Increasing the Application of Developmental Sciences Knowledge in Educator Preparation: Policy Issues and Recommendations

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NCATE
The Standard of Excellence in Teacher Preparation

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Preface

This paper was commissioned by the National Council for Accreditation of Teacher Education (NCATE), with funding from the Strategic Knowledge Fund, a partnership between the Foundation for Child Development and the W. K. Kellogg Foundation. The Strategic Knowledge Fund supports projects that increase knowledge about children from birth to eight years old and their families, particularly children who are at risk for poor educational outcomes. The Strategic Knowledge Fund provided support to NCATE to promote "integration of child and adolescent development deeply and concretely into the preparation of America's teachers." The A. L. Mailman Foundation also supported this project.

NCATE conducted a reputational study and, with the support of the Foundation for Child Development, created a National Expert Panel on Increasing the Application of Knowledge about Child and Adolescent Development and Learning in Educator Preparation. The Panel met four times during 2008-2009 and produced two commissioned papers, summaries of the papers, and a final report entitled *The Road Less Traveled: How the Developmental Sciences Can Prepare Educators to Improve Student Achievement.* All are available at www.ncate.org. The papers may be downloaded from the website by clicking on 'Public' and 'Research/Reports.'

This work was preceded by a collaboration between the National Institute of Child Health and Human Development and NCATE to determine the current state of integration of child and adolescent development in educator preparation programs and the current state of developmental sciences knowledge. The effort found gaps between what is known and what is taught in educator preparation programs. The report is at www.ncate.org; click on Institutions; then Resources. The Foundation for Child Development then initiated the effort that produced this paper and other related materials to set forth actionable recommendations to the education and education policy communities.

It is the strong desire of the Strategic Knowledge Fund leadership that the recommendations contained in the briefs, papers, and final report of this effort receive the utmost attention in the education and policy communities and that the organizations named in the section on policy recommendations, as well as other education stakeholders, take concerted and timely action to implement the recommendations.

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Increasing the Application of Developmental Sciences Knowledge in Educator Preparation

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Introduction

This is one of two publications commissioned by the National Council for the Accreditation of Teacher Education (NCATE) under a grant sponsored by the Foundation for Child Development, the W. W. Kellogg Foundation, and the A. L. Mailman Family Foundation, intended to address the dire need for teacher preparation policy and programs to reflect recent advances in scientific knowledge of child and adolescent development. In the first publication, Jon Snyder and Ira Lit (2010) summarize the scientific support for knowledge of child and adolescent development as a primary focus of teacher preparation programs. The present paper focuses on the implications of this science for policy.

Two fundamental shifts drive this emphasis on knowledge about child and adolescent development in teacher preparation and policy. First, the last two decades have produced new understandings of child and adolescent development and learning based on extensive and rigorous scientific study, too little of which is reflected in teacher preparation or policy. Second, the accountability movement in education — which has largely focused on narrow assessments of academic learning that differ across states — will soon address the need to reconceptualize and reassess educational outcomes in ways that emphasize students' advanced cognition and conceptual understanding, capacity to work in teams and groups, leadership and motivation, skilled communication, and proficiency with digital media and technology. Standards that are "deeper, broader, higher" are now the focus of federal education policy initiatives that will form the basis of a common core of standards across the states. There is no question that teacher preparation, if it is to be a relevant factor in education reform or reflective of new scientific knowledge in what is perhaps its most critical foundational area, must do a far better job of incorporating the science of child and adolescent development into the fabric of programs and certification regimes.

This paper starts with several illustrations depicting the reality and consequences of the absence of systematic or programmatic linkage between the science of child and adolescent development and teacher preparation. It then moves into implications for policy-making at federal and state levels, in accreditation, and in teacher preparation programs.

Contemporary, Scientific Understanding of Child and Adolescent Development and Teacher Preparation

There is a multitude of sources supporting the argument that teacher preparation is not closely connected to the science of child and adolescent development. This section focuses on just a few: the fairly thin treatment of child and adolescent development in the teacher preparation curriculum; the marginal penetration of advances in knowledge of early literacy and language development and cognitive science in teacher preparation and classroom practice; and the relative disconnect between contemporary understanding of adolescent development and teacher preparation and practice.

The teacher preparation curriculum

As one example of the disconnect between the science of child and adolescent development and teacher preparation, consider the findings of a collaboration between the National Institute of Child Health and Human Development (NICHD) — the agency perhaps most responsible for the science of child and adolescent development — and the National Council for the Accreditation of Teacher Education (NCATE) intended to determine the extent to which developmental science had penetrated teacher preparation. These two organizations surveyed NCATE-accredited schools of education and found that most of the most commonly-used texts in child development, although reflective of recent scientific advances, contained virtually no information linking these scientific advances to applications in P-12 teaching (NCATE, 2008). For example, over a 20-year period, NICHD funding resulted in notable advances in understanding the mechanisms underlying the development of literacy; findings included an examination of the way in which specific and explicit instruction in phonological skills is necessary for one learning how to read words fluently, and is of fundamental importance for comprehension and competence in spoken language and vocabulary. Yet most child development textbooks used by students learning to become teachers provided little or no information connecting theories of literacy development to how to promote literacy in the classroom in a manner that aligned with contemporary understanding of literacy, language, or the socially mediated ways in which young children acquire knowledge and skill.

The paucity of developmental science in teacher preparation was confirmed in a 2008 survey of NCATE-accredited teacher preparation programs. Although 90% of respondents indicated that their teacher preparation candidates were required to take at least one child and adolescent development course, half of the respondents indicated that this requirement was insufficient for effective practice. Moreover, most respondents also noted that even these required courses were too often broad surveys that had little to do with applying the science of child and adolescent development to teaching and learning in classrooms. The challenge here is at least threefold: first, despite an explosion in the science of child and adolescent development, teachers-in-preparation are exposed to too little of this information; second, even if exposed to the contemporary knowledge base, they are not prepared with the applied knowledge and skill that would allow their practices to reflect contemporary understanding of child and adolescent development; and third, there are too few tools available to teachers

that guide practice in developmentally-sensitive ways, including instruction in the conduct and use of assessments of teaching and learning in ways that can improve practice (Pianta & Hamre, 2009). It is the aim of the present paper to identify policy levers and changes that could be used to address this problem.

Knowledge of skill targets and early childhood developmental progressions

Decades of basic and applied research on language development and early literacy, in both typically- and atypically-developing samples, has resulted in a well-established body of knowledge on developmental trajectories and the role of classroom instruction and home experience in fostering developmental progress and learning (Snow, Burns, & Griffin, 1998). The science has advanced to the point where it can now inform instruction in language and literacy to focus around high-priority skill targets and utilize curricula that reflect these targets. More specifically, a high-priority target for preschool literacy instruction (Lonigan, 2004) is one for which there is evidence that it is (a) consistently and at least moderately linked to school-age reading and language achievement, (b) amenable to change through intervention, and (c) likely to be under-developed among at-risk pupils. Based on meta-analyses (e.g., National Early Literacy Panel [NELP], 2004) and longitudinal studies of early language and literacy predicting later reading and language skills (e.g., Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Storch & Whitehurst, 2002), there is ample support for six targets. The first three (phonological awareness, alphabet knowledge, and print awareness) are literacy skills that consistently predict school-age decoding (NELP, 2004), are amenable to change via interventions (e.g., Justice & Ezell, 2002) and are under-developed in at-risk pupils (e.g., Snowling, Gallagher, & Frith, 2003), while the others (vocabulary/linguistic concepts, narrative, and social communication/pragmatics) are associated with school-age decoding (NELP, 2004) and reading comprehension (NELP, 2004).

Effective early language and literacy curriculum interventions can be used in classrooms and integrated into teacher preparation programs that directly address these skill targets (e.g., Girolametto, Weitzman, & Clements-Baartman, 1998; Justice & Ezell, 2002; Wasik & Bond, 2001; Whitehurst, Epstein, Angell, Crone, & Fischel, 1994). However, observational studies show little evidence that such interventions are used in most early education classrooms, and — even when available in a classroom — demonstrably effective literacy and language interventions have *no* effect on child outcomes when the quality and effectiveness of implementation (i.e., instructional interactions), is low (Dickinson & Brady, 2005; Howes et al., 2008). This efficacy gap likely exists because teachers receive little instruction in how to apply this knowledge in the classroom.

In what is a critical distinction, teachers not only appear to lack basic descriptive knowledge of literacy or language development, but seem to be in fact drastically under-trained in how to implement instructional activities in early literacy and engage in interactions and conversations that promote language skills (Justice & Ezell, 1999; Morrison & Connor, 2002; NICHD ECCRN, 2002). That is, they have too little exposure to the science supporting the *application of knowledge of development*. For example, teachers are rarely exposed to multiple field-based examples of objectively-defined high quality practice, and they receive few if any opportunities to receive feedback about the extent to which their

classroom instruction and interactions promote these skill domains (Darling-Hammond, Pacheco, Michelli, LePage, Hammerness, & Youngs, 2005; Pianta, Mashburn, Downer, Hamre, & Justice, 2008). Thus, in what has been perhaps the most advanced area of knowledge in a skill domain of pressing national need and focus for over a decade, research not yet penetrated teacher preparation to an extent where the scientific knowledge base is evident in practice.

A very similar situation exists for early math development (Clements & Sarama, 2008; Ginsburg, 1997); that is, recent advances in the understanding of mathematics development and the ways in which instruction and interaction with adults can foster progress are not well-reflected in teacher preparation, teacher knowledge, or teacher application in the early grades. One sign of this absence is the finding that children in early childhood settings receive little if any exposure to math (NICHD ECCRN, 2002; Howes et al., 2008). Most scientists and educators agree that this is a consequence of teachers' own lack of math knowledge and skill, lack of knowledge about math development, and lack of knowledge and skill in teaching and supporting math (Ball & Cohen, 1999; Clements & Sarama, 2008; Ginsburg, 1997).

This could be remedied: a recent National Academy of Sciences report (Cross, Woods, & Schweingruber, 2009) outlines a very clear set of parameters for mathematics development (e.g., number, geometry) and cognitive skills (reasoning, problem-solving) that, as described above in the case of literacy, could serve as high-priority skill targets that are supported scientifically. Moreover, the NAS report and several controlled studies reveal quite clearly that teachers can be trained — both in knowledge of math and its instruction — and supported in their classroom practices in ways that dramatically improve children's mathematics performance (e.g. Clements & Sarama, 2008; Ball & Cohen, 1999).

Adolescent development and teachers' classroom practices

Another area of burgeoning scientific discovery is adolescent development (Steinberg, Brown, & Dornbusch, 1996). In nearly every domain — cognition, brain development and neuroscience, physiology and endocrinology, social development — our understanding of basic developmental progressions and their linkages with one another and with experiences in social settings has deepened and broadened substantially in the last decade. Yet, for all of this available knowledge, disengagement and alienation reported by youth are high and often the result of classroom experiences that are disconnected from their developmental needs (Crosnoe, 2000; Dornbusch, Glasgow, & Lin, 1996; Eccles, Lord, & Midgley, 1991). When fewer than 60% of 9th graders in certain demographic groups (NCES, 2003) actually graduate in four years, when decreasing the dropout rate remains a singular focus of most secondary schools for 10 years, and when the average *annual* dropout rate is 10% — and ranges up to almost 30% for recently-immigrated Latinos — it is clear that the secondary school classroom is not working well as a setting for youth development. Evidence suggests that competitive, standards-driven instruction in de-contextualized skills and knowledge may contribute directly to this sense of alienation and disengagement (Eccles, Lord, Roeser, Barber, & Jozefowicz, 1997). Unsurprisingly, high school hallways and lunchrooms still brim over with youthful energy, excitement, and enthusiasm; clearly, something is missing in the classroom.

A range of studies report associations between youths' sense of social connection and their educational outcomes, ranging from higher achievement scores to greater student engagement and more positive academic attitudes (e.g., Crosnoe, Johnson, & Elder, 2004; Ryan & Deci, 2000; see also, NRC, 2004, for extended review of other similar findings). Most students, unfortunately, do not feel their teachers care about them personally (Public Agenda, 1997). Recent experimental work has shown that a sense of isolation can significantly reduce energy for intellectual pursuits, and that this reduction is powerful enough to temporarily depress results on tests (Baumeister, Twenge, & Nuss, 2002) while increasing irrational, risk-taking behavior (Twenge, Catanese, & Baumeister, 2002). The power of peer interactions can be directed toward (or away) from academic purposes depending on the structure of the classroom (Berndt & Keefe, 1996). In addition, the extent to which teachers' routinely use differential treatment of students and competitive techniques in classrooms has been linked not only to poorer academic attitudes but also to lower student self-esteem (Roeser & Eccles, 1998).

Conversely, more cooperative methods, particularly those which in some way reward students for the learning of *all* students within their group, have been consistently found to increase levels of student engagement and achievement (Slavin, 1996).

Centuries ago, late adolescents were commanding armies and running countries (Barzun, 2000); today, however, an ever more competent generation of adolescents is confined to classrooms for hours a day with too little vision of how what occurs in the classroom relates to the world outside it. One of the most avoidable errors that some secondary school teachers make is the assumption that youthful drives for autonomy and self-expression represent negative forces to be countered rather than positive energy to be harnessed. This basic misunderstanding of adolescent development manifests itself in controlling and punitive classroom and school settings and in instruction that is teacher-driven and discourages exploration and curiosity. On the contrary, autonomy can be supported by allowing students to choose partners for group projects and the types of projects to pursue (Allen, Kuperminc, Philliber, & Herre, 1994; Anderman & Midgley, 1998). The fundamental challenge for teachers in this regard to is to understand adolescents' developmental push for autonomy so that they can then seek to guide and direct it. Involving students in significant, real-world, voluntary community service, and then discussing it within the classroom in an ongoing way, has been found to reduce failure rates by 50% in randomly controlled trials with similarly profound effects upon other behaviors in youths' lives as well (Allen, Philliber, Herrling, & Kuperminc, 1997).

Summary

Throughout the prior discussion, frequent mention has been made of the science of child and adolescent development and its achievements that could and should inform teachers and their practices. It would be a vast oversimplification however, to assume that knowledge of development, in and of itself, is sufficient to improve teacher practices. Being able to describe language development or the importance of peer relations for middle schoolers will not lead to improvements in teacher practice or student outcomes. Rather, it is important to identify sectors of this science that can then be applied to teacher preparation more systematically,

and to both identify and develop a *science of application for p-12 teacher practices and teacher preparation* (Pianta & Hamre, 2009).

In this regard, it may be useful to distinguish between knowledge of a) basic developmental progressions in a given domain (the "what comes after what" that is the core of much developmental science); b) the connections across domains (for example, how hormones influence behavior and cognition in middle school); c) how experiences in settings (schools, families) influence change and learning; and d) how to apply these forms of knowledge in real-life interactions in classrooms. The science of child and adolescent development can be evident in every one of these areas and each can and should be reflected in teacher preparation programs and in the policies and tools that shape teacher preparation and performance. Of equal importance is the recognition that, though the "science of child and adolescent development" is indeed considerable, robust, and relevant to teacher preparation, the vast majority of this science is of the "basic" form — category "a" above. Far too little investment and attention have been paid to the science of application and implementation, a reality that constrains a deeper and more informed understanding of the connection between knowledge of child and adolescent development and teacher practice.

As just one example of the science of application, consider recent efforts to draw from the rich literature on adult-child interactions to derive metrics for the quality of teacher-child interactions in p-12 settings (Pianta & Hamre, 2009). Evidence indicates that these metrics, encompassing social/emotional practices, organization of the setting, and teachers' press for student cognition, account for student developmental and learning gains not only on standardized tests but also on observations of engagement and reports of social competence. With such metrics in-hand, professional development, in the form of courses and coaching approaches, have been shown in experimental trials to produce more effective teaching and student learning gains (Pianta et al., 2008). This pattern of moving from knowledge of development and its contextual regulators to rigorous scientific work in application (Clements & Sarama, 2008) forms a critical next phase of work.

Classrooms that engage students deeply — cognitively, socially, and developmentally — are those classrooms in which students develop knowledge and competencies to perform well not only on standardized exams but also in a range of roles — as citizens, employees, leaders, and parents. In these classrooms we can readily observe the signs of motivation and engagement and see behaviors that reflect knowledge of particular individuals and human development more generally. Below, we describe a sample of observable teacher behaviors that signal a teacher's deep knowledge of child and adolescent development and reflect that knowledge in interactive skills that support student's learning and development.

We are following an 8th grade social studies class preparing for a debate. *What you would likely notice first is the teacher making eye contact and warmly greeting students by name as they enter the class, eliciting students' attention and smiles in return. The teacher takes time to ask students about free time or extracurricular activities that she knows are important to them, and her questions show that she values and respects personal information about their lives. The students engage actively with peers while they also appear to follow an organizational routine as they gather materials, take their seats, and prepare for class, until*

the teacher says that it is time to begin. The teacher begins the debate activity by situating it within a "big idea" that is relevant to contemporary 8th graders and reflects her knowledge of these students' lives. In order to encourage her students to apply their thinking to a real-world event, she asks them which debates they have seen in person or televised. Several students mention that they watched the presidential debates on TV. She asks about the nature of debates and their purpose, both in terms of presidential decisions and also other issues over which there are often differences of opinion — again, drawing on their life experiences. As students respond, the teacher acknowledges them, listens to them, repeats their responses, and reflects, always confirming her understanding and then linking the student response to deeper understanding and larger ideas. She shows the class some short clips from several presidential debates to make the real-world connection more concrete.

Next, the teacher asks a few questions about what the students remember about the conduct of a debate. As students respond, the teacher looks around the room to assess body language as a measure of student confusion or agreement with classmates' comments. Several times the teacher responds to student remarks with probing prompts, like, "Tell me more about what you mean," or by asking another student to rephrase what has been said, asking questions like, "Can you say in your own words what Christa is referring to?"

The class now begins setting the stage for the students to prepare for and conduct a debate. The teacher explicitly presents a structure to organize the students into debate teams and the structure of the debate task itself. While the students share their understandings of the debate rules with each other, the teacher makes these rules explicit by posting them on an overhead, reviews them once more, and reminds students they will be available throughout the exercise.

Students then quickly move to their respective debate teams and the teacher compliments the class for their cooperation, noting specific behaviors. The teacher provides each team with the position they will argue in the debate and then provides direction for what each team will need to present. She then allows the teams to talk together to arrange their presentations. She reminds the teams that even though only one person will present the opening argument of the debate, any of them could be called on and they all should know the team point well.

Once the teams are holding their discussions among themselves, the teacher begins moving from one group to another. When she joins a group, she crouches down to the eye level of the students, looks around the group at each of them, and smiles. She listens for a moment to hear how they are formulating their opening arguments. She hears the students first disagree and then agree on how they will present their opening argument as they provide constructive suggestions to one another. She skillfully enters each discussion, often clarifying what she hears or observes while expanding on what is expressed by students, making clear and explicit linkages to the prior class discussions.

In one group, a student asks her to clarify a point. The teacher first asks the other group members to see if they can help their teammate. When no one replies, she says, "Let's go back to yesterday's discussion to see what might give us a better idea about this." Then, after giving them the cue that what they covered yesterday will be helpful to them now, several students are able to provide clarifying information based on their class conversation from

the previous day. The teacher asks the original student to restate what he heard. When he responds, the teacher confirms that he now understands the information and restates it again in a different way. All of this has happened in less than 15 minutes.

It is evident that this is a teacher who creates a positive and engaging classroom environment by knowing her students and showing them respect when she greets them, and this is reflected in the ways the students talk to one another. The teacher makes it clear both in what she says to students and in the way she interacts with students that their viewpoints are important, and that they are responsible for their learning as a group. The teacher also shows multiple examples of awareness of and responsiveness to student knowledge and provides different types of support (e.g. students clarifying ideas for one another, her restating information in different ways) to ensure they are continuing to participate and learn. By focusing the debate activity to encourage a deep understanding of the content through meaningful and interactive discussion, the teacher helps her students go beyond the ability to recall bits of information; they begin to understand concepts at a broader level. The feedback that she gives her students, and that they give one another, extends their learning and understanding and encourages a higher level of student engagement.

Knowledge of Child and Adolescent Development—What Will Common Core Standards Mean for Teacher Preparation?

In the U.S., the first wave of education reform resulted in a standards-based approach to education, with clear guidelines for student knowledge and learning outcomes and performance benchmarks; as a result, *standards are now the lens through which classroom instruction is viewed*. All children, not just some, are expected to master the core academic standards. Assessments aligned to these standards communicated student achievement to administrators, parents, students, policy-makers, and the general public. Policy also reflected the importance of teachers to student achievement and defined a *highly qualified* teacher primarily in terms of knowledge content or subject matter (e.g., math, history). Competence was demonstrated by completion of an academic major with *virtually no (or greatly diminished) requirements concerning knowledge of child and adolescent development or skills in applying that knowledge* (at a time when the science was very robust). It is not surprising, then, that someone can be licensed to teach while having passed only one undergraduate survey course in child development. In fact, some state laws and regulations capped the number of education courses that could be taken for initial licensure.

Unsurprisingly, teacher preparation programs gradually oriented their curricula to prepare future teachers to address state standards. By and large, the evidence suggests that standards-based education reform increased the amount of attention paid to student outcomes and the connection between these outcomes and educational inputs. Yet, more than a decade into reform, far too many students still fail to complete high school or are not college- or career-ready. Even those who are college-ready often engage in their schoolwork at only a superficial level (Miller, 2001).

It is widely recognized that students need not only to learn basic skills and reach high levels of academic preparation, but must also develop dispositions and advanced skills for the 21st century workplace. A recent report by the Center for Workforce Preparation (2009) considers three clusters of competence "foundational": basic skills (reading, writing, speaking, listening and mathematics), higher-order intellectual skills (reasoning, creative thinking, decision-making and problem solving), and motivation and character (personal maturity, responsibility, sociability and self-esteem). These skill clusters are the focus of nearly every discussion of contemporary education reform and standards and are likely to play a central role in reauthorization of the Elementary and Secondary Education Act. Activity is already underway across the country to develop new, common core standards across states that emphasize advanced cognitive and group collaboration skills, among others.

The impetus for this new focus on "higher, deeper, broader" standards is not just the business community. Rather, the science of child and adolescent development has played a major role in re-shaping our understanding of the capacities of children and youth and the ways in which schools can foster these capacities. Fundamentally, the primary lesson learned from this new science is that children and youth are far more capable of advanced skills (skills we have traditionally considered "adult-like"), and, when exposed to opportunities to learn such

skills, they do so with considerable ease (Allen et al., 1997; Eccles et al., 1991; Slavin, 1996). The chasm between antiquated teacher preparation and classrooms that foster 21st century learning is perhaps never more evident than in findings that many practicing teachers' understandings of cognitive development derives from Piaget, while their conceptions of social interaction and behavior rests on Skinner — both good starting points, but certainly not aligned with contemporary research or theory in the corresponding domains.

The fundamental question is, recognizing the critical — if not singular — role of teachers in fostering student learning gains, what can be done to ensure that teachers are equipped, supported, and incentivized to contribute to learning in all these foundational skill domains? Policy recommendations in this paper suggest a stronger, more robust revision of standards-based reform *that recognizes the central role of the teacher and makes explicit the need to much more fully integrate knowledge and skill in child and adolescent development in teacher preparation*.

This is not a call for more courses in self-esteem promotion or advocacy of a position that has no basis in solid scientific research — rather, we argue that the best science demonstrates with great clarity that there is a knowledge base in child and adolescent development that is pertinent to the education of young people, and that — if the best science in education identifies teachers as the largest source of variation in student performance — then it seems reasonable to connect the two. *Contemporary* knowledge of child and adolescent development along with the *skills to apply it* must be better integrated into teacher preparation programs' didactic and field experience, and teachers in the field should be held accountable for performance consistent with contemporary knowledge and skill.

The remainder of this paper will focus recommendations in four policy domains: federal, state, national accreditation, and teacher preparation programs. We will discuss policy-related actions to ensure that every teacher possesses a deep knowledge of child and adolescent development and effectively applies that knowledge in the classroom to enhance P-12 student learning.

Federal Education Policy and Teachers' Knowledge of Child and Adolescent Development

In what may be an unprecedented Federal investment in public education, the American Recovery and Reinvestment Act of 2009 placed more than 100 billion dollars in education to improve the learning outcomes of students and to build the capacity of states, districts, and higher education institutions to educate children and youth for the new and complex global environment that is reflected in the Center for Workforce Preparation's "foundational skills."

This investment reflects four basic strategies:

- Creating new standards and assessments
- Improving educator education quality
- Improving national, state, and district data systems
- Turning around low-performing schools.

As the funds for this next wave of educational reform start flowing, numerous grant competitions are underway for states, districts, and institutions of higher education, competitions that reflect these four strategies and that connect the flow of money to applicants' adherence to certain criteria. It is likely that, unless these criteria more explicitly encourage deeper understanding of the contemporary science of child and adolescent development among teachers and educators, reform will not be strong enough to advance student learning in the desired domains.

For example, although states are urged to adopt national academic content standards for mathematics and language arts, there is little to no discussion of national standards for social and emotional learning even though the social and behavioral development of children and adolescents fosters academic learning and would play a key role in advancing the group collaboration, communication, and leadership skills on which the new standards focus (Center for Workforce Preparation, 2009). Although $365 million of Race to the Top (RTTT) funds will be allocated to new *student performance assessment systems, there is little discussion of money to assess the learning environments of schools or teachers' knowledge of child and adolescent development or their skills in applying developmental science in the classroom*. Similarly, the U.S Department of Education will soon distribute $143 million appropriated under Title II of the Higher Education Act of 2008 to transform teacher education; however, the science of child and adolescent development is virtually absent from discussions surrounding this bill, whether in terms of knowledge standards for teachers, new assessments of knowledge or application, or identification of core areas of child and adolescent development knowledge that must be represented in curricula.

Child and adolescent development knowledge might penetrate teacher preparation and classroom practice through RTTT funding, but, again, the prospects are slim. The purpose of the program is to encourage and reward states that promote innovation and reform, increase

student outcomes, close achievement gaps, improve high school graduation rates, and ensure that all students are college and career ready. The heart of the reform strategy lies in standards, assessments, data systems, effective teachers and school turnaround.

There is nothing in the RTTT criteria to prevent states from adopting, in addition to academic content standards, standards for teachers' knowledge and practices related to the contemporary science of child and adolescent development. In the most recent competition, however, as well as the one planned for summer 2010, there is no explicit mention of this linkage as a criterion for review. New performance assessments, designed to measure cognitive and socio-emotional learning, can emphasize performance tasks that measure such attributes as collaboration, teamwork, and moral judgments. If implemented, these standards would help ensure that all students are college- and career-ready and inform new, more credible data systems to monitor student progress and drive instruction, but any explicit linkage between teacher knowledge of development and new standards is absent in the legislation.

Race to the Top requires states to improve teacher effectiveness, defined in a way that is linked to student achievement. The RTTT definition of "highly effective teacher" requires "students that achieve at high rates (e.g., one and one-half grade levels in an academic year) and student growth." This definition is only a small move in the right direction, and will only truly be an advance if states, LEAs, and schools include multiple measures of teacher effectiveness, and include in those measures or standards authentic assessments of teachers' knowledge of the subject matter that is arguably at the core of every professional decision they make and every action they take in the classroom — that is, the science of child and adolescent development. Would it not be imperative for any professional to be required to master and update their knowledge and skill in an area central to their performance? Assessments and standards for teachers' knowledge are critical to real progress, especially those that are not limited to multiple choice tests of the basic progression of child development (the "what comes after what") but rather authentic, practice-focused assessments that capture teachers' knowledge of contextual influences on development, their knowledge of classroom application,, and their skill in applying this knowledge in practice (Ball & Cohen, 1999; Clements & Sarama, 2008; Pianta & Hamre, 2009; Cross et al., 2009). At present, it is unlikely that RTTT applications will do much to advance the linkage between teacher preparation or performance assessment and the science of child and adolescent development.

Moreover, to improve the effectiveness of teacher and principal preparation programs and successfully compete for RTTT funds, states must develop data systems to link teachers and principals to student performance data and in-state teacher preparation programs. States must examine these data and expand preparation and credentialing programs that are successful at producing effective teachers and principals. This presents a unique opportunity to transform teacher preparation by requiring states and Federal research agencies — such as the NICHD and the Institute of Education Sciences (IES) — to develop assessments of teachers' knowledge and skills in the contemporary science of child and adolescent development and to build these assessments into preparation and certification standards.

Finally, RTTT proposals require states to develop high-quality plans to turn around low-performing schools. At present, most turnaround models focus on issues of management, data use, leadership, and school organization to achieve results. There is ample evidence, however, that culturally-specific and contemporary knowledge about child and adolescent development and the contextual assets likely to promote development is fundamental to designing school environments that successfully address the challenges of educating in high-poverty, high-need communities (Allen et al., 1997; Eccles et al., 1991; Slavin, 1996; Comer, 2004). Failure to require turn-around proposals to explicitly articulate models of child and adolescent development that drive their proposals for school design and management will perpetuate the cycle of low performance and alienation already present in these schools.

Race to the Top is not the only Federal education program, and even as this report is issued some grants will already have been made; thus, the perspectives and recommendations of this report can only be reflected in the subsequent round of funding. However, there are many grant programs within the Department of Education that provide other opportunities for states, institutions of higher education, and local education agencies to use federal funds to advance teachers' and educators' understanding and application of contemporary knowledge of developmental science. The Teacher Quality Grants Program authorized by Title II, Part A of the Higher Education Opportunity Act of 2008, for example, could be used to challenge existing standards of teacher preparation with funding totaling $143 million over a five year period. Every partnership developed under this program involving colleges of education, colleges of arts and sciences, and local and state education agencies can disseminate the science of child and adolescent development. These grants could provide opportunities for developmental scientists and teacher educators to develop innovative training materials and assessments for pre-service and in-service teachers, precisely the resources that are needed to leverage the impacts of other policy innovations described earlier.

This administration is anxious to reauthorize the Elementary and Secondary School Act, providing a unique opportunity to transform standards-based reforms. The ultimate success of any reform emanating from reauthorization will hinge, at least in part, on policy that leverages teachers' knowledge of the scientifically-based subject matter in child and adolescent development, something almost entirely missing in No Child Left Behind.

The Profession and National Accreditation—Policy Changes

Every profession must have command of the domains of knowledge required for competent professional performance and the ability to certify that practitioners have mastered that knowledge in its most current form. In medicine, professional organizations (e.g. the American Medical Association and smaller specialty associations) and certifying boards continually engage in the identification of modern scientific knowledge and its applications and implement regulatory practices that ensure that such knowledge and skills are evident in the preparation and practice of professionals. Professionals are routinely prevented from practicing a profession when they fail to demonstrate knowledge or skill sufficient to meet the demands of a profession's standards.

The teaching profession lags far behind many other professions in its creation and maintenance of knowledge and skill standards, leaving most regulation to states and certifying organizations (Crowe, 2008). Teaching, as a profession, needs to reach clearer consensus on the particular knowledge and skills to be required of its practitioners, how to measure those requirements directly, and the consequences of success and failure to attain standardized levels of ability. This must include not only knowledge of child and adolescent development, but ongoing formative assessment of children's skills, instruction that is informed by knowledge of children's learning methods at each stage of development, assessment of instruction on an ongoing basis, and adaptation of instruction based on knowledge of development. Thus, as has been mentioned before, it is not enough to know the science of child development; rather a teacher must also be able to use principles of development in her teaching.

Most mature professions do a better job of defining their priorities and guiding the preparation of professionals in their field. They do this primarily through *national accreditation by professional organizations*. National accreditation is, for example, widely accepted and expected in medicine, pharmacy, law, engineering, nursing, architecture and social work. In education, however, only around 60 percent of all schools of education are nationally accredited; fewer than 50 percent of the top *US News and World Report* schools of education are nationally accredited (Hitz, 2008). National accreditation and clear, measurable knowledge and performance assessments related to the contemporary science of child and adolescent development would indicate a major step forward in teacher preparation and certification.

The oldest and largest national accrediting organization for teacher education programs, the National Council for the Accreditation of Teacher Education (NCATE), has six unit standards, all enjoying fairly widespread acceptance (Hitz, Hall & Grumet, 2006). The standards are:

1. Candidate Knowledge, Skills, and Professional Dispositions
2. Assessment System and Unit Evaluation

3. Field Experiences and Clinical Practice
4. Diversity
5. Faculty Qualifications, Performance, and Development
6. Unit Governance and Resources

Each NCATE standard is divided into subsections with rubrics to guide accreditation teams in their determination as to whether each substandard is met. For example, for Standard 1c, "Professional and Pedagogical Knowledge and Skills for Teacher Candidates," the "target" category of the rubric states: "They [teacher candidates] know how students learn and how to make ideas accessible to them." (NCATE, 2008, p. 18) However, neither the "acceptable" nor the "unacceptable" categories makes reference to candidate knowledge of child and adolescent development or its application, and it is unclear how a teacher candidate would demonstrate competence with regard to that standard. This is typical of problems that one encounters throughout the standards.

Thus, it is conceivable that teacher preparation programs can meet the standards by reaching the "acceptable level" while not actually preparing candidates to know and apply knowledge of child and adolescent development or to teach using developmental principles. The likelihood of this outcome is forecast in the earlier discussion regarding teachers' lack of knowledge of literacy and language development and the lack of attention to formative assessment or assessment of the instructional environment.

Similarly, as demonstrated by Standard 3c., "Candidates' Development and Demonstration of Knowledge, Skills, and Professional Dispositions To Help All Students Learn," and Standard 4, "Diversity," there is simply not enough content specificity at present in the accreditation rubrics, nor in the measures by which accrediting organizations can ensure such knowledge, for the relevant science to be reflected in teacher preparation or teacher practice.

In addition to the six standards, NCATE requires that a school of education create a conceptual framework for its programs which "establishes the shared vision for the unit's efforts in preparing educators to work in P-12 schools..." (NCATE, 2008, p. 14), a very broad requirement that appears to lack explicit reference to child and adolescent development knowledge and likely includes an excessively wide range of content in its area. However, as the conceptual framework forms the foundation for all candidate and program assessment, it is of prime importance. Conceptual framework requirements are outlined in the NCATE standards, and language could be strengthened to force units to articulate more specifically the ways in which contemporary knowledge of child and adolescent development will function as the lens through which all instruction and teacher preparation experiences are viewed.

NCATE also includes in its accreditation system 21 sets of standards of developed by Specialized Professional Associations (SPAs; Hitz et al., 2006). Some of those already focus heavily on child and adolescent development, such as early childhood, elementary, and middle school standards. Many others, including some secondary areas and other specialty areas, do not include clear expectations for the application of child and adolescent

development knowledge. As many states utilize SPA standards as the basis for teacher preparation program approval, it is critical that contemporary knowledge of child and adolescent development be very explicitly reflected in SPA standards. This includes attention to assessment and instruction as well as knowledge.

To address the wide variation in SPA standards, the Specialty Areas Study Board (SASB) of NCATE created a Task Force on Program Standards. The SASB Task Force developed four principles to guide standard development in the various disciplinary areas: content knowledge, content pedagogy, learning environments and professional knowledge and skills. According to this task force, SPA standards must:

> "…address candidates' knowledge of the ways children and adolescents learn and develop, including their cognitive and affective development and the relationship of these to learning. They [standards] describe for the SPA's specialty, candidates' understanding of how students differ in their approaches to learning and that instructional opportunities must be adapted to diverse learners. Standards cover candidates' understanding of language acquisition; cultural influences on learning; exceptionalities; diversity of student populations, families, and communities; and inclusion and equity in classrooms and schools. Standards address what candidates need to know, for their specialty field, about learning."

This framework for further development of SPA standards could have a pronounced impact on state certification and teacher preparation, and is now NCATE policy. In present form, however, this framework is far too general, and does not focus on practice or application; the ultimate effectiveness of these efforts for teacher knowledge and skill and student outcomes will depend in large part on curricular and assessment shifts that would provide appropriate accountability; including the addition of specific content that teachers must know, specific skills they must demonstrate to indicate application of that content, and specific measures and stakes for accountability concerning that content and those skills.

Summary

Given the considerable influence of NCATE in the design and delivery of teacher preparation, it is important to revisit key features of the "science of child and adolescent development" mentioned earlier, including: a) basic developmental progressions in a given domain (the "what comes after what" that is the core of much developmental science); b) the connections across domains (how hormones influence behavior and cognition in middle school); c) how experiences in settings (schools, families) influence change and learning; and d) how to apply these forms of knowledge in real-life interactions in classrooms. The need for clear standards in all of these areas, relevant and authentic assessments tied to practice, and the requisite tools for developing these competencies in teachers must be at the core of any NCATE effort to infuse contemporary scientific understanding in teacher preparation. Otherwise, efforts are likely to be superficial and lack any real impact.

State Education Policy

Much of the policy pertaining to teacher preparation and performance is made at the state level. There is, for the most part, a close and coordinated connection between state policy requirements for teacher certification, licensure, and preparation and the work of the major teacher preparation program accrediting organizations, such as NCATE. The area with perhaps the most immediate potential as a policy driver for infusing knowledge and application of the science of child and adolescent development into teacher preparation is evaluation of teachers, both for purposes of hiring and tenure, and for decisions concerning career ladder placement, merit pay, and professional development assignment. Teacher performance assessment is on the cutting edge of an assortment of second-generation education reforms, and is becoming more advanced through the strong support of major foundations and innovations in districts and some states (Gordon, Kane, & Staiger, 2008; Pianta & Hamre, 2009).

Teacher evaluation

States play a major role in driving teacher preparation and quality through the ways in which they evaluate teacher performance. Ongoing attention to contemporary knowledge in child and adolescent development should play an integral part in every teacher's professional growth and should take on a significant role in teacher evaluation systems. Appraisal of the professional practice of teachers is typically required by policy at the state level, while design and implementation remain at the district/local level. Such appraisal systems are often designed to support both formative assessment to aid teachers in planning for professional growth and summative assessment to help make employment decisions. There is little evidence that contemporary knowledge of child and adolescent development, or application of this knowledge, plays a role in these state systems for teacher preparation, ongoing professional growth and evaluation.

Teachers working in traditional administrator-focused evaluation systems tend to utilize direct instruction for the purposes of lessons to be observed. Teachers find it far less complicated than an explanation of the value of a project-based learning environment that may lack the traditionally desirable norm of "order" (Searfoss & Enz, 1996.), despite the latter's far greater relevance to the contemporary science of cognition and the socially mediated nature of learning, particularly for adolescents. Peer observation of teachers, as formative or summative evaluation, can broaden the understanding of models of teaching across classrooms, overcoming the isolation of the teaching profession and encouraging deeper analysis and critique of practices (Walen & DeRose, 1993; Toch, 2008.). Peer review can also provide evidence and a foundation of support and intervention to make high stakes employment decisions that are strongly linked to professional development and to principles of effective practice that reflect contemporary knowledge of subject matter, either content-based or focused on child and adolescent development. Peer evaluation systems also mitigate the common wisdom that it is difficult to fire "bad teachers" (Goldstein & Noguera, 2006); the success of these programs ultimately depends on investment in the quality of observation, conferencing, and even employment decisions. With appropriate standards for knowledge

and the application of contemporary developmental science, as well as standards typically required for any assessment (reliability, validity), states' use of peer or administrator-based review and evaluation systems could advance teacher effectiveness in demonstrable ways (Pianta & Hamre, 2009).

Perhaps the most recent and widespread scientific effort to influence the assessment of scientific knowledge of child and adolescent development among teachers performance, comes from the Gates Foundation's "Measures of Effective Teaching" Study, followed in kind by the Wm. T Grant Foundation's efforts to develop assessments of the quality of settings serving youth. Each of these efforts has demonstrated a pronounced focus on developing rigorous assessments of teachers' actual performance in classrooms that at least in part reflect their understanding and application of child and adolescent development. The Gates study draws from observational assessments of teacher behavior (Grossman, 2005; Hill et al., in press; Pianta et al., 2008), student reports reflective of teacher practices and students' work samples, in addition to value-added metrics. Both the Gates and Grant foundations' efforts noticeably aim to advance the use of standardized observation at-scale, so that measures can be widely applied and linked to a variety of decisions and professional development opportunities. To the extent these large-scale rigorous studies yield scalable assessments that are reliable and valid, the implications for state certification and licensure systems are enormous.

Tiered licensure systems

The Council of Chief States School Officers (CCSSO) is working across states to adopt a national system of teacher assessment that builds off the work of Connecticut's Bureau of Educator Standards and Certification (BEST) and California's Performance for California Teachers (PACT). Such a model implemented in state policy might include:

1. An assessment of teaching to precede the award of an initial teacher license;
2. A teacher evaluation process guided by assessments at each level to support constant teacher growth;
3. An assessment of professional teaching to precede a professional license; and
4. An assessment of accomplished teaching to include national board certification.

In this tiered approach to licensure, teachers who receive their initial license should have completed at least a one-year internship and receive mentoring by an accomplished practice teacher who is licensed and trained to do so and who has demonstrated mastery in developmentally appropriate teaching. At each stage of a teacher's career path, he or she should be part of a professional learning community led by an accomplished, master teacher.

Although NCATE, the National Board for Professional Teaching Standards, the National Education Association, the American Federation of Teachers, and the National Commission of the Future of Teaching could, and perhaps should, come together to design and advocate for a national system of teacher assessments and a tiered licensure system, , this promising reform could easily fall short of expectations and fail to actually change teacher performance

or children's learning unless it explicitly articulated the content of contemporary child and adolescent development knowledge that teachers would be required to know as a result of preparation, methods for acquiring new knowledge as it emerged, and standards and assessments for measuring that knowledge and its application.

Throughout the prior discussion, frequent mention has been made of the science of child and adolescent development and its achievements that could and should inform teachers and be reflected in their practices. It would be a vast oversimplification however, to assume that knowledge of development, in and of itself, would improve teacher practices. Being able to describe language development or the importance of peer relations for middle schoolers will not lead to improved teacher practice or outcomes for students. Rather, it is important to identify sectors of this science that can then be applied to teacher preparation more systematically.

Policy Implementation in Teacher Preparation Programs—Barriers and Processes

Although there are a notable and growing number of exceptions, such as Teach for America, the Teaching Fellows programs in New York City and Boston, and Troops to Teachers, the vast majority of the hundreds of thousands of teachers in the United States are prepared in accredited teacher preparation programs in institutions of higher education. This infrastructure, consisting of a vast array of institutional, personnel, and programmatic resources is unwieldy, complex, often resistant to change, and increasingly the focus of scathing criticism for its failure to provide evidence of its benefits to its own students and the students they serve in pk-12 classrooms. Teacher preparation programs in colleges and universities embody a certain capacity that could be harnessed and improved through various points of leverage. Indeed, teacher preparation programs can and should focus on knowledge of child and adolescent development and skill in applying that knowledge in the classroom; however the fundamental nature of university-based teacher preparation poses obstacles to policy implementation that are critical to address if the full benefits of key policy shifts are to be realized.

Courses

No one would argue that teachers do not require a deep understanding of the subjects they will teach as well as the knowledge and skills necessary to help all students learn, or that preparing 18-21 year olds adequately in terms of knowledge and skills within the context of a time-constrained program does not present a significant challenge. The addition of a course provides the surest way to compliance with policy requirements and assures some level of exposure to the information deemed important; at the same time, however, courses vary considerably in nature and quality, and most evidence suggests that they contribute little to knowledge or skill. The creation of separate classes for each area of need also makes it easier to demonstrate to licensing and accrediting agencies that these important topics are covered, and that each passing student has experienced some level of exposure.

In the present context, it is not clear whether recommending additional coursework in child and adolescent development would improve teachers' knowledge, teaching quality, or students' learning. Clearly, whether or not additional coursework is needed (and in what form it is best-delivered) is both an empirical question and highly dependent on the availability of explicit, applicable content to teach. Credit for applying knowledge and the appropriate structures for supporting development of applied skills also require careful attention to the specification and assessment of skills. In all these areas of the teacher preparation curriculum, content, skills, courses, modules, practice — the substance and structure of the preparation program — the contemporary science of child and adolescent development must be both explicit and foundational.

Faculty capacity

The lack of knowledge on the part of the majority of teacher education faculty and P-12 school partners presents one of the greatest challenges to increasing emphasis on contemporary knowledge in child and adolescent development in the teacher preparation curriculum. In a high quality teacher preparation program, goals, activities, and assessments related to child and adolescent development knowledge and skills necessary for teachers must be clearly stated and easily identified throughout the curriculum, in courses, practica, assessments, and preparation milestones. Teacher education faculty members would engage in regular review of the program based on evidence collected from assessments and regularly update the curriculum on the basis of new knowledge in the scientific literature.

Snyder and Lit (2009) describe three different groups of faculty in teacher preparation programs; each group occupies a different status in the institution and wields a different influence on the curriculum. Those who teach courses are most likely to be in tenure track lines and have terminal degrees. They are highly specialized in one area of teaching, such as social studies, literacy, math education, early childhood education, and so on, and their research tends to be in their area of specialization. Clinical supervisors are more likely to be masters-level faculty with extensive classroom experience, and, though they are university employees who assign grades to teacher candidates and may be involved in curriculum design, they often have less influence on curriculum or program policies than do tenure track faculty members. School-based instructors are classroom teachers who work with student teachers and other practicum students, generally for little compensation. They have considerable input regarding the teacher candidate's performance in the practicum, but traditionally have had little influence on the curriculum. Accreditation standards and a few reform initiatives have motivated many teacher preparation programs to improve communication among these different faculty groups to ensure better program coherence and better overall preparation for teacher candidates. Nevertheless, the distinctive faculty roles remain, and they challenge the creation of coherent, effective, and efficient curricula. Add to this the fact that many teacher preparation programs employ large numbers of adjunct faculty (Darling-Hammond et al., 2005) and the challenge of reaching agreement on goals and curriculum priorities and communicating these effectively to all instructors further complicates matters.

Instructional resources and partnerships

Field experience and student teaching are crucial parts of the development of any new teacher; however, a strong foundation of coursework in content and pedagogy that includes knowledge of child and adolescent development must be integrated into ongoing opportunities so that candidates might experience key principles first hand. Further, opportunities to practice skills such as identifying the developmental needs of students, adjusting instruction to meet individual needs, and reflecting on practice, must be sufficiently extensive and intensive to allow teacher candidates to build solid foundations on which to begin professional practice. This may be most evident when comparing individuals pursuing alternate routes to teaching without student teaching to those who had quality field experiences; "…those who had student teaching experience seemed to show higher levels of

confidence in improving student learning, satisfaction with their teaching career, and a higher sense of efficacy." (Oh, Ankers, Llamas, & Tomyoy, 2005)

For field experiences to be most effective, they must reflect coherent design and implementation – design that is infused at its core with child and adolescent development knowledge and its application. Design elements range from selection of placement sites and cooperating teachers to the careful alignment of specific experiences with concepts and coursework (Burton & Greher, 2007). Programs must address not only the learning and experiences of the candidate, but also the ongoing development and support of field supervisors and cooperating teachers (Darling-Hammond & Baratz-Snowden, 2007). Just as an understanding of child and adolescent development is essential for university faculty to integrate important concepts into teaching, coursework, and assessments, the readiness of both cooperating teachers and field supervisors to address application of child and adolescent development knowledge is a prerequisite if they are to provide meaningful feedback or foster deeper levels of reflection among student teachers.

Field experience sites must be rich with diversity and a range of student needs in order for candidates to practice their craft with attention to child and adolescent development. For student teachers to infuse their teaching with developmentally appropriate practices, teacher preparation programs must identify and select P-12 school placements that already reflect an understanding of developmental issues. In fact, evidence of the application of child and adolescent development knowledge should not only be a criterion in selecting school sites, but should also be reflected in appropriate standards for accreditation of teacher preparation programs. This requires higher education institutions to have a working knowledge of school sites for all placements and field experiences associated with coursework.

It is not surprising that higher education institutions are challenged to implement practices that match student teachers with ideal cooperating teachers. For large institutions with high numbers of candidates in search of field experience each semester, it is a challenge to find an adequate number of placement sites, leaving aside the added difficulty of evaluating each placement for its alignment with the college's conceptual framework or building a collaborative relationship for activity design. Even in smaller teacher preparation programs faculty members are frequently stretched to their limits, rendering additional collaboration with faculty at field placement sites difficult. As noted earlier in this paper, faculty members who are assigned to supervise field experiences are often viewed as lower in status than faculty who primarily teach or those who focus their energy on research and publishing (Worthy, 2005). Attention to the quality of collaboration between teacher preparation programs and P-12 schools, however, is fundamental to site selections and candidate matches that result in child and adolescent development assuming centrality in the new teacher's development.

Whether through use of video or visits to classrooms, candidates should see and discuss teaching and learning strategies and begin to experiment with their own planning and delivery of instruction. At present, there is a dearth of such resources available, despite the exponential growth in the use of video to capture and analyze teaching and classroom interaction. For such efforts to be useful, certain "common denominators" — evidence-based

approaches to identifying effective practice — must be applied to video material; otherwise its utility in the effort to reform teacher education in limited. This requires that P-12 schools and university partners share a common understanding of the key principles to be observed and collaborate to identify and design meaningful opportunities to experience those principles in action (LeFever-Davis, Johnson, & Pearman, 2007; Oh et al., 2005). The Comer schools are one excellent example of child/adolescent development principles in practice in P-12 schools, and are exemplars for outcomes of child development principles. Program design elements also include the selection of placement sites and cooperating teachers to foster experiences carefully aligned with specific concepts and coursework (Burton & Greher, 2007).

Policy Recommendations

With the prior discussion in mind, the Panel makes the following recommendations for policies that will advance teachers' knowledge of child and adolescent development as well as the application of that knowledge in teacher preparation, certification, licensing, and practice.

Recommendation 1: Educator Preparation Program Role

1. A. Through dean/program director leadership, ensure that the contemporary knowledge base of child and adolescent development is a fundamental part of educator preparation. This knowledge base should be reflected in the college/school of education or other preparation provider's conceptual framework and assessment system, and also in that of individual programs within the college/school of education or other preparation provider's structure.

1. B. Through dean/program director leadership, ensure that candidates possess contemporary knowledge of child and adolescent development and its effective application in the P-12 classroom. Assessments of related proficiencies should include measures of candidate performance in the classroom, and require demonstration of candidates' skills in interacting with students and families, in cultural competence, in classroom management, in developing a positive and supportive learning environment, and in other key skills informed by knowledge of child/adolescent development. The assessments should provide evidence of candidates' ability to enhance P-12 student learning and development.

1. C. Through dean/program director leadership, candidate knowledge and application of child and adolescent development proficiencies should be integrated in a coherent manner throughout courses/field experiences and student teaching/internships. Candidates must have many opportunities to put their classroom learning into practice and receive continuing, frequent, and iterative feedback on their proficiency in applying knowledge of child/adolescent development from their highly qualified and skilled supervisors.

1. D. Through dean/program director leadership, provide professional development as needed for relevant faculty on contemporary child and adolescent development knowledge and its effective application in the P-12 classroom, including the development of appropriate assessments to ensure that faculty know how to help candidates improve P-12 student learning by applying principles of child/adolescent development.

Recommendation 2: Accrediting Body Role

2. A. NCATE should adopt standards for educator preparation programs that incorporate specific evidence of candidates' mastery of the core competencies identified with knowledge of child and adolescent development. All appropriate program components that are assessed for earning and maintaining accreditation status should be linked, in a significant way, to this knowledge base and its application. All NCATE specialized professional associations should incorporate this knowledge base as appropriate for their disciplines.

2. B. Educator preparation programs should assess candidate core competencies in knowledge and application of child/adolescent development at specified points throughout the program. The evidence required (including artifacts and processes) for successful accreditation should reflect candidate proficiencies.

2. C. Specialized professional associations should be encouraged to provide guidance and professional development to programs on the development and implementation of appropriate coursework, training modules, assessments, practicum experiences, and faculty expertise that reflect the competencies identified with application of child/adolescent development principles.

2. D. NCATE should address how to assure, through standards and processes, that faculty employed in educator preparation/licensure programs are proficient in the use of these core competencies. The evaluation processes, both program evaluation and faculty evaluation, should reflect attention and commitment to mastery and use of these competencies.

Recommendation 3: The State Role

3. A. A new regulatory strategy should require all beginning teachers — from any route — to meet common expectations. The knowledge base of child/adolescent development should be integrated into all routes to teaching.

3. B. States should redesign policies related to teaching effectiveness to assure that all teachers can demonstrate their ability to apply contemporary knowledge of child and adolescent development in P-12 classrooms to enhance P-12 student learning.

- States' program approval, teacher performance, professional development, incentive, evaluation, and licensure systems and standards should make explicit reference to and include measures of teachers' classroom performance that demonstrate their ability to apply contemporary knowledge of child/adolescent development to enhance P-12 student learning and create a positive and supportive environment for learning.

- States should design tiered systems for knowledge and skill levels and professional development that reflect those standards.

3. C. States should work with local districts as appropriate to ensure that the knowledge in child/adolescent development is incorporated into teacher performance, professional development, evaluation, compensation, and tenure decisions.

Recommendation 4: The Federal Role

4. A. The Elementary and Secondary Education Act, currently at the beginning of a reauthorization process, should include language that supports the creation and expansion of state and local professional development opportunities that will promote educators' knowledge and application of the science of child and adolescent development to curriculum, instruction, assessment, management, and organizational practices. Federal funding requirements should also include amending /revising current educator appraisal systems to include such competencies. Suggested specific actions include:

- Requiring evidence that professional development regarding the application of child/adolescent developmental principles improves teacher knowledge and skills and demonstrates a positive impact on P-12 student learning.
- Amending the definition of "highly effective" teacher to include mastery of the knowledge and application of the science of child and adolescent development.

4. B. The Department of Education review panels for any substantial programmatic funding (e.g. American Recovery and Reinvestment Act, Race To the Top) or research funding through the IES should include specific developmental content in the area(s) relevant to that competition. When relevant, explicit use of "knowledge and application of the contemporary science of child and adolescent development" should be added to review criteria for Department of Education grant programs, particularly those that pertain to teacher preparation and evaluation and to school turnaround. Review panels may also need to add developmental scientists to ensure that contemporary content is evident in review criteria and proposals.

4. C. 1. The NICHD and the IES should set aside funds for two competitions. The first competition will focus on identifying the contemporary and established scientific knowledge of child and adolescent development relevant to teacher preparation and developing valid measurements of that knowledge and its application. Nearly all other policy recommendations are predicated on identifying the contemporary knowledge base and assessing that knowledge in teachers and candidates. This competition should be given sufficient resources, structure, and support so that its goals can be achieved successfully within two years. A key deliverable from this competition should be the construction of a repository of video of teachers' classroom practices clearly demonstrating the application of child and adolescent development knowledge, as well as exemplars of child and adolescent development in the classroom setting, with the videos having met stringent criteria for demonstrating developmental principles and practices.

4. C. 2. The second focus of a joint NICHD-IES competition should focus on developing and building the science of implementation and classroom practice to address the knowledge gap identified early in this paper regarding the need for a much stronger and more robust scientifically-based understanding of the mechanisms that regulate teachers' classroom practices and their application of child/adolescent development principles. Given the considerable evidence supporting the importance of teachers for student learning and the extensive literature on child and adolescent development, we know nothing about the complex regulators of teachers' classroom practices and how to improve their capacity to use principles of child and adolescent development to foster student learning and development.

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