher, Kidron, Brackett, et al., 2016). Second, both context in general and the social and emotional conditions for learning mediate and moderate learning outcomes (Cantor et al., 2018; Osher et al., 2018). Third, schools do more than produce learners and workers; they also develop future parents and citizens. Although a focus on learning is important, learning is more than cognitive development and academic performance, and a whole child approach maximizes learning. This is particularly important for children who struggle with the impacts of adversity or who come from a background that lacks warmth, compassion, and strong, supportive relationships. For example, schools and early childhood educational settings can heighten human development and buffer the effects of poverty-related stress and other adversity on development through positive relationships and by direct targeting of self-regulation, executive function, and social and behavioral skills (Jones & Bouffard, 2012; Osher et al., 2018).

A whole child development framework promotes all dimensions of development from early childhood to young adulthood, including physical, social, emotional, cognitive, spiritual, and values-based learning. At their best, whole child settings integrate these components while supporting engagement, creativity, and the development of intrapersonal and interpersonal skills and related attitudes.

### Holistic Education is Underrealized in Formal Education Systems

Education systems are largely unprepared to provide holistic education at scale. A recent study (Spier et al., 2017) mapped the extent to which formal education systems valued and provided education that supported the whole child (or at least some aspects beyond simply academic learning) in Western Europe (Belgium, France, Germany, Ireland, the Netherlands, Portugal, Spain, and the United Kingdom) and in North America (the United States and Ontario, Canada). The study found that holistic education is both highly valued and consistently provided in the pre-primary grades (kindergarten). However, as children enter primary school, most education systems rapidly narrow their focus to academic instruction that does not explicitly or intentionally address social, emotional, physical, expressive, and, in many cases, ethical needs. Non-cognitive aspects of children’s development—social, physical, artistic, and so on—are increasingly seen as distinct from academic learning and not essential to core educational (i.e., academic) content. When these aspects of holistic development are addressed, it is often through a “menu” approach rather than an integrated, holistic approach, supporting only some areas of children’s development, for some children, and at some ages. For example, in most of the countries in the study, arts education was universally provided to children in primary grades but tended to vanish from the curriculum once children entered secondary school—especially for those not on a “university track.” Supports for physical development, social and emotional learning, and play-based learning and creative thinking faced a similar fate. Yet, adolescence is an extremely important period of development. In fact, adolescent brains show greater malleability of non-cognitive skills than of cognitive skills (Kautz, Heckman, Diris, ter Weel, & Borghans, 2008).

When educators feel strong pressure to boost academic achievement, other aspects of holistic education are not prioritized. Change toward addressing these aspects of learning can be costly, takes time, and involves a certain degree of uncertainty. Educators and policy makers are unlikely to make substantial changes in how classrooms and schools operate without a clear understanding of both why and how to do so. We know that within formal education systems, it is possible to provide holistic education to all children because that is what we do already at the pre-primary level. We now need to better understand how to make effective holistic education a reality from early childhood to young adulthood.
We Need to Know More About What Works to Support Holistic Development

Empirical evidence lends support for a holistic view of child development. There is an existing body of evidence for what works to support social and emotional learning, and some other aspects of children’s holistic development. Yet, as is the case with much intervention research, there is a lack of ecologically valid empirical evidence for what works, in what contexts, with which children, and with what effects. This issue may not stop the scaling of holistic education in general but may compromise the scaling of the right supports in effective ways.

For example, studies conducted in France, Canada, and the United States have shown that musical training improves preschool children’s cognitive skills in areas related to literacy (Anvari, Trainor, Woodside, & Levy, 2002; Chobert, François, Velay, & Besson, 2014; François, Chobert, Besson, & Schönb, 2013; Moreno, Friesen, & Bialystok, 2011). A recent study of children attending Head Start preschools in the United States found that participation in arts activities (music, dance, and visual arts) over several months significantly reduced children’s levels of a stress hormone (cortisol), relative to children who spent the time in typical homeroom activities (Brown, Garnett, Anderson, & Laurenceau, 2017). There is also evidence from Germany that music lessons improve preschool children’s stress regulation (Kranefeld, 2015). We are left with a strong suggestion that the arts, or at least some aspects of the arts, may be beneficial for children’s development and psychosocial well-being. Most of this evidence comes from preschools, and we also know that in formal education systems, the availability of arts programming is typically at its highest for younger children (Spier et al., 2017). Would older children also receive these same benefits from arts programming? Do children receive benefits from the arts if they are integrated into other learning activities, or only if they receive direct instruction in the arts? Without this information, it would be difficult to know how best to develop beneficial educational programming that integrates the arts in ways that are beneficial to children of a specific age and in a specific context. There are similar questions around other kinds of holistic educational supports—questions that we can increasingly answer using innovations in neurobiological sciences.

New and Innovative Research Tools Can Help Us Learn More

Although the science of learning and development demonstrates how tightly interrelated a child’s developmental processes are and how they jointly produce the outcomes for which educators are responsible (Darling-Hammond, Cook-Harvey, Flook, Barron, & Osher, under review), many linkages of this “constructive web” (Fischer & Bidell, 2006) have not been fully explored, demonstrated, or translated into actionable strategies or results. We need information about how different children’s skills develop across different situations and time. Teachers are still unclear exactly what works, and how they can implement it, particularly in a context with pressure on producing students with high academic learning outcomes, along pre-decided lines, and in a limited time.

In recent years, the integration of the fields of education and social neuroscience have produced promising insights to bridge the gap between academic knowledge and student learning on the one hand and effective teaching for whole child development on the other. The next sections look at neurological findings that have shown preliminary yet promising results for holistic education, and issues that have surrounded the implementation of these findings.

Neuroscience

Neurological techniques look at the structure and function of the brain. Brain structures that are not used decrease in size (“use it or lose it”) while new experiences can shape the structure of the brain, so functionality and structure are closely interlinked. Neuroscience research makes use of technological devices that scan the cerebral blood flow or electrical activity of the brain. Two methods that track changes in cerebral blood flow, functional magnetic resonance imaging (fMRI) and functional
near-infrared spectroscopy (fNIRS), provide high-resolution spatial information. They show which areas of the brain are activated upon the execution of certain (cognitive or manual) tasks or through various experiences. For example, fMRI has been used to examine how emotions are processed in the brain, with comparisons across cultural groups (Immordino-Yang, Yang, & Damasio, 2016). This type of brain imaging has shown the great extent to which cognition, emotion, and social learning are all interrelated (Immordino-Yang, 2011).

A second group of brain imaging techniques, such as electroencephalography (EEG) and event-related potentials (ERPs), assess changes in the electrical activity of the brain. They provide high-resolution temporal information and show us when information is processed and how children are engaged. For example, while engaging children in an activity such as sleeping, exercising, playing the violin, or solving a mathematical problem, researchers can monitor which brain areas are activated, in which sequence. They have the potential to explore and uncover the interconnection between different development areas.

Neuroscientists have recently begun exploring the integrated uses of both techniques (Antonenko, van Gog, & Paas, 2014), each of which comes with its advantages and limitations. Near-infrared spectroscopy has gained significant popularity among researchers because the devices are more compact, cost-effective, and allow for more ecologically valid research than other functional neuroimaging techniques (Antonenko et al., 2014). Similarly, EEGs that traditionally require the wearing of an electrode skull cap that is connected to a machine, have currently been developed as wireless headsets (see products of Advanced Brain Monitoring or NeuroSky).

Many studies have been conducted regarding the links between training or experience and brain structures or functions. For example, in 2008, Limb and Braun (2008) found through an fMRI scan that jazz musicians who improvise while playing showed increased activation of brain areas related to self-knowledge and a decrease in the self-inhibitory regions. Other research at Stanford University has used fNIRS to examine the association between humor and creativity in young children, as well as the effect of physical exercise on thoughts and feelings. Neuroimaging studies have also shown that the prefrontal cortex in adolescents’ brains is not yet fully developed, which provides a neurobiological explanation for the impulsivity and poor judgment often seen during adolescence (Kautz et al., 2008). In turn, these insights provide real input that can be valuable to strengthen holistic teaching and learning. For example, viewing mathematics education from this perspective leads to the suggestion of meditation to improve students’ concentration and focus on material presented in a classroom (Vaninsky, 2017). Other counter-intuitive findings of neuroscience that are relevant for education include the idea that play is the best way for children to learn self-control, that rote memorization can be a stepping stone to using higher-order critical thinking and problem-solving skills, and that integrating arts into the curriculum can improve students’ long-term memory of what is taught (Carey & Hardiman, 2014).

**Multimedia**

Like neurological research, multimedia technology continues to develop innovative techniques that enable us to better research holistic development processes. One method that has recently gained importance for education research is eye tracking (Holmqvist et al., 2011; Rodrigues & Rosa, 2017), because students take in most information through their eyes, and rely on their vision to execute tasks. For example, students’ visual attention allocation data can be used to identify and analyze students’ learning strategies, the interaction between students and teachers in the classroom, or the use of the teaching environment (Jarodzka, Holmqvist, & Gruber, 2017). These can then lead to improvements in students’ learning, teachers’ instructions or classroom design, and ultimately to increased holistic development.

Taken together, these and other emerging innovations in neuroscience and multimedia can and should be used to provide a more comprehensive and coherent picture of children’s holistic development—a picture that can inform what needs to happen in classrooms.
We Need to Know More About How to Effectively Provide Holistic Education

There are innovations in technology that can provide us with a direct window into children’s brain activity during classroom experiences. For example, the Australian Science of Learning Research Center hosts two experimental classrooms which allow for studying students’ social behavior and cognitive learning in a natural setting. The educational neuroscience classroom, based at the University of Queensland, allows for precise measurement of brain activity, eye movements, and physiological responses that occur while individuals engage in learning. The Learning Interaction Classroom at the University of Melbourne is equipped with audio and video recording technology and has a one-way mirrored window through which classroom action can be observed by a team of scientists. By taking this kind of information and using dynamic, non-linear statistical modeling, we can learn how an individual child is affected by a specific experience at a specific time and in a specific place (the “Specificity Principle”), rather than just focusing on what is “typical” (Bornstein, 2018; Singer & Willett, 2003).

There is also a new impetus in the field to move away from solely relying on very lengthy and costly impact studies to learn whether innovations work in classrooms. For example, rapid-cycle evaluations (RCE), or micro-randomized trials, consist of series of low-cost and quick-turnaround evaluations that help researchers understand whether their interventions are having intended effects, when and for whom they are effective, and what factors moderate the interventions’ effects (e.g., see Nesselroade, 2018; Klasnja et al., 2015). RCEs typically rely upon administrative data (such as student attendance) to track outcomes, so there are currently some limitations in terms of what kinds of interventions and outcomes can be studied using this methodology.

Evidence is necessary, but not sufficient. For innovations to work in schools, educators need to implement the innovations with fidelity to the key drivers and principles that underlie the interventions. This must be done in a sustainable, scalable, but also nuanced manner if we are to reach and address the needs of diverse learners in diverse contexts (Blase, Fixsen, & Duda, 2011; Dymnicki, Wandersman, Osher, & Pakstis, 2016). We need to not only find out what works, but also invest the time and resources required to bring innovations in neuroscience into all schools and classrooms, in ways that teachers can provide holistic education.

We need to develop the readiness and capacity of teachers and schools to implement fluently, efficiently, and with quality and understanding (Coburn, 2003). Building readiness and capacity entails addressing the affective, social, emotional, and cognitive barriers to change (Dymnicki et al., in press). We can build and enhance capacity by addressing both the affective and skills issues that undermine readiness and capacity (Hall, Dymnicki, Coffey & Brodowski, 2014) and through continuous quality improvement (CQI). CQI should be done in a manner that addresses the individuality of learning as well as variation of impact among individuals and environments. Implementation is a process, not an event, and readiness is not a moment in time. Both unfold in dynamic environments and diverse contexts (Chambers, Glasgow, & Stange, 2013). Quality implementation is not just an individual phenomenon; it depends upon the conditions for implementation, which include a leadership environment and school climate that support good implementation (Education Endowment Foundation, 2018).

In Conclusion

The promise of holistic education has been only partially fulfilled. We know that it is possible to support holistic development for all children, in typical education systems. However, more information is needed to help us understand exactly what types of support work best for children of different ages, backgrounds, and needs, and living and going to school in different contexts. Fortunately, new innovations in biological and behavioral research can help us fill in the gaps. There is also a great need to understand how to make holistic education work well in practice. Here, new innovations in implementation science can help us to identify more efficiently how to make holistic education a reality for all children and youth.
Notes

1 “Bioecological” refers to the interaction between a child’s genetic predispositions or potentialities and his or her environment.

2 For example, see www.advancedbrainmonitoring.com or http://neurosky.com

3 See https://nirs.stanford.edu/research

References


Many Layers, Many Dimensions


