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Computerizing Social-Emotional Assessment for School Readiness: First Steps toward an Assessment Battery for Early Childhood Settings

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Introduction

The transition into formal schooling is a crucial foundation that can set children on a cycle of success or failure in both academic and social domains.[1–6] Further, children living in poverty and children of color already demonstrate a significant achievement gap as early as kindergarten.[7] Because of this gap, maximizing instructional effectiveness in preschool programs, including those serving children growing up in poverty, is a focus of much inquiry.[8,9] Researchers evaluating the success of these programs and policies for ameliorating the effects of poverty on school readiness[10,11] are now sorely in need of adequate measurement instruments, particularly in terms of direct assessments with young children.[12,13] Easily administered assessment tools could not only be useful for program evaluation but also could potentially assist early childhood educators in maximizing the success of specific children.

In our view, preschoolers' overall school readiness includes both *classroom adjustment* and *academic readiness*. *Classroom adjustment* can be defined as young children's behaviors and attitudes associated with learning in the classroom environment, such as positive approaches to learning (e.g., competence motivation, attention/persistence[14]), as well as abilities to participate both cooperatively and self-directedly in classroom activities, enjoy comfort with teachers, and like school.[15] Children who demonstrate such classroom adjustment are more accepted by classmates and teachers and are given more instruction and positive feedback by teachers. Thus, we view *classroom adjustment* as a crucial outcome for a successful introduction to schooling.

Young children's *academic readiness* is defined as mastery of certain basic skills that help ensure success in the new learning environment of formal schooling.[16] We center our thinking on literacy and numeracy, which reflect attainment of specific pre-academic readiness milestones.

Further, regarding both school readiness and its assessment, early childhood social-emotional learning (SEL) has recently become an important focus of interest, because of its conceptual and empirical linkages with classroom adjustment and academic readiness.[12,17,18] As Zins and colleagues[19] have noted, "schools are social places, and learning is a social process" (p. 191). Even young students learn alongside and in collaboration with teachers and peers and must be able to utilize their emotions to facilitate learning. During schooling, a child's abilities to regulate emotion, attention, and behavior, understand emotions of self and other, make good decisions regarding social problems, express healthy

emotions, and engage in a range of prosocial behaviors all work together to grease the cogs of a successful school experience.[20]

A preschooler who has attained age-appropriate SEL skills may be able to pay more attention to academic tasks, plan better, and devote more resources to learning than one who has not, *because* s/he can benefit more from teachers' instructions, get and give academic information from peers, share academic resources with peers, and model peers' learning skills.[21] However, many children have deficits in these skills by the time of school entry,[22] and educators lack the requisite tools to identify, track, and assess skills these children need to learn.

Because SEL is so crucial, research-based, social-emotional assessment tools with strong empirical predictive validity for classroom adjustment and academic readiness need to be adapted for practical instructional and outcomes-based use in early childhood educational settings. When adapted, such classroom-based assessments could serve to (1) allow teachers to track students' progress and inform instruction (formative assessment); (2) measure children's outcomes (summative assessment); and (3) provide program accountability and evaluation.

The need for such adaptation can be succinctly described via 4 propositions. First, classroom adjustment and academic readiness in kindergarten are associated with early achievement—starting children off on positive readiness trajectories at school entry is important for later academic success.[23,24] Second, children's abilities to regulate their behavior, emotions, attention, and effort (i.e., self-regulation[25]) and get along well with others (prosocial skills) are identified as among the most important skills supporting school readiness.[23] Third, despite widespread evidence and recognition of these skills' importance to classroom adjustment and academic readiness, we lack reliable and valid assessments of these skills that can be reasonably administered by teachers in childcare, Head Start, and prekindergarten classrooms. Finally, state education systems and Head Start programs are increasingly including other SEL skills in prekindergarten learning standards, including emotion knowledge (emotion labeling and recognition as well as understanding relations between emotions and behavior) and social problem-solving (i.e., the early childhood aspect of responsible decision making), yet we also lack psychometrically sound ways to assess these skills.

Given these propositions linking school readiness and SEL, enunciating the need for SEL assessment for early childhood, we pursue the following goals in this article. First, we build the case that SEL is crucial to early school readiness and success, giving a theoretical

foundation for SEL's importance as well as empirical evidence of its components' prediction of school readiness and early school success. Next we put forward possible processes by which SEL may operate as a predictor of school readiness. Then we move on to consider why assessment is important in early childhood, both generally and more specifically for SEL, with further consideration of using technology, particularly computerization, in implementing such assessment. We give examples from our work of direct assessment and observation measures of SEL, with plans for computerizing them. Finally, we address several important considerations with regards to computer-based assessment, including the contents and utility of summary reports and the integration of assessments into regular classroom practices.

Why SEL Is Important to School Readiness: Theoretical and Empirical Foundations

We have already asserted that components of SEL are central to young children's school readiness during the preschool period and early academic success as they transition into the elementary classroom. But consideration of SEL requires grounding the multifaceted construct in a theoretical perspective. We view SEL development through an organizational, bio-ecological lens, in which specific developmental tasks are central to each age, undergirded by maturing neurological structures.[26,27] This perspective organizes stability and change in development key tasks and constructs, influenced not only by within-child abilities, processes, and biological predispositions but also by the immediate environment of the child (e.g., interactions of the child with parents or teachers), transactions between elements of the child's immediate environment (e.g., parent-teacher communication), elements outside the child's immediate environment that nevertheless impact it (e.g., demands on parents' time and energy, parent psychopathology), and the broader social/political context of the child's world (e.g., the No Child Left Behind Act).

The SEL tasks specific to early childhood center on: (1) maintaining positive engagement in the physical and social environment, as well as (2) managing emotional arousal and other aspects of more cognitive self-regulation, while (3) maintaining positive social interaction with peers and adults.[28,29] Success in these areas may not be easy for children just entering pre-academic and academic settings. Preschool and kindergarten contexts are taxing for children to navigate. For example, children are often required to sit still, attend, follow directions, and approach/enter group play. The tasks of remaining productively involved, emotionally

positive, calm, focused, and available for sustained interactions with others are difficult in the new contexts inherent within schooling. Thus, it is important to assess these developmental tasks as benchmarks against which to evaluate a preschooler's SEL success; all components of SEL are operative in the service of these developmental tasks.

To explain, describe, and evaluate such wide-ranging developmental tasks theoretically, a broadband approach is necessary—over-reliance on any one behavior or set of behaviors can lead to misleading conclusions. To this end, an adaptation of Rose-Krasnor's theory[30] and that of Payton and colleagues[31] helps in constructing a detailed working definition of SEL (see Figure 1 for our prism model of SEL).

We put forward the definition of the construct (SEL) at the model's topmost level, as *effectiveness in interaction, the result of organized behaviors that meet short- and long-term developmental needs*. This overarching definition is then differentiated in lower levels of the prism. For example, SEL success can be viewed by the self, others, and the social group as a whole—it is an intrapersonal and interpersonal goal, evaluated in varying contexts (see also the third dimension of the model, i.e., contexts in which SEL is played out).

Finally, the more microanalytic elements of our view of SEL meet the specific developmental tasks of early childhood already enumerated; at the model's lowest level, these are primarily individual skills. All are vital contributors to a child's ultimate successful, effective interaction. At this level, we enumerate 4 core SEL competencies for our assessment battery, as noted above: self-regulation, social awareness, responsible decision making, and relationship/social skills.[19,31] Given a clear theoretical perspective, we can move on to consideration of evidence for SEL's contributions.

Each core competency has its own theoretical traditions and voluminous empirical literatures. Below, we briefly define each competency, based on current theoretical viewpoints, and provide empirical evidence for their associations with social competence, classroom adjustment, and academic success. In addition to reviewing research conducted by others, we then review results we are obtaining with our own current SEL measurement battery, which forms the basis of our current computerization efforts.

Our SEL assessment battery includes the developmentally appropriate, direct and observational measures of each aspect of SEL already outlined, which we studied in our Assessment Consortium research, funded by the National Institute of Child Health and Human

Development, Administration for Children and Families, Head Start, and the Office of Special Education and Rehabilitative Services.-funded These measures were (1) self-regulation (the Preschool Self-Regulation Assessment—PSRA[32]); (2) emotion knowledge (Affect Knowledge Test—AKT[33]); (3) responsible decision making/social problem solving (the Challenging Situation Task—CST[34]); and (4) social behavior and emotional expressiveness/regulation (the Minnesota Preschool Affect Checklist-Revised—MPAC-R[11]). It is in reference to this battery that we then discuss steps being taken to adapt the measures for computer-based assessment. These measures are described in greater detail in later sections, as part of our Computerized Assessment for Preschool SEL (CAPSEL) battery, which is currently under development – an example of potentially efficacious computerized assessment tools in this area. CAPSEL is currently under development, and we share its potential here.

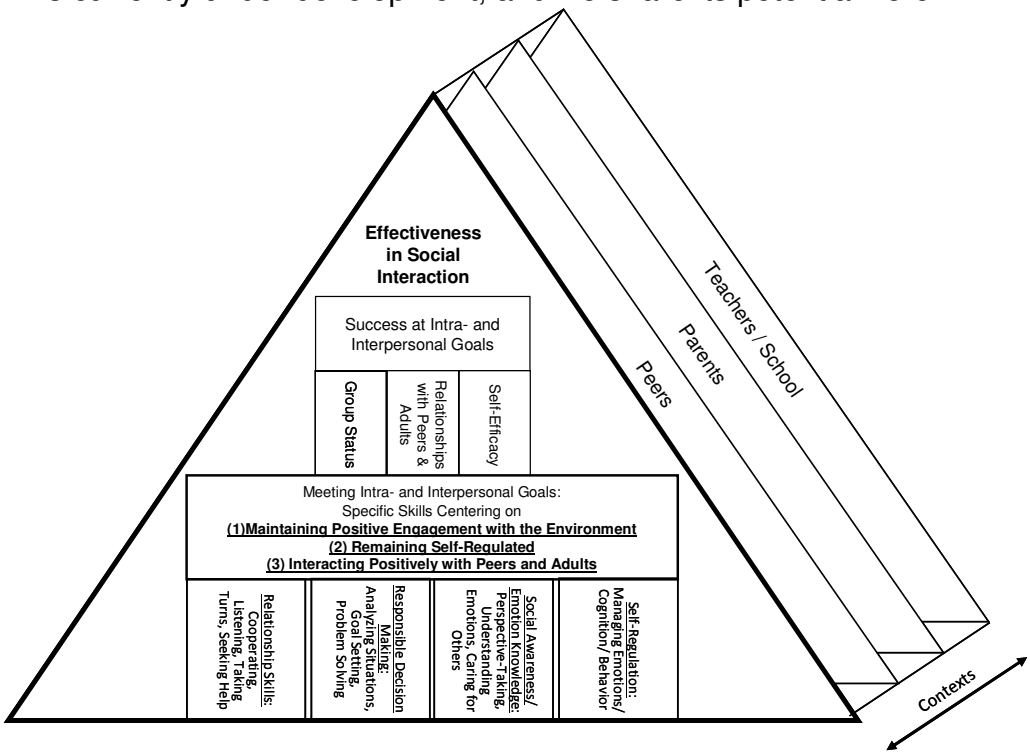


Figure 1. Adaptation and integration of the Rose-Krasnor[30] model of social competence and the Payton et al[31] model of social-emotional learning, showing specific skills level with emotional competence and social problem skills specifically delineated. Please note that we include all but one of the CASEL SEL skills,[31] although we use the term self-regulation rather than self-management to remain consonant with the broader literature on this topic. In addition, we do not include self-awareness due to the relative paucity of literature relating it to early school readiness and success, probably due to the smaller number of excellent measurement tools in this area for early childhood.

Self-regulation

Broadly speaking, self-regulation involves 3 aspects of regulation: emotion, cognition, and behavior. Emotion regulation includes the abilities to: (1) handle one's emotions in productive ways, be aware of feelings, monitor them, and modify them when necessary so that they aid rather than impede the child's ability to cope with varying situations; and (2) express emotions appropriately.

At the same time, important nonemotional aspects of self-regulation are paramount to success in the preschool-to-primary years; these include being able to use executive function skills (e.g., working memory, attention, and inhibitory control) in the service of regulating both social and academic behavior. Recent advances in both developmental psychobiological theorizing and research and neuroimaging suggest that 2 types of executive function are distinguishable, both neurally and behaviorally, and that such distinctions can be important both theoretically and practically.[35,36] Therefore, we consider that cognitive aspects of self-regulation include cool executive control (CEC; more affectively neutral, slow acting, and slow developing) and hot executive control (HEC; more reflexive, fast acting, early developing, and under stimulus control).

Relations of self-regulation to classroom adjustment and academic readiness. Children's abilities to regulate emotion, cognition, and behavior have been related to their school/classroom adjustment and academic achievement.[8,25,37] In terms of emotion regulation, children who have difficulties dealing with negative (or even positive) emotions may not have the personal resources to focus on learning, whereas those who can maintain a positive emotional tone might be able to remain productively engaged with classroom tasks. Research shows that maternal and teacher reports of constructive modes of emotion regulatory coping are associated with success with peers and overall social effectiveness during the preschool years.[38-40]

Focusing more specifically on classroom adjustment, Shields and colleagues[41] assessed Head Start teachers' views of preschoolers' adaptive emotion regulation, including emotional flexibility, equanimity, and the contextual appropriateness of their emotional expressions. Emotion regulation rated early in the fall predicted children's spring school/classroom adjustment (i.e., an aggregate evaluating pre-academic progress, cooperation, and engagement in the classroom, positive relationships with staff, and enjoyment of school), even after accounting for the contributions of age, verbal ability, emotional lability, and emotion knowledge. Graziano et al[42] also found that parent ratings of children's emotion regulation predicted teacher reports of kindergarteners' academic

success and productivity, as well as standardized literacy and mathematics assessments, even with the contribution of IQ removed.

Similarly, Trentacosta and Izard[43] found that kindergartners' teacher-rated emotion regulation predicted first graders' attentional regulation (i.e., "pays attention, works well alone"), which in turned predicted early academic success, even with age, verbal ability, and early attentional regulation held constant. In these results, we see a trajectory of different aspects of regulation working together to contribute to early academic success—that is, emotion regulation supported or promoted behavioral and cognitive regulation, which in turn promoted academic success.

Researchers have also observed preschoolers' classroom emotion regulation and found that even mild negative emotional expressiveness was negatively related to children's persistence and learning attitudes (i.e., the positivity with which they approached school tasks), whereas observed emotional dysregulation was negatively related to children's motivation to learn (i.e., their willingness to try new, difficult tasks).[44] Other researchers have directly assessed emotion regulation. Howse et al,[37] using a direct assessment series of frustration tasks as well as teacher ratings of children's emotion regulation, found that preschool emotion regulation predicted kindergarten achievement; this effect was, however, mediated by the contribution of behavioral regulation, similar to Trentacosta and Izard's[43] results.

The more cognitive aspects of self-regulation clearly are also important in their own right. For example, Liew et al[45] found that, after accounting for numerous covariates, first grade inhibitory control (an aspect of CEC, e.g., being able to walk on a line and trace a star) predicted third grade reading scores. In a study that examined attentional and inhibitory control (both aspects of CEC) and tested more complex models of self-regulation's contribution to early academic success, Valiente et al[46] found that attentional and inhibitory control were indeed related to academic success but that children's school liking (another aspect of early classroom adjustment) mediated this association, even with contributions of parents' education and family income removed. Thus, children who exhibited more mature cognitive self-regulation (CEC) liked school more and subsequently demonstrated greater academic success.

Valiente and colleagues[46] raise the issue of important contextual mediators, as well as the multifaceted nature of early academic success. That is, self-regulation did not necessarily predict academic success exclusively directly—at least in part, cognitive aspects of self-regulation

seem to promote the child's positive experience in school, which even more directly accounted for thriving academically.

Other researchers examining *behavioral* aspects of regulation—"regulation in action"—have focused even more simply on young children's ability to carry out complex directions, finish tasks, concentrate, ask questions, seek help when necessary, and enjoy challenging tasks as behavioral demonstrations of regulation. Howse et al[37] found a direct relation between this form of regulation and kindergarten achievement.

Along these same lines, an ingenious task centering on such behavioral regulation abilities—in this case, to remember instructions, pay attention, control motor responses, and inhibit a dominant response—has been recently created. Using this Head-Toes-Knees-Shoulder task (HTKS; e.g., when children are asked to "touch your head," what they really must do is to touch their toes), Ponitz et al[47] have shown that kindergartners who perform more proficiently on the HTKS task in fall showed greater achievement in spring, especially in mathematics. Similarly, McClelland and colleagues[25] found that preschoolers' behavioral regulation, as indexed by Head-to-Toes task (a simpler version of HTKS), predicted fall and spring literacy, vocabulary, and math skills. Moreover, growth in behavioral regulation predicted growth in such early academic success, even with contributions of site, child gender, and other background variables held constant.

Another approach to the measurement of self-regulation, the Preschool Self-Regulation Assessment (PSRA), includes cognitive/ attentional, emotional, and behavioral aspects of self-regulation. The PSRA uses a collection of field-based assessment tasks to examine self-regulation comprehensively. In their development of the PSRA, Smith-Donald et al[32] found that preschoolers' ability to maintain emotional positivity, pay attention, and control impulses were related to both their early mathematics and verbal skills. The PSRA also demonstrated expected associations with children's behavior problems and competencies.

In recent work with the PSRA, we have found that there were 3 related but distinct factors in young children's cognitive/behavioral self-regulation as measured by the PSRA[48]: CEC, HEC, and compliance. This 3-factor structure was fully equivalent across race and center types—Head Start or private child care—and partially equivalent across gender and age. Moreover, many of the PSRA tasks predicted (controlling for age, gender, and risk status) with teachers' ratings of children's academic readiness, both predictively and concurrently (see also Willoughby et al[35] and S.A.D. et al, unpublished data, 2012). In other research with the same

sample, a shortened version of the PSRA, based on ceiling effects found, was created; it showed that CEC and HEC differentially predicting preschool readiness. HEC, being able to delay impulses, predicted attention/persistence, attitudes toward learning, and lack of anger/aggression, and social sensitivity/cooperation (the first 2 also in kindergarten). CEC, reflected in inhibitory control, attention, and working memory, predicted competence motivation in both preschool and kindergarten and academic success in kindergarten.[49] Given our success with this measure, we include it in our CAPSEL battery. In short, several aspects of regulation enhance children's classroom adjustment and academic readiness across the age range are considered here. All aspects of regulation that are increasingly studied in the preschool period—emotion regulation, executive control, and their union in behavioral regulation—are important aspects of SEL that ought to be promoted and assessed during early childhood.

Social Awareness

This aspect of SEL includes the ability to take others' perspectives, understand and empathize with their feelings, and appreciate others' similarities and differences. Children constantly attempt to understand their own and others' behavior; emotions convey crucial interpersonal information that can guide interaction.[50] The inability to interpret emotions can make the classroom a confusing, overwhelming place.[51] Because of the centrality of emotion knowledge, we focus upon it here.

Relations of social awareness to social competence, classroom adjustment, and academic readiness. Young children's emotion knowledge contributes to their overall social competence; it is related to their positive peer status and prosocial reactions to peers' and adults' emotions.[52-55] More recent research by Izard and colleagues[56,57] corroborates these assertions: Head Start children's emotion knowledge predicted both contemporaneous and later teacher reports of social functioning (see also Smith's[58] results predicting peer acceptance). In particular, misattributing anger was related to peer rejection and boys' aggression. These findings regarding both concurrent and predictive relations between emotion knowledge and preschoolers' social competence are well established.

Increasingly, researchers are also confirming a link between early classroom adjustment and academic success and young children's emotion knowledge. For example, Leerkes et al[59] showed that emotion knowledge—and not emotion regulation—was related to preschoolers' pre-academic achievement (see also Garner & Waajid[60] for relations

between low-income preschooler's emotion knowledge and both classroom adjustment and achievement). Shields and colleagues[41] also found that Head Start preschoolers' emotion situation knowledge predicted later classroom adjustment, even with contributions of age, verbal ability, emotional lability, and emotion regulation held constant. Similarly, Izard et al.[56,61] found strong evidence that 5-year-olds' emotion knowledge predicted both their age-9 social and academic competence. Thus, it is evident that children's ability to understand emotions, especially in context, plays an important role in their concurrent and later academic success.

Researchers using the Affect Knowledge Test (AKT)[33] have found that children who apply their more substantial emotion knowledge in emotionally charged situations have an advantage in peer interaction; they are more prosocially responsive to their peers and rated as more socially skilled by teachers and more likable by their peers.[33,39,61,62] Lack of emotion knowledge puts the preschooler at risk for aggression.[62]

More specifically addressing classroom adjustment and academic readiness, other recent research with the AKT has uncovered 2 related but distinct factors of emotion knowledge (i.e., recognition and situational understanding) that predicted preschool classroom adjustment and social competence (S.A.D. et al, unpublished data, 2012).[63-64] This 2-factor structure of young children's emotion knowledge was fully equivalent across race and gender and partially equivalent across age and center types. In addition, preschool AKT scores are predictively related to indices of classroom adjustment in kindergarten, as well as kindergarten teachers' evaluations of mathematics, literacy, and general knowledge.[64] Given our success with this measure, we include it in our CAPSEL battery.

Responsible decision making and relations of social problem solving to social competence, classroom adjustment, and academic readiness. As the everyday social interactions of preschoolers increase in frequency and complexity, young children must learn to solve social problems—to take in social situations, set prosocial goals, and determine effective ways to solve differences that arise between them and their peers. Not as much research exists in this area as for self-regulation and social awareness aspects of SEL. However, an early meta-analysis of interventions focusing on such social problem solving showed that children's use of such skills is in fact related to their improved social behavior.[65] Various aspects of social problem solving are related to preschoolers' social competence.

For example, encoding of social information is differentially related to social functioning. Using the Challenging Situations Task (CST[34]), Coy

et al[66] found that preschool boys diagnosed with oppositional defiant disorder generated more aggressive alternative solutions. In tracing the reason for such aggressive solutions, Coy et al[66] found that the diagnosed boys demonstrated less accurate encoding of social information; they did not differ from nondiagnosed boys in interpreting already encoded social information. Capage and Watson[67] also found important individual differences in aggressive and nonaggressive preschoolers' goals for social problem solving. Finally, Ziv and Sorongon[68] found that preschoolers' response evaluation, in particular their positive evaluation of aggressive responses, were related to both sociodemographic risk and their aggressive behavior, partially mediating links between risk and aggressive behavior in preschool. In short, all aspects of social information processing have been related to aspects of preschoolers' social functioning, particularly to their aggressive behavior.

Other reports[69-71] have found links between social problem solving and academic success, as well as the advantages of learning specifically *prosocial* problem solutions. For example, children's emotional and behavioral responses to hypothetical peer dilemmas of the CST were related to teachers' concurrent and later assessments of children's classroom adjustment, social competence, and their kindergarten academic progress.[72] Specifically, children who indicated on the CST that they would be sad in the face of peer provocation but still picked prosocial solutions to this problem were seen as academically successful, even with age, gender, and earlier school adjustment held constant.

Bierman and colleagues[10] have also shown that Head Start preschoolers' competent and less skillful behavioral choices on the CST were related to concurrent emotion knowledge and to end-of-year vocabulary and literacy. In person-centered approach with the CST, Denham and colleagues[73] identified 5 groups of preschoolers based on their emotional and behavioral response choices with respect to situations of peer provocation: 1) Happy/Passive, 2) Sad/Socially Competent, 3) Angry/Passive, 4) Angry/Aggressive, and 5) Sad/Passive. Further analyses showed that, compared to children in the Sad/Socially Competent group, children in other groups were later rated as demonstrating relatively poor classroom adjustment and academic readiness, even with contributions of gender and economic risk held constant. Given our own and others' success with the CST, we include it in our CAPSEL battery.

Relationship Skills

The goal in this aspect of SEL is to promote positive and effective exchanges with others and ultimately to develop relationships that last over time. Numerous skills are crucial at this level, including making positive overtures to play with others, initiating and maintaining conversations, cooperating, listening, taking turns, seeking help, joining others in play, expressing appreciation, negotiating, and giving feedback. In addition, assertion, conflict resolution, and negotiation develop during the preschool-to-primary period.

Relations of relationship skills to social competence, classroom adjustment, and academic readiness. Children with poorer social skills are more likely to have difficulties with peer relationships and thus, indirectly, with school adjustment.[74-81] Unpacking this indirect relation, Normandeau and Guay[82] have found that kindergartners' prosocial behavior predicts their cognitive self-regulation in first grade, which then predicts first grade achievement. Prevention/intervention results also show social skills to be associated with school adjustment.[83]

Numerous researchers have found that the social skills constituting this component of SEL are even more directly related to early academic success. In a sophisticated structural model examining an amalgam of social skills, Elias and Haynes[84] (see also Welsh et al[85]) showed that initial social competence and improvements in social competence (i.e., cooperation, self-control, and assertion) predicted third graders' end-of-year grades in reading and mathematics; this held true especially for African American students.

Examining prosocial behavior (e.g., cooperating, sharing, and helping) more specifically, Caprara and colleagues[86] found that self-rated, peer-rated, and teacher-rated prosocial behavior in third grade formed a coherent latent variable that predicted academic achievement (grades) 5 years later, even with earlier academic achievement held constant. In fact, with prosocial behavior in the structural model, earlier achievement did *not* predict later achievement. Moreover, peer and teacher ratings of aggression did not predict later achievement. (See also Malecki and Elliott's study[87] of third and fourth graders for similar prediction from social skills to later academic success, without any contribution by problem behaviors.)

Bierman et al[88] also had a similar focus. However, their teacher rating aggregate of Head Start preschoolers' "prosocial behavior" also included both understanding feelings and resolving social problems, along with specifically prosocial behaviors. This prosocial rating aggregate was related to academic achievement (i.e., early literacy and mathematics

skills), especially for girls. Profile analyses showed that children high in aggression and low in prosocial behavior had the biggest deficits in school adjustment problems (e.g., not following rules, lacking enthusiasm). However, only prosocial deficits—again, not in combination with aggression—negatively predicted academic achievement.

Finally, social skills play significant roles in predicting promotion and retention after first grade.[89] In fact, children with poor social skills/ peer relationships are at increased risk of eventually dropping out of school.[78,90-93] The power to behave prosocially with one's peers resonates powerfully, predicting not only more broadly grained views of social success, such as peer and teacher ratings, but also extending to classroom adjustment and "harder" indices of school success. Finally, social skills play significant roles in predicting promotion and retention after first grade.[89]

In terms of lack of social skills, researchers using the Minnesota Preschool Affect Checklist-Revised (MPAC-R)[11] showed that negative affect/aggression observed in the preschool setting were negatively associated predictively and concurrently with teachers' ratings of preschoolers' and kindergartners' social competence and classroom and kindergarten academic success, even with contributions of age, gender, and socioeconomic risk held constant (S.A.D. et al, unpublished data, 2012).[94,] Emotionally regulated, prosocial behaviors were marginally positively predictive of preschool social competence and classroom adjustment and kindergarten academic success. Given our success with this measure, we include it in our CAPSEL battery.

SEL Skills Working Together

With theoretical models and empirical support, we have reviewed how each SEL skill uniquely relates to children's concurrent and later social competence, classroom adjustment, and academic success. Knowing how various SEL skills work together to predict children's school adjustment and academic readiness is beneficial to understanding a big picture. The prediction of later school adjustment and academic achievement provided by Bierman et al's[88] aggregate is a beginning toward such integration.

In this regard, one way to examine SEL skills working together is from a person-centered approach. For example, we have used the AKT, CST, PSRA, and MPAC-R to find clusters of children with similar profiles.[95] Based on these operationalizations of all 4 SEL components examined here, 3 groups were found: SEL Competent-Social/Expressive, SEL Competent-Restrained, and SEL Risk. The children with these 3 profiles of SEL competency differed on later classroom adjustment in

preschool and on classroom adjustment, social competence, positive relationships with one's teacher, and academic success in kindergarten.

Further, using a variable-centered modeling approach, Denham and colleagues (S.A.D. et al, unpublished data, 2012) created a path model of SEL skills predicting school adjustment and academic success. In this model, significant paths were found from (1) self-regulation to social awareness, social problem solving, and relationships skills; and (2) social awareness to relationships skills. In addition, each SEL skill directly and indirectly through other skills predicted later school adjustment (social competence and classroom adjustment aggregated) and academic success.

Components of SEL are likely interrelated.[44,96] Thus, it is important to consider the "big SEL picture" in predicting social competence, classroom adjustment, and academic success, both during preschool and later. These results pulling together the 4 aspects of SEL underscore the importance of SEL to these outcomes.

Processes linking SEL and social competence, classroom adjustment, and academic readiness. In short, young children who exhibit age-appropriate SEL skills are likely to succeed as they enter school. By what processes do these SEL skills afford children such advantages? Many benefits accrue when one is capable of mutually satisfying experiences with peers and adults within the social setting of the classroom. First, one cannot underestimate the direct influence of SEL on such satisfying social experience—when SEL milestones, such as the regulation of negative emotion, are not negotiated successfully, preschoolers are at risk for psychosocial difficulties, both at the time and later in life.[97-101] Further, as already noted and zeroing in more specifically on academic readiness, a young child with SEL skills is likely to pay better attention in school, plan tasks and interactions more skillfully, and have more personal resources for learning than one who lags in SEL skills. Having SEL skills also enables a child to be attuned to teachers' instructions, collaborate with peers during classroom tasks, and "learn how to learn" from peers.

But by what sorts of processes are such salutary outcomes attained?[20] Self-regulation and relationship skills are likely linked with academic readiness via *engagement processes* or the amount of time the child chooses to engage in a specific activity (e.g., whether attending to the teacher in a classroom or choosing to attend to a peer in need of emotional soothing). Relational processes—bidirectional exchanges among persons, including reciprocally evoked interactions and the subjective interpretation of the exchanges—also work dynamically to link

SEL skills, especially relationship skills and social awareness, with academic readiness. For example, prosocial interchanges can elevate mood, which facilitates learning and vice versa.[56,88] Such positive interactions with teachers and peers also promote language, cognitive, and social information processing development.

Finally, social awareness and responsible decision making are likely dynamically related to academic readiness via *representational processes*—including encoding, interpreting, and organizing information when engaged in learning opportunities and social encounters. That is, the exchanges between persons and the child's experienced environments—whether interpersonal or academic—are interpreted, organized, and stored in memory to be translated into mental models or schemas that inform subsequent exchanges.[102,103] SEL components of understanding others' emotions and social problem solving likely impact academic readiness via such knowledge structures that accompany children in everything they do. For example, children who do not understand emotions and who have hostile social problem-solving biases would enter the classroom sphere of learning at a distinct disadvantage with teacher and peers alike.

Why assess SEL? In summary, all aspects of SEL considered here as foci of our measurement efforts—self-regulation, emotion knowledge, social problem solving, and relationship skills—are related, via several processes, to early childhood and primary academic success, broadly defined as social competence, classroom behaviors, approaches to learning, and "harder" academic data. Much work with our own assessment tools has added to this body of research. However, given that SEL appears intimately associated with academic success, we need to consider what decisions should be made regarding assessment of SEL. To begin to answer this question, we introduce issues surrounding broader early childhood assessment.

Early Childhood Assessment

The broader topic of assessment during early childhood, its relation to academic readiness, and its use in intervention and policy is hotly debated at local, state, and federal levels.[104,105] The general consensus now is that we need to utilize assessments that yield the most-needed, developmentally grounded information, most economically and most ethically in terms of teacher, parent, and child time, effort, and attention.[106-108]

Thus, assessment should be developmentally appropriate, integrated with curricula, beneficial to all parties, often based on ongoing

teacher observation, primarily reliant on the child's everyday activities, and culturally and linguistically responsive. Data emanating from such assessment should, moreover, not be used for high-stakes decisions, such as retention in kindergarten. Instead, assessment, whether summative or formative, is performed to improve and understand learning, understand individual level and classroom-level strengths and weaknesses, promote improved instruction, and evaluate programming. Finally, assessment should be "gathered from realistic settings and situations that reflect children's actual performance" (p. 2),[109] suggesting that the direct and observational assessments proposed here are in fundamental alignment with current educational thinking.

SEL Assessment in Particular

The last decade has witnessed a blossoming of educator and policy attention to SEL during early childhood as crucial for both concurrent and later well-being and mental health, as well as learning and academic readiness.[110-112] In fact, a content analysis of the early learning standards in 46 states has revealed that SEL is now well represented, albeit with fewer indicators and in less systematic ways compared to cognitive skills.[113] More and more states (e.g., Washington, California, Illinois, and Alaska) have standards for SEL starting at early childhood.

At the national level, new legislation has been introduced, authorizing the US Department of Education to allocate funds for technical assistance, training, and programming.[114,115] Moreover, views from "the trenches" of early childhood education, especially from those serving children at risk due to low income and/or membership in racial, ethnic, and linguistic minority groups that historically have underachieved academically, point to an urgent need for SEL programming and assessment.

For example, Buscemi and colleagues[116] have specifically reported that Head Start programs cite emotional-behavior issues among their top needs for training and technical assistance. Similarly, teachers view children's "readiness to learn" and "teachability" as marked by positive emotional expressiveness, enthusiasm, and ability to regulate emotions and behaviors.[22] In fact, kindergarten teachers have reported that regulatory aspects of children's behavior are especially essential for kindergarten readiness.[117] As well, educational researchers have discovered parents' and teachers' beliefs about the advantages of SEL: when ". . . children can interact meaningfully with each other and adults, follow simple rules and directions, and demonstrate . . . independence in

the classroom . . . , then kindergarten teachers could teach them the other academic skills and knowledge . . .” (p. 357).[118]

Because SEL skills are so important and viewed as such not only by academicians but vehemently by early childhood educators, parents, and even political bodies, it would behoove us to be able to assess them well. Moreover, “what’s measured gets treasured”: if we assess early childhood SEL well, we can make better decisions about how to facilitate children’s functioning.[12] That is, formative and summative functions of assessment should be undertaken to effectively identify children needing intervention or higher level services, highlight specific needs of children and classrooms in terms of programming, and show overall effects of programming.[119,120]

As was described above, our research team has compiled and tested an assessment battery to measure self-regulation (PSRA), emotion knowledge (AKT), responsible decision making/social problem solving (CST), and social behavior and emotional expressiveness/regulation (MPAC-R). In the preceding sections, these measures have been shown to predict social competence, classroom adjustment, and academic readiness.

We argue that this battery needs to be adapted, to maximize utility and feasibility in preschool, Head Start, and child care classrooms for both formative and summative child assessments and classroom/program evaluation. That is, we wish to move from research-based assessments to in-class tools administrable by teachers and other educational personnel, to inform overall classroom instruction and instructional plans for specific students, and to generate outcome data as well for classroom or program accountability. In order to do so, one possibility that looms large is to adapt these measures to be administered using computers.

Why Make Greater Use of Technology in These Assessments?

In order to be used, especially in the busy early childhood classroom, assessment tools need to be easy to administer. Computerized means of assessment fit this requirement. Other principal advantages of computer-based systems over conventional assessment methods are that (1) assessment can be more precise and (2) significant savings can be made in both time and labor. Computerized assessment can usually be administered more speedily than by conventional methods, and scoring can be immediately available, without error-prone optical scoring. Moreover, direct assessments and observations, which are arguably essential means of assessing *anything* during the early years, can be standardized when they are computerized, and training for assessment

administrators (i.e., teachers or educational resource personnel in Head Start) can be dramatically reduced and streamlined.

Finally, computer-based assessment can also take advantage of the capabilities of the technology for animation, speech, and sound, rendering the assessments more similar to direct assessments in their attractiveness to children.[121,122] In fact, young children engage with educational software as soon as they can manipulate the mouse, touchscreen, or keyboard.[123] They show intense interest and pleasure, and surprising stamina, in interacting with computers.[124-127] Thus, computer use, whether for instruction or assessment, can be a highly motivating, positive experience for young children. Furthermore, computers are more integrated into the world of early childhood than even previously. Computers are now common in the early childhood classroom, used for many functions.[123,128]

We should note that others have attempted to create computer-based measures of constructs similar to our work. Regarding self-regulation, computerized flanker tasks have been used by, for example, McDermott et al[129] and Rothbart[130]; a few other attention-focusing and response-inhibition tasks have been created with children as young as 2 years old in mind.[131,132] Computerized card-sorting tasks have been used, largely with older children[133,134]; mostly noncomputerized card-sorting tasks have been used with younger children,[135] although a few computerized versions have been developed.[136,137] In terms of emotion knowledge/social awareness, Parker et al[138] and Perlman et al[139] have created computerized emotion knowledge measures for preschoolers (in fact, Perlman et al created a program that closely parallels the AKT). To our knowledge, no computerized social problem-solving/responsible decision-making measure has been used with young children, although Kupersmidt et al[140] have created a web-based measure for elementary-aged children. Sarkar and colleagues,[141] Greenwood et al[142] and Roberts[143] have created computer observational programs suitable for assessing relationship skills, but all are either too inclusive of non-SEL domains of development or not inclusive enough of varying SEL skills. In general, these measures are for research purposes, not shortened or piloted for applied use, and not combined into a battery.

Further, we must consider one main end user of such a computerized assessment battery—the teacher. Teachers' use of computers in the classroom is a complex phenomenon, related both to teachers' beliefs about the child- or teacher-centered nature of education and their attitudes toward technology integration, as well as contextual conditions in their teaching environments, including technical support and

the nature of their students.[144] More specifically, preschool teachers generally consider the computer a positive part of the preschool classroom, a great tool to enhance development, but also see that time and resources can be a barrier to working with the computer.[145] Nonetheless, overall, although they bring varying expertise with computers to the classroom, early childhood teachers show increasing acceptance of technology use.[146]

Because of this complexity, however (and because it is the right thing to do), teachers need to be partners in assessment development. In attempts to computerize our preschool SEL battery, important goals are to make the assessments very simple to use and not demanding of teacher time and to pair the assessment tools with ample guidance to help teachers know how to respond to technical difficulties. Our ultimate goal is to sensitively help teachers move toward use of electronic portfolios[147] of both formative and summative SEL assessment.

In summary, it is crucial to develop appropriate means of standardizing and streamlining direct and observational assessments, via computer usage. Although our original measures are valuable in predicting academic success, the training, coding, and administration requirements resources they require are definite “deal breakers” for the early childhood classroom. If we are to make these means of assessment useful and if we are to move toward both formative and summative assessment, we feel that these assessments must be computerized, with much thought given to supporting the end-users (i.e., preschool, Head Start, and childcare teachers, Head Start mental health consultants, and others). We also consider making the assessment attractive and fun to children to be an important goal and a “plus” of such assessment.

Measures to Be Adapted and Computerized

Given these points, it is important to describe our current, noncomputerized measures (original and shortened versions). To reiterate, we chose the PSRA, AKT, CST, and MPAC-Revised-Shortened (MPAC-R/S) because of our success during the NICHD/ACF/Head Start/OSERS-funded Assessment Consortium. Also as noted above, we performed research showing that not only did children enjoy the measures, but their results predicted concurrent and later school success. In the following, the paper-based version of each measure is fully described first, and then the adaptations made for computer-based

Table 1. Evaluation of Noncomputerized SEL Measures According to Criteria from American Educational Research Association, American Psychological Association, and National Council on Measurement in Education[148]

Measure	Validity	Reliability	Cost in Time & Materials	Cultural Sensitivity
Self-Regulation				
Preschool Self-Regulation Assessment (PSRA)	Good with low- and middle-income children	Good interrater reliability, coherent, consistent factors	20 minutes total for child, 10 more minutes for assessor. Original training takes 15 hours. Materials ~ $50 per kit	This measure is administered in the child's language whenever possible. It is largely nonverbal after initial instructions from the tester, especially in terms of required responses from the child. Observers of diverse ethnicities spend time in the classroom before observing in order to become familiar with children.
Emotion Knowledge				
Affect Knowledge Text (AKT)	Good with low- and middle-income children and across nations/cultures	Good internal consistency and 1-year stability	Shortened version 5-10 minutes. Training lasts 2 hours. Materials: 4 puppets and several small props (4 ethnicities/ families of puppets cost about $100).	This measure has been used with children from a variety of income levels and ethnicities. Results are generally comparable, although ceiling effects for 5-year-olds may not be as pronounced with low-income children. Tester training includes sensitivity to cultural aspects of social-emotional functioning. Observers of diverse ethnicities spend time in the classroom before observing in order to become familiar with children.
Social Problem Solving				
Challenging Situations Task (CST)	Good with lower- and middle-income children	Adequate with plans for improvement	Approximately 10 minutes. Training for administration takes approximately 2 hours.	This measure is administered in the child's language whenever possible. It is largely nonverbal after initial instructions from the tester. Observers of diverse ethnicities spend time in the classroom before observing in order to become familiar with children.
Observed Emotional Expressiveness				
Minnesota Preschool Affect Checklist (MPAC)	Good with both low- and middle-income children	Good interrater, adequate factor internal consistency	Approximately 20 minutes. Training for original version lasts 6 hours+. Materials already exist for training.	Observer training includes sensitivity to cultural aspects of social-emotional functioning. Observers of diverse ethnicities spend time in the classroom before observing in order to become familiar with children.

assessment are detailed. Together, these measures make up the CAPSEL battery.

The measures (see Table 1) have proven valid and reliable with low- and middle-income preschoolers. Psychometric adequacy is indicated, for internal consistency, by examination of Cronbach's alpha and inter-item correlation levels for our shortened measures (tempering conventional levels of alpha with information that is useful when measures are quite short) and by intraclass correlations and kappa for interrater reliability. Validity is indicated by significant correlational evidence (either via zero-order correlations or standardized beta coefficients). Each measure is relatively brief (< 20 minutes) in its current instantiation, and each minimizes the child's verbal production. In our training and administration of each, we attend to multiple issues of language, culture, and ethnicity.

Computerization of each measure is currently underway, again funded by NICHD. General procedures that we will follow, and which could be generalized to others' efforts in this area, are as follows: (1) creation of reliable and valid noncomputerized measures (as already noted, this step is complete); (2) creation of a beta version, for each measure, of the computer program for performing it; (3) pilots of these beta versions, as well as focus groups to gather teacher views about feasibility and usefulness of the measures; (4) revision of each measure given these results; and finally (5) testing of each measure with a larger sample of children, particularly in comparison with the noncomputerized version.

Self-Regulation

The PSRA[32] was utilized to capture children's strengths and weaknesses in cognitive and behavioral self-regulation. The PSRA consists of 10 structured tasks, including 4 HEC, or delay, tasks (Toy Wrap, Toy Wait, Snack Delay, and Tongue Task) and 3 CEC, or inhibitory control, tasks (Pencil Tap, Balance Beam, Tower Task Turn Taking) from laboratory-based work[149-151] (see Table 2 for details). In addition, the PSRA includes latency to complete 3 "do" tasks to assess children's compliance (Tower Clean-Up, Toy Sort, and Toy Return).[152] Table 2 provides a description of the procedure for each task, the corresponding measurement method, and the corresponding latent construct for our models.

In our work, the PSRA has shown moderate to good internal consistency of scales (Cronbach's alphas = .90, .82, and .52 for 19 CEC items, 6 HEC items, and 4 Compliance items, respectively). Stability across a 3-month period was .69 for CEC, .61 for HEC, *p*s < .001, and .25

for compliance, $p < .01$. Interrater reliability was moderate to high (across all tasks, kappa and intraclass correlations as appropriate are in the good-to-excellent range for either index, > .80).

Regarding validity, both CEC and HEC, but particularly CEC, from children's last preschool year were significantly related to concurrent and kindergarten school adjustment, as well as preacademic success.[48,49] Ratings of positive emotion and engagement, as well as emotion regulation during the assessment, have been significantly related to several indices of academic success.[94]

We attempted to create shorter forms for each of our measures. In detailed analyses of the 10 PSRA tasks, examination of scores' distributions and item-to-total correlations suggested retention of Pencil Tap, Toy Sort, and Toy Wrap tasks. However, examination of tasks' ceiling effect suggested retention of Balance Beam, Pencil Tap, Toy Wrap, and Snack Delay.[49] Among these tasks, Pencil Tap and Snack Delay were most predictive of academic success. Moreover, the inclusion of a compliance factor in self-regulation measures is argued. Thus, it is likely that we would create computerized forms of a new self-regulation assessment, which would include Pencil Tap, Delay, and Card Sort.

In addition to the existing PSRA tasks (i.e., Pencil Tap and Snack Delay), we would choose to add the Dimensional Change Card Sort task (DCCS) to our self-regulation measure, for the following reasons: (1) the DCCS will measure attention set shifting, which is one of the constructs of executive control not addressed by Pencil Tap and Snack Delay; and (2) this task is easy to administer in person so that we could compare the computerized version with direct assessment. Furthermore, research with school-age children has shown that attention set shifting is related to reading[153] and math achievement.[154] With Head Start children, Welsh et al[155] found that executive control (measured by peg tapping, the DCCS, and backward word span) predicted growth of emergent literacy and numeracy skills during the prekindergarten year, as well as unique contributions to prediction of kindergarten math and reading achievement. In creating an SEL assessment battery, we would adapt the card sorting task to be developmentally appropriate by telling children the sorting criteria.

Computer-based assessment of self-regulation. Two parallel versions would be created. Tasks included would be (1) Pencil Tap—to assess working memory and "cool" inhibition; (2) Card Sorting by shape, color, and number—to assess attention (shifting) and "cool" inhibition; and (3) Delay—to assess "hot" inhibition. For Pencil Tap, the child would hear computer instructions and touch the screen as directed to "tap the drum";

scores would be a total number of correct taps in 16 trials. For Card Sort, scores for each child would be correct or incorrect sorting for each card. For Delay, we obviously could not have the child wait for a snack. But we could, for example, have her wait until a timer goes off to feed a puppy, as follows. In Trial 1, the assessor would say, "The puppy is hungry; he wants a snack. This is his snack. You can give it to him." (The assessor would prompt the child to give the puppy one snack.) The puppy would get excited to get the snack (his reaction should be very animated, so that the child would want to see it again). In Trial 2, the assessor would say: "Uh-oh. The puppy is hungry again. You can give him a snack again, but you need to wait for me to beep the timer. Put your hands on the 'hand' marks, and keep them there until I beep the timer." (The assessor would repeat this for various waiting times; scores would be time waited and whether hands remained on the icons.) The 2 parallel versions could use the same tasks, with different designs, colors, and so forth.

Table 2. PSRA Tasks (20 minutes total)[32]

Task Title	Construct	Assessor Directions/Procedure
1) Balance Beam (3 trials)	Cool Executive Control	Ask child to walk on a short length of tape for 3 rounds. Reduce speed for 2nd trial and slower for 3rd trial.
2) Pencil Tap (16 trials)	Cool Executive Control	Ask child to tap unsharpened pencil after assessor. Assessor taps 1x child should tap 2x; assessor taps 2x child should tap 1x.
3) Tower Task (12 blocks)	Cool Executive Control	Ask child to build a very high tower with blocks taking turns with assessor.
4) Latency to Tower Cleanup	Compliance	Ask child to put blocks back into container from tower task. Give child 2 minutes to complete.
5) Latency to Sort Jumbled Toys	Compliance	Ask child to sort a set of intricate small objects (cars, beads, dinosaurs, and bugs) into different containers.
6) Gift Wrap (Peek)	Hot Executive Control	Ask child not to peek while assessor wraps a toy in tissue paper and bag for 1 minute.
7) Gift Wrap (Wait)	Hot Executive Control	Ask child to wait 1 minute before opening wrapped toy.
8) Toy Return	Compliance	Ask child to return toy back to assessor after playing with it for 1 minute (after opening).
9) Snack Delay (3 trials)	Hot Executive Control	Ask child to wait before getting an M&M from under a cup for 3 rounds (10 sec, 20 sec., and 30 sec.).
10) Tongue Task (1 trial)	Hot Executive Control	Ask child to hold an M&M on her tongue for 40 sec. before eating it.

Note: Tasks adapted from Murray and Kochanska,[151] Hughes et al,[156] and Raver et al.[157]

Emotion Knowledge

In the AKT (see Table 3), children's understanding of emotion is assessed using puppets with felt attachable faces that depict happy, sad, angry, and afraid expressions.[33,62,158,159] For the *emotion labeling* portion of the measure, children are asked to refer to the attachable puppet faces and identify happy, sad, angry, and afraid facial expressions by verbally naming them (expressive knowledge) and then by pointing to them (receptive knowledge).

For the *situation knowledge* portion of the measure, 20 vignettes are enacted using the puppets. Each is accompanied by vocal and visual affective cues emitted by the puppet/experimenter. For 8 vignettes, the puppet depicts the same emotion most people would feel (e.g., happiness at receiving an ice cream cone, fear when awakening from a nightmare) as an index of children's stereotypical emotion knowledge. The remaining 12 vignettes are used as an index of children's nonstereotypical emotion knowledge (i.e., whether children realize that another person can feel differently than *they do* in a given situation), a developmentally appropriate skill.[160] For these vignettes, the puppet depicts an emotion different from that which each child's mother reports, in a questionnaire, that her child would feel. Among these 12 nonstereotypical vignettes, 6 pit positive and negative emotions (e.g., happy or sad to come to preschool), and 6 pit 2 negative emotions (e.g., angry at or afraid of his/her sibling for hitting him/her).

Children affix the felt face of their choice to report how the puppet felt; they receive 2 points for correct identification of emotion in any section of the measure and 1 point for identifying the correct valence but not the correction emotion (e.g., sad for afraid). Mean scores for emotion labeling and stereotypical situations are calculated. For nonstereotypical situations, mean scores are calculated separately for items pitting positive and negative emotions and for items pitting negative and negative emotions. In examining the scales' distributional properties and item-to-total correlations during our recent work, we found that labeling (expressive and receptive) and stereotypical situation items involving happiness did not show adequate variability; therefore, these items were eliminated from emotion labeling and situation knowledge aggregates in subsequent analyses. Thus, Cronbach's alphas averaged .65 for emotion labeling, .89 for situation knowledge, and .90 for total emotion knowledge across 2 times of measurement 3 months apart. Stability across the 3-month period for these aggregates ranged from .48 to .69, *p*s < .001.

Table 3. Affect Knowledge Test (AKT)

Part 1: Expressive & Receptive Identification of Emotions
Expressive: 1. Lay out the 4 felt faces so that they are facing the child in 1 straight row. 2. Point to each one and ask the child, *"How does he/she feel?"* Repeat for all 4 faces.
Receptive: 1. Shuffle the faces and lay them down again in 1 straight row. 2. Ask the child to *"Point to the (fill in emotion) face" or "Show me the (fill in emotion) face."* Repeat for all 4 emotions.
Part 2: Examples of Stereotypical Situations (Using Puppets)
[sibs] 1. **HAPPY:** **NANCY/JOHNNY:** *"Hi! I'm Nancy/Johnny. Here is my brother/sister. Ah! She/he gave me some ice cream. YUM, YUM!!"* [sibs] 2. **SAD:** **NANCY/JOHNNY:** *"We are walking home."* SIB: *"I am going to push you down!!"* NANCY/JOHINNY: *"Ow!! It hurts!! OWW!!"*
Part 3: Examples of Nonstereotypical Situations (Using Puppets)
1. [mom/child] Here come Nancy/Johnny and her/his mommy. A. **HAPPY: Nancy/Johnny:** *"We are coming to school I like it here—we have so much fun!"* B. **SAD: Nancy/Johnny:** *"We are coming to school I don't like it here. I miss my mommy. Don't go, Mommy!"* 2. [mom/child] **Mom:** *"We are going to get some ice cream at the ice cream store, but you have to stay home. Bye, Bye."* A. **MAD:** (Nancy/Johnny behaviorally expresses the emotion) B. **SAD:** (Nancy/Johnny behaviorally expresses the emotion)

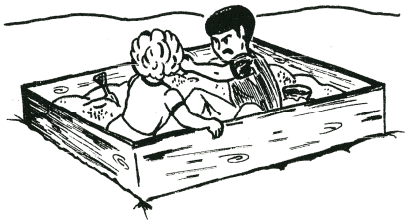
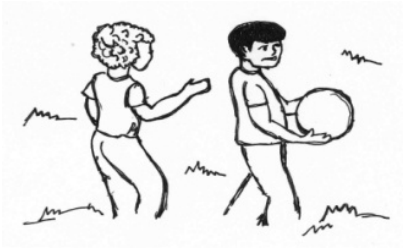
In shortening this measure, 2 parallel versions with similar internal consistency could be created, with 15 items each (3 expressive and 3 receptive items that were the same across parallel measures and 3 stereotypical and 6 nonstereotypical items, randomly varied across forms). Scores on these 2 forms were, as expected, extremely highly correlated, r (322) = .92, and showed good internal consistency, Cronbach's alpha = .77 - .81 for both forms. AKT scores from children's last preschool year were also significantly associated with teacher ratings of especially kindergartners' learning behaviors and social competence in expected directions, validating the short form of the AKT.[63,65]

Computer-based AKT. As with the computer-based PSRA, we would create 2 parallel versions of the AKT. The child would see customized (regarding his/her own race/ethnicity and the content of nonstereotypical items) video of the items with a female examiner using race/ethnicity appropriate puppets; responses would be recorded by the child touching the correct emotion's face. First, receptive labeling would include all 4 expressions (i.e., including happy), so that our subsequent tutorial telling the child any emotions s/he gets incorrect would allow the child to access them for the nonstereotypical situation items. Next, the stereotypical and nonstereotypical situations would be presented, each using half of the situations for each version (only negative situations for the stereotypical), as has already been done with the shortened version of the AKT (see above).

Responsible Decision Making/Social Problem Solving

Children's ability to predict their own behavior decisions and their attendant emotions to 3 problematic peer situations was assessed using the CST.[34] The CST is a pictorial forced-choice measure. The unambiguous hypothetical peer-oriented scenarios are presented in a random order to the child via a 3x4 inch (7.6 x 10.2 cm) picture and a short verbal description of the situation (see Table 4). Children are then presented with 4 affective choices using schematic drawings and verbal labels of happy, sad, angry, and just okay and then asked to point to the drawing depicting how they would feel in the situation (see Figure 2). Children are next asked to report what they would do in the situation via pointing at 4 schematic drawings depicting socially competent, aggressive, passive, or dysregulated/crying behavioral responses appropriate for that situation (see Table 4). Then children are asked to report how the peer would feel then, what the peer would do, and how the child would feel in the end. Responses for each emotion and behavior choice are summed for CST scales.

Table 4. Challenging Situation Task (CST) Scenarios and Behavioral Response Choices

Scenario	Stimuli	Behavioral choices
1. Mary/John was building a very tall tower of blocks. Bobby knocked it down.		1a.Build another tower? 1b. Hit Bobby or yell at him? 1c. Cry? 1d. Go find someone else to play with?
2. Mary/John is having a good time playing in the sandbox when Bobby hits her/him.		2a. Tell him it's not a nice thing to do? 2b. Hit him? 2c. Cry? 2d. Go play somewhere else?
3. Mary/John was kicking a soccer ball. Bobby came and took the soccer ball.		3a. Ask Bobby to play with you? 3b.Grab the ball back or yell at him? 3c. Cry? 3d. Go play something else?

Note: For all scenarios, affect response choices included: (a) happy, (b) sad, (c) mad, or (d) just ok. Behavioral response choices for the scenarios were categorized as follows: (a) socially competent, (b) aggressive, (c) dysregulated/crying, or (d) passive.

Previous studies have utilized adaptations of this measure with preschoolers to understand social cognitive processes underlying behavioral disorders,[66,161] in cross-cultural comparisons,[162] and in examinations of Head Start intervention effects.[8] Their work and ours[72,73,163] show significant associations between CST indices and social competence, behavior problems, school adjustment, and pre-academic success. In particular, our research group has shown that sad emotion choices and socially competent behavior choices are significantly related to school success up to 2 years later.

The sequential nature of the CST rendered the process of shortening a somewhat different matter than for other measures. In our deliberations, we decided to focus only on the 3 peer provocation situations and to eliminate the lengthy responses required after asking how the child would feel and what s/he would do. In terms of reliability, such a small number of items (3 each for peer provocation situations), average inter-item correlations are most instructive. From our recent work,[72] the inter-item average correlation for emotion responses was .21 ($p < .001$), and for behavioral responses, it was .28 ($p < .001$). “Just ok” and “crying” were excluded due to low inter-item correlations. Stability correlations across a 3-month period were significant; for emotion choices these ranged from.17, $p < .01$, for angry, to .36, $p < .001$, for sad. For behavior choices, stability correlations ranged from .14, $p < .025$, for crying, to .40, $p < .001$, for socially competent.

We are increasing the number of items, using the Preschool Taxonomy of Problem Situations,[164] to improve internal consistency reliability of the measure and include 3 types of peer provocation (i.e., physical/instrumental and social provocation). Scenarios include the following general attributes (see Table 5 for specific scenarios): (1) wrecking the child’s product; (2) exhibiting physical aggression; (3) taking an object away; (4) excluding the child from play; (5) being laughed at, and (6) being called a bad name. Again, we would create 2 parallel versions of the CST.

Computer-based CST. For the computerized version of the CST, children would be presented with the scenario pictures and hear audio of the narrator explaining the altercation. They would then be shown the 4 response options, with each being described by the narrator. Children would select their response by touching the appropriate picture on the screen. Scores would be saved for the emotional and behavioral responses selected.

Table 5. Challening Situation Task (CST) Items
Note: *Italicized scenarios* were included in the original CST.

		Version	Scenario
Physically Provoked	**Wrecking the child's product**	*Version A*	*Mary/John was building a very tall tower of blocks. Bobby knocked it down.*
		Version B	Mary/John was drawing a picture of airplane. Bobby came and drew a big red line on Mary/John's picture
	Exhibiting physical aggression	*Version A*	*Mary/John is having a good time playing in the sandbox when Bobby hits her/him.*
		Version B	Mary/John was waiting her/his turn in line for the swing. Bobby came and pushed Mary/John off the line and took her/his place
	Taking an object away	*Version A*	*Mary/John was kicking a soccer ball. Bobby came and took the soccer ball.*
		Version B	Mary/John was playing with a toy car. Bobby came and took it away from Mary/John
Socially Provoked	**Excluding others from play**	Version A	Mary/John asked Bobby to play with her/him. But Bobby said that he doesn't want to play with Mary/John. He is going to play with Tom
		Version B	Bobby was having a "pretend" birthday party. Mary/John asked Bobby if she/he can come to his birthday party. Bobby said, "I don't want you to come to my birthday party!"
	Being laughed at	Version A	Mary/John drew a picture of a dog. Bobby saw it and said, "It doesn't look like a dog. It looks like an ugly monster!" and started laughing
		Version B	Kids were taking turns kicking a ball. When it was Mary/John's turn, she/he missed it and fell down. Bobby started laughing and said, "Mary/John can't kick the ball."
	Being called a bad name	Version A	Mary/John brought a doll to school for naptime. Bobby said, "You're a baby!"
		Version B	Mary/John woke up from naptime sucking his/her thumb. Bobby saw and said, "Only babies suck their thumbs!"

Relationship Skills

The MPAC[98] was originally created as an observational means of assessing children's emotional expression, emotion regulation, and social behavior and subsequently adapted by Denham and colleagues (MPAC-R[11,98]; see Table 6). In using the MPAC-R, children's behavior is observed and coded for a 5-minute interval across 4 different days. Observations can occur in differing contexts, although coders are encouraged to observe during less structured periods (i.e., center time, outside recess, gym, etc. as opposed to teacher-led instructional time). The MPAC-R includes 66 items, which are organized into scales for positive and negative affect, inappropriate affect, positive/negative involvement, positive and negative reactions to frustration, peer skills, isolation, hostility, and empathy/prosocial behaviors (see Table 6). Thus, the MPAC-R taps important elements of SEL; the variety of behaviors sampled yields a richness of the information regarding children's SEL skills achieved in 4 short observations. In the current MPAC-R version, the prosocial category was further extended from versions created by Sroufe et al[100] and Denham et al[98] to include items such as sharing, listening, cooperating with peers, taking turns, and using polite language. Thus, this version taps children's relationship skills in a more extensive manner than previously. All scales showed good interobserver reliability across the 4 periods of observation; intraclass correlations ranged from .84 for emotion regulation to .97 for positive emotion. Across 3 waves of data, 3 or 4 similar factors emerged from the various scales, with internal consistencies from .54 to .73 and significant average inter-item correlations.

A key task was to shorten the MPAC-R to lessen observer burden. Examination of item score distributions and item-to-total correlations from 3 longitudinal waves of data, as well as theoretical considerations, suggested retention of 18 of the 66 original items. Using just these items from the MPAC-R/S, 3 factors emerged across the 3 waves of data—emotionally positive/productive, emotionally negative/aggressive, and emotionally regulated/prosocial. Aggregates paralleling these factors had alphas ranging from .52 to .70, with significant mean inter-item intercorrelations and highly significant stability across a 3-month period. Interrater reliability, as assessed by intraclass correlations, ranged from .84 to .97 for the scales that formed the MPAC-R/S factors.

Table 6. Scales and Example Items from the original Minnesota Preschool Affect Checklist (MPAC)

MPAC Scales	Exemplars of behaviors observed
Expression and regulation of positive affect	Displays positive affect in any manner—facially, vocally, bodily; shows ongoing high enjoyment (30 sec. or more)
Expression and regulation of negative affect	Uses negative affect to initiate contact, to begin a social interaction with someone; uses face or voice very expressively to show negative affect
Inappropriate affect	Expresses negative affect to another child in response to the other's neutral or positive overture; takes pleasure in another's distress
Productive involvement in purposeful activity	Engrossed, absorbed, intensely involved in activity; independent—involved in an activity that the child organizes for himself
Unproductive, unfocused use of personal energy	Wandering; listless; tension bursts
Lapses in impulse control	Context-related, physical, interpersonal aggression; inability to stop ongoing behavior; becomes withdrawn
Positive management of frustration	Promptly expresses, in words, feelings arising from problem situation, then moves on; shows ability to tolerate frustration well even if does not verbalize
Skills in peer leading and joining	Successful leadership; inept attempts at leadership; smoothly approaches an already ongoing activity
Isolation	No social interaction continuously for 3 minutes or more
Hostility	Unprovoked, physical, interpersonal aggression; hazing, teasing, or other provocation or threat
Prosocial response to needs of others	Interpersonal awareness—behavior reflecting knowledge or awareness about another person; helping behavior

Note. General item content from Denham et al.[98] Subsequent versions of MPAC-R[93] clarified and expanded prosocial behaviors. MPAC-R/S does not include the inappropriate affect scale and trimmed numerous items that were very rarely seen or had little variability.

Earlier MPAC-R versions have demonstrated validity. Concurrent validity for the MPAC-R was established by showing interpretable age changes and associations with preschool and maternal affect.[98,100] Denham and Burton[11] also showed changes on the MPAC-R between pre-intervention and post-intervention, with children who showed the greatest SEL deficits benefiting maximally from the intervention efforts. Validity

analyses showing significant relations of the shortened MPAC-R/S with teacher ratings have been reported above.[94,97]

Computer-based MPAC-R/S. The first step necessary for developing a user-friendly measure would be to create a tutorial for observers[142] so that they could learn SEL event definitions, with immediate correction and feedback. The learner is presented a written classroom scenario to read, followed by an opportunity to enter the appropriate event codes using the format used in actual data entry. Thus, data entry and event definitions are taught simultaneously. The computer evaluates each entry. If correct, a new scenario is presented. If incorrect, a feedback screen is presented, allowing the trainee to compare the definition entered against the correct entry. Response to written scenarios are followed by video segments to code.

For both the tutorial and ultimate use, the 21 items for the entire measure are utilized. Similar to Sarkar et al.,[141] the first screen notes the categories of the MPAC-R/S: Positive and Negative Affect, Productive and Unproductive Involvement, Positive and Negative Reactions to Frustration, and Peer Skills/Prosocial Behavior. Once the observer notes a behavior within any category, touching that category leads to the specific, clickable behavioral items from which to choose. Total scores for each of 4 5-minute trials for each scale are saved.

Bringing the New CAPSEL Battery into the Classroom

After creating such a computerized battery, determining the efficacy of putting it into use will be an initial challenge. In an effort to gauge user attitudes, we have collected evidence about early childhood educators' and caregivers' responses to the original versions of our measures. Child care and Head Start teachers have told us, in focus groups (S.A.D. et al, unpublished data, 2012) their thoughts about the research-based measures in our battery. In general, they were convinced of their value, ability to engage children, cultural appropriateness, and usefulness in conjunction with SEL curricula, although they gave us important spots to refine the measures. Importantly, regarding their own potential use of the measures in the classroom, there also was a generally positive response—that children enjoy the measures, which would be helpful and not too difficult to learn. On the other hand, they were worried about time management if they were to administer the measures. In short, we were encouraged by teachers' positive responses to our SEL measures' value, concerned about their need for time, and thus motivated *by them* to make a more classroom-useful, streamlined battery. We will need to continue to communicate with teachers regarding their thoughts specifically on the

measures throughout the process of creating viable computerized measures.

Even given a viable, streamlined, and computerized SEL battery, we will need more information, and more research should be performed. For example, it would also be important to find out from center directors about existing availability and use of computers in classrooms and the center as a whole. If the center is not using computers widely and with facility, introducing the battery would be difficult. Second, we would need to know even more specifically teachers' attitudes toward computers (e.g., affective, perceived usefulness, perceived control components),[165] along with their experience with/general use of computers and how they already use the computer in the classroom for instructional methods and materials.[166] Armed with such knowledge, designing means of entry into the classroom would be much easier.

Beyond the important consideration of teacher and director acceptance, of critical importance to the viability of such a battery would be the utility of the information it generates. As was acknowledged above, one challenge of moving assessment tools from the research realm into practitioner use is the feasibility of time-intensive training. This holds true both for the actual administration procedures and for the interpretation of the data collected. Teachers are not trained statisticians nor do they have time to aggregate and interpret raw data on children's SEL progress. When designing computer-based assessment tools, researchers must take this into consideration from the start of the battery development.

To be fully embraced by early childhood educators and program directors, the battery must include a practical feedback mechanism. For the CAPSEL assessment tool, macros will be used to generate easy-to-interpret summary reports at multiple levels. Teachers will have access to individual child reports reflecting child performance across all 4 components, showing change scores across multiple administrations, comparing children to their class and age-mate averages, and highlighting areas where tailored programming could benefit the individual child.

Imagine formative assessment that could assist early childhood teachers in their promotion of SEL in their classroom. Perhaps they find that a child cannot understand the "Tap the Drum" task, suggesting that CEC may benefit from instruction. The teacher could try to scaffold situations in which the child needs to pay attention (e.g., giving him/her quiet space in which to complete art projects) and could give him/her practice in games like "Simon Says" and "Red Light, Green Light." Another teacher who observes negative emotion and dysregulated, aggressive behavior via the MPAC-R/S could assist the child by dialoguing with

him/her and other children involved in peer conflict, as well as by using proactive techniques to assist the child before situations became frustrating (e.g., providing calmer activities and playmates).

Such child-level reports may also be of use to parents and kindergarten teachers. If early year reports identify areas where additional support is needed, parents and teachers can work together to address these issues. For example, if Johnny demonstrates inconsistent emotion knowledge, sometimes confusing sad and angry facial expressions, the parent-teacher team could scaffold his interpretations of others' facial expressions. These targeted interventions could continue into formal schooling if reports were passed along to kindergarten teachers. Armed with change scores and end-of-year SEL summary reports, kindergarten teachers would be better able to plan early SEL interventions to continue to help children solidify their competencies.

Beyond meaningful single-child summary reports, preschool teachers and program directors can benefit from aggregated data painting a picture of overall classroom and program SEL progress. Such class-level summary reports will enable teachers to see areas where programmatic changes will have the greatest impact on the greatest number of students, such as adding an additional week of social problem-solving curricula to lesson plans. For directors, classroom-level summary reports could play a crucial role in the supervision and development of teachers. With reports identifying areas where a class needs additional SEL support, a director can assess the effectiveness of a teacher's response to feedback and provide meaningful end-of-year performance reviews for individual teachers. Finally, if several classes seem to struggle with similar skills, the director can schedule focused professional development tailored to the center's needs. Research partners can also assist directors in using the measures to evaluate effectiveness of SEL programming. Thus, much research needs to be done on each of these possible applications, but our CAPSEL work to create a viable battery is a beginning. We invite other researchers to join us in similar efforts.

Conclusion

In sum, access to detailed SEL data about individual children, also easily distilled into meaningful summary reports, can empower teachers and directors to address individual and systemic SEL needs within a preschool program. However, such plans are all contingent on the computer-based battery being accepted by staff and administered correctly. In addition, the information provided needs to be clear, useful, and specific. Above all of this, however, the utility of such a battery is entirely dependent on the

quality of the assessments themselves. Computer-based SEL assessment tools should be developmentally appropriate, integrated with curricula, beneficial to all parties, often based on ongoing teacher observation, primarily reliant on the child's everyday activities, and culturally and linguistically responsive. By converting a rigorously tested, reliable, and valid set of measures to a computer-based platform, we intend for the CAPSEL battery to assist early childhood educators in making informed decisions that help their students become ready for school.

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