



Using the Teaching Pyramid Observation Tool (TPOT) to Support Implementation of Social–Emotional Teaching Practices

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Abstract

The emphasis on social–emotional competence and its importance to positive academic and nonacademic outcomes has led to a focus on identifying and implementing effective practices for supporting young children’s social–emotional competence. Our work to identify, validate, and support the fidelity of implementation of evidence-based practices to promote young children’s social–emotional competence and to address challenging behavior has focused on the Pyramid Model for Promoting Social–Emotional Competence in Infants and Young Children framework (Fox et al. in *Infants Young Child* 23:3–14, 2010; Hemmeter et al. in *Sch Psychol Rev* 35:583–601, 2006; Hemmeter et al., in: Buysse, Peisner-Feinberg (eds) *Handbook of response-to-intervention in early childhood*, Brookes, Baltimore, 2013). The implementation of the Pyramid Model practices to provide effective intervention that leads to meaningful child outcomes will require that practitioners are able to implement the practices with fidelity. Implementation science provides guidance on the “drivers” or key components that must be in place within a system to ensure the use of evidence-practices or interventions (Blase et al. in *stages of implementation analysis: where are we?* FPG Child Development Institute, University of North Carolina, Chapel Hill, 2013; Metz et al. in an integrated stage-based framework for implementation of early childhood programs and systems. OPRE Research Brief OPRE 201548, 2015). In this paper, we address competency drivers by describing an instrument that has been developed, validated, and used to measure the fidelity with which practitioners implement Pyramid Model practices. In addition, we describe the professional development intervention we have used to support teachers to implement the practices with fidelity. We focus on how a fidelity tool can be used to measure practice implementation as well as to guide professional development focused on the practices.

Keywords Social–emotional competence · Challenging behavior · Fidelity · Professional development · Implementation science

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Social–emotional development is critically important to children’s school readiness and has been identified in a number of national publications and policy statements as critical to children’s success in school and life. In a recent report, Jones, Greenberg, and Crowley (2015) found significant positive relationships between children’s social–emotional skills in kindergarten and their outcomes as young adults (e.g., higher levels of education, less criminal activity, fewer mental health issues). In *Neurons to Neighborhoods*, Shonkoff and Phillips (2000) identified three areas of children’s development that reflect social and emotional competence: (1) learning to regulate one’s own emotions, behaviors, and attention; (2) learning language, reasoning, and problem solving; and (3) learning how to get along with others and develop friendships.

The importance of social–emotional competence during the early childhood years is emphasized in federal- and state-level early care and education programs. The Head Start Early Learning Outcomes Framework includes social and emotional development as a domain for infants, toddlers, and preschoolers noting that it is a critical foundation for development and learning throughout life (Office of Head Start, 2015). The Office of Child Care has a priority to increase the number of states that are implementing early learning guidelines that include social and emotional development, noting that almost all states and territories have social–emotional guidelines for infants and toddlers (National Center on Early Childhood Quality Assurance, 2016; Scott-Little, Kagan, Reid, Sumrall, & Fox, 2014). The Office of Special Education Programs (OSEP) requires states to report data on child and family outcomes in early intervention (Part C of IDEA) and early childhood special education (Part B, Section 619 of IDEA) on three outcomes: (1) positive social–emotional skills, (2) acquiring and using knowledge and skills, and (3) taking appropriate actions to meet needs.

Supporting Children’s Social–Emotional Competence Through Evidence-Based Teaching Practices

The emphasis on social–emotional competence and its importance to positive academic and nonacademic outcomes has led to a focus on identifying and implementing effective environmental, interactional, and instructional practices for supporting young children’s social–emotional competence. Without early intervention, social–emotional challenges may persist or worsen and lead to negative outcomes (Brennan, Shaw, Dishion, & Wilson, 2012; Bulotsky-Shearer & Fantuzzo, 2011; Hauser-Cram & Woodman, 2015). Over the last decade, there has been an increased emphasis on identifying evidence-based curricula as well as evidence-based practices that early childhood educators and families can use to promote children’s social–emotional competence and address challenging behaviors (e.g., Conroy et al., 2015; Domitrovich, Moore, & Greenberg, 2012; Domitrovich et al., 2009; Hemmeter, Snyder, Fox, & Algina, 2016; Webster-Stratton, Reid, & Stoolmiller, 2008).

In addition to being evidence-based, the curricula or teaching practices used by early childhood educators and family members must be developmentally appropriate; feasible and acceptable; and designed to meet the range of social, emotional, and behavioral needs of children in inclusive early childhood classrooms. In early childhood settings, social–emotional teaching practices may be addressed using a comprehensive preschool curriculum such as the Creative Curriculum (Dodge et al., 2016) or Connect4Learning (Sarama, Brenneman, Clements, Duke, & Hemmeter, 2016),

a social-emotional curriculum such as Preschool PATHS (Domitrovich, Greenberg, Kusche, & Cortes, 2004) or Second Step (Committee for Children, 1991), as part of an instructional framework such as embedded instruction for early learning (Snyder et al., 2017b), or some combination of these. Although the teaching practices reflected in each of these might differ in intensity, delivery mode, organization, and other characteristics, across them there is a focus on high quality, developmentally appropriate, intentional teaching practices (Copple & Bredekamp, 2009).

Our work to identify, validate, and support the fidelity of implementation of evidence-based practices to promote all young children’s social–emotional competence and to address challenging behavior has focused on the *Pyramid Model for Promoting Social–Emotional Competence in Infants and Young Children* framework (Fig. 1; Fox, Carta, Strain, Dunlap, & Hemmeter, 2010; Hemmeter, Fox, & Snyder, 2013; Hemmeter, Ostrosky, & Fox, 2006). The *Pyramid Model* is a multi-tiered system of support framework of evidence-based practices for promoting the social–emotional competence of all children; addressing the social, emotional, and behavioral needs of children who are at-risk; and developing, implementing, and evaluating individualized positive behavior supports for children with persistent social, emotional, or behavioral challenges. The *Pyramid Model* practices were identified through a review of the research on promotion, prevention, and intervention practices that have been associated with positive social–emotional outcomes for young children and decreases in their challenging behavior (Hemmeter et al., 2013). In the present paper, we describe the development and use of an instrument designed to measure the extent to which *Pyramid Model* practices are implemented with fidelity by practitioners in early childhood classrooms.

Describing Pyramid Model Practices Across Tiers

The universal tier of the *Pyramid Model* refers to promotion practices related to responsive and supportive interactions such as supporting children’s play, ongoing and extended conversations, and positive feedback and encouragement of appropriate behavior (e.g., Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Chien et al., 2010; National Research Council, 2001; Peisner-Feinberg et al., 2000). It also includes practices related to teaming, family engagement, communication with families, and family engagement. These practices are considered essential to the provision of high quality, developmentally appropriate programs for young children (Copple & Bredekamp, 2009; Division for Early Childhood, 2014).

Fig. 1 Pyramid Model for promoting social–emotional competence in infants and young children



The universal promotion tier also includes practices related to high-quality supportive environments that have been shown to promote children’s engagement in developmentally appropriate learning activities. These practices include providing adequate and appropriate materials in learning centers, defining the boundaries of learning centers, offering a balanced schedule of activities with length and type matched to developmental needs of children (large and small group), structuring transitions, providing clear directions to all children and individualized directions to children who need additional support, teaching and promoting a small number of classroom rules, and actively promoting the engagement of children (e.g., Chien et al., 2010; Jolivet, Wehby, Canale, & Massey, 2001; National Research Council, 2001; Peisner-Feinberg et al., 2000).

The secondary prevention tier involves providing systematic instruction on social skills to all children in the classroom and systematic instruction for small groups or individual children who are at-risk of challenging behavior and emotional/behavioral disorders or have social–emotional skill deficits. Within the *Pyramid Model*, social skills instruction is delivered for all children but varies in form and intensity depending on the individual needs of each child (Brown, Odom, & Conroy, 2001; Snyder, Bishop, & McLaughlin, 2017a). Secondary prevention practices include teaching children to identify and express emotions; teaching

and supporting self-regulation; teaching and supporting children’s use of strategies for handling difficult emotions (e.g., anger and disappointment); teaching and supporting social problem solving; teaching and supporting friendship skills; teaching and supporting collaboration with peers; and providing individualized instruction for children who need additional support (Brown et al., 2001; Denham & Burton, 1996; National Research Council, 2001; Webster-Stratton, Reid, & Hammond, 2004). For children who have social–emotional delays or instructional support needs, specific social skills or emotional competencies are targeted and a systematic plan is designed to ensure that adequate learning opportunities are embedded within meaningful activities (Snyder et al., 2017b).

At the individualized intervention (tertiary) tier of the *Pyramid Model*, early childhood educators are part of a team that develops and supports the implementation and evaluation of an assessment-based, individualized behavior support plan that includes prevention practices, targeted instruction and responding strategies (Dunlap & Fox, 2011; Dunlap, Wilson, Strain, & Lee, 2013; Dunlap et al., 2017). These individualized behavior support plans include systematic instruction on individualized social–emotional targets described at the secondary level. Progress monitoring is frequent and ongoing and tracks both reductions in challenging behavior and the use of replacement skills. In the *Pyramid Model*, each tier builds upon the previous tier, and tier 2 and 3 practices are reliant on the previous tiers for the

implementation of practices that are critical to promoting social–emotional outcomes.

Importance of Measuring Fidelity of Implementation of Evidence-Based Social–Emotional Teaching and Behavioral Support Practices

In the development of the *Pyramid Model*, we identified the tiers of evidence-based practices to address the range of social, emotional, and behavioral intervention needs of young children within a program or classroom. The implementation of these practices to provide effective intervention that leads to meaningful child outcomes requires that practitioners are able to implement the practices with fidelity.

Assessment of fidelity is critical for linking practice implementation to child outcomes and for establishing the efficacy of interventions used in educational settings (Hagermoser Sanetti, Dobey, & Gritter, 2012; Horner et al., 2005; Lloyd, Supplee, & Mattera, 2013; O'Donnell, 2008). A meta-analytic review of over 200 social–emotional learning school-based interventions compared outcomes for programs that were well implemented versus those that had implementation fidelity issues. Findings showed better outcomes for programs that were well implemented, with student academic gains twice as high and reductions in conduct problems almost twice as large when programs were well implemented versus when they had implementation fidelity issues (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011).

Given the important relationship between fidelity of practice implementation and desired outcomes, measuring fidelity of practice implementation has received renewed attention, particularly with the growing interest in the science of implementation. Implementation science focuses on the study of what supports and processes are necessary for programs, practices, or interventions that have promising research evidence to be implemented on a larger scale and in authentic settings (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005; Metz, Halle, Bartley, & Blasberg, 2013). Information about the fidelity of practice implementation permits nuanced understanding of the mechanisms by which interventions impact outcomes and aids in replication or diffusion activities (LoCasale-Crouch, Williford, Whittaker, DeCoster, & Alamos, 2017). Measures that provide information about the extent to which specific evidence-based practices are implemented with fidelity have been identified as preferable to those that focus on general model components (Hullerman & Corrdy, 2009). In addition, direct observation fidelity measures have been identified as providing less biased reports of practice

implementation than self- or implementer-reported measures (Abry, Hulleman, & Rimm-Kaufman, 2015).

Implementation science provides guidance on the “drivers” or key components that must be in place to ensure the use of evidence-practices or interventions (Blase, Van Dyke, & Fixsen, 2013; Metz, Naoom, Halle, & Bartley, 2015). These drivers include: a) competency drivers, (b) organization drivers, and (c) leadership drivers (Fixsen et al., 2005; Metz et al., 2013). Competency drivers are the structures needed to establish or improve and sustain practitioners' use of evidence-based practices. These structures include the use of a practice fidelity assessment tool; implementation materials; the provision of robust and ongoing professional development, including coaching to ensure fidelity of implementation; and the training of leadership personnel who support implementation by practitioners.

In the remainder of this paper, we describe an instrument that has been developed, validated, and used in research to measure the fidelity with which practitioners implement *Pyramid Model* practices. In addition, we address competency drivers by describing the professional development approach we have used to support teachers to implement *Pyramid Model* practices with fidelity. We focus on how a fidelity tool can be used to measure practice implementation as well as to guide professional development focused on the practices.

Teaching Pyramid Observation Tool

The *Teaching Pyramid Observation Tool* (TPOT; Hemmeter, Fox, & Snyder, 2014) is an instrument designed to measure practitioners' implementation of the environmental, interactional, and instructional practices associated with the *Pyramid Model*. It was developed to measure the fidelity with which preschool teachers implement *Pyramid Model* teaching practices. Consistent with the *Pyramid Model* framework, the practices included on the TPOT are *universal practices* (i.e., nurturing and responsive relationships and environments that promote young children's social and emotional competence and prevent challenging behavior), *targeted practices* (i.e., explicit social–emotional and behavior support teaching practices such as teaching children friendship skills or teaching children to express emotions), and practices that demonstrate teachers' capacity to implement *individualized practices* (i.e., social–emotional or behavioral support interventions for children with persistent social, emotional, or behavioral challenges).

The TPOT has three subscales: (1) key teaching practices (14 items), (2) red flags (17 items), and (3) effective strategies for responding to challenging behavior (3 items). For the key teaching practices items, observable practice indicators are organized under each key practice. The number

Table 1 Teaching pyramid observation tool key practices items and number of observable indicators associated with each item

Key practices item	Number of observable indicators
Schedules, routines, and activities ^a	10
Transitions between activities ^a	8
Supportive conversations ^a	10
Promoting children's engagement ^a	9
Providing directions ^a	7
Collaborative teaming ^a	9
Teaching behavior expectations ^a	7
Teaching social skills and emotional competencies ^a	8
Teaching children to express emotions ^b	8
Teaching problem-solving ^b	9
Teaching friendship skills ^b	9
Interventions for children with persistent challenging behavior ^c	5
Connecting with families ^c	8
Supporting family use of <i>Pyramid Model</i> practices ^c	

^aScored via observation^bScored via observation or interview^cScored primarily via interview

of indicators associated with each item varies from 5 to 10 for a total of 114 practice indicators related to key teaching practices. Table 1 illustrates the 14 key practice items and the number of indicators associated with each item. Red flag items are environmental or interactional practices that conflict with or impede the implementation of *Pyramid Model* practices (e.g., children are reprimanded for expressing emotions, learning centers do not have clear boundaries). The strategies for responding to challenging behavior item have three essential practices that teachers should use to respond to any incident of challenging behavior.

The TPOT is completed following a 2-h observation in a preschool classroom. Assessors observe both teacher-directed (e.g., circle time, small group) and child-initiated activities (e.g., free play, center time), as well as transitions between activities. The observation is followed by a 15- to 20-min interview with the teacher. Eight of the key teaching practices indicators are scored based solely on the assessor's observation. The indicators associated with three key teaching practices are scored based on the observation and interview. The remaining three key teaching practices are scored based on interview only (see Table 1). All but three of the red flags are scored based on the assessor's observation. The remaining red flags are scored based on observation and interview (2 items) or interview (1 item). The effective strategies for responding to challenging behavior practices are scored each time an incident of challenging behavior occurs during the observation.

Development of the TPOT

The TPOT was initially developed as part of a development and innovation (Goal 2) study funded the Institute of Education Sciences to measure the fidelity with which preschool teachers were implementing *Pyramid Model* practices before and after their participation in a professional development (PD) intervention that involved workshops, implementation guides, materials to support practice implementation, and controlled doses of practice-based coaching (Hemmeter et al., 2016). We also used the measure to evaluate implementation of *Pyramid Model* practices in comparison group classrooms. Through measurement of the TPOT key practices items and associated indicators, we wanted to quantify several aspects of fidelity of *Pyramid Model* practice implementation by teachers: adherence, quality of delivery, and program differentiation (cf. Carroll et al., 2007; O'Donnell, 2008). Development of the pilot version of the TPOT began in 2005. The content of the pilot version was informed by generating a list of potential items (e.g., teaching children to express emotions, promoting children's engagement) that reflected key *Pyramid Model* practice elements based on a thorough review and synthesis of the literature. We then generated a definition for each practice element that would become a TPOT item and specified a list of observable indicators associated with each key practice element to reflect adherence, quality of delivery, or program differentiation.

To help inform the development of observable indicators, we used the Inventory of Practices (Center on the Social and Emotional Foundations for Early Learning, 2003).

The Inventory of Practices was associated with *Pyramid Model* work conducted under the auspices of the Center on the Social and Emotional Foundations for Early Learning (CSEFEL). We developed additional indicators that were identified as important based on reviews of the literature but that did not appear on the Inventory of Practices. We also developed additional practice elements when practices from the Inventory of Practices did not fit into one of the prespecified practice elements. After these content development steps, further development of the pilot version of the TPOT involved iterative processes of content validation by experts and field testing in preschool classrooms (Hemmeter et al., 2014).

The pilot version of the TPOT had 14 key practices items with multiple practice indicators associated with each item, seven items related to environmental arrangements in classrooms, one item focused on whether challenging behavior occurred and strategies used to respond to the challenging behavior, and 16 red flag items. Based on psychometric data for the pilot version of the TPOT and feedback from users, revisions were made, which resulted in the current Research Edition of the TPOT (Hemmeter et al., 2014).

Score Reliability and Validity Evidence for TPOT

A number of studies have been conducted to examine TPOT score reliability and validity with samples of preschool teachers and classrooms (Hemmeter et al., 2014). Some of the psychometric evidence is based on studies conducted using the pilot version of the TPOT (Fox, Hemmeter, & Snyder, 2008; Fox, Hemmeter, & Snyder, 2009). Other data are from studies in which the Research Edition of the TPOT was used. The characteristics of the teachers and classrooms in which TPOT psychometric integrity evidence was gathered are described in Hemmeter et al. (2014).

Of particular relevance to the present paper, we have examined TPOT score stability and interrater reliability and agreement. For the former, we have explored the stability of individual differences (SID) and stability of means over occasions of measurement (SOMOM) for TPOT scores by having two trained raters conduct three observations in 50 preschool classrooms when no professional development or training was being provided on the *Pyramid Model* (Hemmeter et al., 2014).

SID was assessed by examining correlation coefficients for scores collected at different occasions when the professional development intervention was not delivered. Results showed that teachers whose implementation of key practices resulted in high or low scores on the first measurement occasion also engaged in practices that resulted in relatively high or low scores on the second and third measurement

occasions. SID stability coefficients were highest for key practices related to schedules, routines, and activities, and lowest for collaborative teaming and connecting with families. The finding that SID stability coefficients were lowest for collaborative teaming and connecting with families might relate to variations in the need to implement these specific practices over measurement occasions relative to the other TPOT practices such as predictable schedules, routines, and activities. Overall, SID stability coefficients for occasions 1 and 2 ranged from .43 to .85, from .48 to .79 for occasions 2 and 3, and from .41 to .75 for occasions 1 and 3. Across all 14 key practices, SID stability coefficients were .91 for occasions 1 and 2, .87 for occasions 2 and 3, and .85 for occasions 1 and 3. Red flag stability was .69 for occasions 1 and 2, .80 for occasions 2 and 3, and .67 for occasions 1 and 3.

For SOMOM, average percentage scores for each key practices item were generally very stable across time. Over the three occasions of measurement, without professional development being provided on *Pyramid Model* practices, implementation percentage scores on the TPOT remained stable or showed slight declines. Average percentage scores show that across each measurement occasion, most indicators associated with key practices items were not scored as “yes” (i.e., implemented based on criteria specified for the indicator). Percentage scores ranged from 11.4% (collaborative teaming) to 67% (connecting with families) on occasion 1, from 9.1 to 61.8% on occasion 2 for the same two items, and from 8.0 to 61.3% on occasion 3 for the same two items. Average percentage scores for the all indicators associated with the 14 key practices items were 41.9% on occasion 1, 38.9% on occasion 2, and 36.4% on occasion 3. Red flags percentage scores were 16.4% on occasion 1, 20.1% on occasion 2, and 19.9% on occasion 3.

The stability data described above show that without explicit professional development or training focused on the *Pyramid Model*, teachers’ fidelity of implementation of practices associated with the observable indicators on the TPOT generally was low and did not change appreciably across three occasions of measurement separated by at least 2–3 weeks. Based on the psychometric data presented in this paper and elsewhere (Hemmeter et al., 2014), the TPOT appears to be a promising tool to quantify the adherence and quality of baseline implementation of *Pyramid Model* practices.

Because the TPOT is designed to be completed by trained assessors and it is a judgment-based instrument that is scored following an observation and interview, it is important to have evidence of interrater score reliability or agreement. Assessors are trained during a 2-day workshop in which they learn to score the tool and practice scoring individual items. During the second day of the workshop, the assessors watch a 2-h video and 30-min interview and

score the entire TPOT. Their scores are compared to “gold standard” scores and must achieve 80% agreement to achieve reliability. They then practice the tool using live observations and achieve reliability with gold standard observers. For three studies in which the pilot version and research edition of the TPOT was used (Hemmeter et al., 2014), generalizability coefficients were computed based on classroom, rater, and error facets. Maximum likelihood estimates of the variance components were calculated. Each generalizability coefficient used the variance components due to classrooms as the numerator and the sum of the variance components as the denominator. As noted by Hemmeter et al. (2014, p. 98), “This is a conservative generalizability coefficient because it assumes that in routine use of the TPOT, data will be collected using a different rater for each classroom, whereas typically raters are the same in all or in subsets of classrooms.” Findings from the analyses showed interrater score reliability and agreement were very good to excellent for the key practices subscale (≥ 0.89) and ≥ 0.84 for the red flags subscale. For each key practices item, interrater coefficients generally were good across each of three measurement occasions (range for occasion 1 = .51 to .78, range for occasion 2 = .43 to .78, and range for occasion 3 = .55 to .81).

Comparability of Baseline TPOT Scores Across Studies

As the evidence presented above demonstrates, TPOT scores remain relatively stable in the absence of a PD intervention focused on *Pyramid Model* practices. In a series of three studies, we have also found relative comparability across studies in the average practice implementation percentage scores prior to PD intervention or without intervention (i.e., baseline TPOT scores; Hemmeter et al., 2016; Hemmeter, Snyder, Fox, & Algina, 2017; Snyder, Hemmeter, Fox, Bishop, & Miller, 2013). Table 2 shows data from these three studies and the average percentage implementation (and range of percentage implementation) for the 114 indicators associated with the TPOT key practices items. Average percentage implementation at baseline for the three studies was 39.1, 38.24, and 48.27%, respectively. For red flags, the mean number of red flags in the three studies was 3.0, 3.75, and 3.23, respectively. These data show in the absence of

PD focused on the *Pyramid Model* practices, implementation of practices as measured by the TPOT was, on average, below 42%.

From a practical perspective, these data are significant given they were implemented across early childhood service delivery systems (e.g., child care, Head Start, public school Pre-k) and regardless of setting, the average scores are below the levels of implementation that would be needed to affect change in children’s social skills and problem behavior. Further, given that many *Pyramid Model* practices on the TPOT reflect developmentally appropriate (Copple & Bredekamp, 2009) and recommended practices in early intervention/early childhood special education (Division for Early Childhood, 2014), the low implementation fidelity data were troubling.

With respect to the utility of the TPOT as a measure of fidelity of practice implementation in both treatment and control conditions, we have evidence that improved implementation of *Pyramid Model* practices is associated with improved child social and behavior outcomes. In our research, improvements in ratings of children’s behavior and social skills were associated with teachers who received coaching and training related to the *Pyramid Model* and whose growth in implementation of *Pyramid Model* practices as measured on the TPOT by blind observers changed to a statistically significant and noteworthy extent across three measurement occasions (Hemmeter et al., 2016, 2017). In these studies, mean implementation fidelity percentages for teachers in the control groups remained relatively stable across time and their TPOT implementation fidelity scores were not associated with statistically significant or noteworthy changes in children’s behavior and social skills.

Professional Development and the Measurement of Practice Implementation Change

The TPOT has been used to guide the organization of a professional development intervention that includes workshops, implementation guides, materials, and practice-based coaching of classroom teachers in several research studies (Hemmeter, Hardy, Schnitz, Adams, & Kinder, 2015; Hemmeter et al., 2016) and within states engaged in scaling up implementation of the *Pyramid Model* (e.g., Johnson, 2017, Vinh, Strain, Davidon, & Smith, 2016). Coaching is a professional development strategy that is used to guide practitioners to

Table 2 Average percentage and range of TPOT key practices items and number and range of red flags implemented during baseline across three studies

	Snyder et al. (2013, $N = 50$)	Hemmeter et al. (2016, $N = 40$)	Hemmeter et al. (2017, $N = 92$)
Key teaching practices ($v = 114$)	39.1% (14–73%)	38.24% (16–74%)	48.27% (19–86%)
Red flags ($v = 17$)	3.0 (0–11)	3.75 (1–10)	3.23 (0–11)

v = number of indicators (key teaching practices) or items (red flags)

implement and sustain the use of evidence-based practices as intended (Metz et al., 2013; Snyder, Hemmeter, & Fox, 2015). An important aspect of effective coaching is the explicit identification of the practices that are the focus of coaching and the use of repeated cycles of observation and feedback on the implementation of the targeted practices. Coaching that uses these and other elements (i.e., explicit set of practices, cyclical process of coaching support, reflection) has been shown to be effective in several research studies related to social–emotional teaching practices (e.g., Artman-Meeker & Hemmeter, 2013; Fox, Hemmeter, Snyder, Binder, & Clarke, 2011), behavior support (Conroy et al., 2015), and embedded instruction practices (Snyder et al., 2017b), and early childhood literacy practices (McCollum, Hemmeter, & Hsieh, 2013).

Using the TPOT as an instrument to support practice implementation was carried out within a defined coaching framework known as practice-based coaching (PBC). PBC has been described as “a cyclical process for supporting preschool practitioners’ use of effective teaching practices that leads to positive outcomes for children” (Snyder et al., 2015, p. 2). PBC is implemented through a collaborative partnership with the coachee and is focused on a defined set of effective teaching practices. The cyclical process involves the development of shared goals and an action plan, the use of focused observation of targeted practices, and the use of reflection and feedback.

When using PBC to support fidelity of implementation of *Pyramid Model* practices, the coach and teacher use TPOT data to assess a teacher’s current level of implementation of the *Pyramid Model* practices (i.e., implementation strengths and needs) and to guide the collaborative development of an action plan. At the initial meeting, the teacher shares the priorities for implementation and the coach shares the TPOT results and describes the practices that could be pivotal for the teacher to focus on for the action plan. After reviewing the teacher’s preferences and the data from the TPOT,

the coach and teacher collaboratively identify the practice goals that will be listed on the action plan. After defining the action plan, the PBC process is used in repeated cycles of focused observation (i.e., observing the implementation of practices identified on the action plan) and debriefing from the observation by guiding reflection and providing feedback. The coach might continue to use the TPOT informally, as a progress monitoring checklist, to identify teacher growth in practices and then re-administer the TPOT to formally assess teacher growth in practice implementation.

The use of the TPOT within PBC allows for precision in the delivery of coaching that is targeted and efficiently delivered. Using TPOT data, the coaches are able to target practices needed for growth and identify any red flags that need to be addressed as a priority. In addition, the TPOT provides an assessment of growth in teacher practices as an outcome from coaching efforts.

We have used the TPOT as a component of PBC delivery in two randomized trials with notable fidelity of practice implementation outcomes. Table 3 shows comparative data across conditions and studies (Hemmeter et al., 2016, 2017) and suggest TPOT scores are sensitive to detecting change in preschool teachers’ implementation of *Pyramid Model* practices following a PD intervention.

Both studies focused on teachers’ implementation of the *Pyramid Model* practices and examined associated outcomes for children in the classroom. In the first study, 40 public school classroom preschool teachers in Florida and Tennessee were randomly assigned to two conditions with one group receiving workshop training, implementation guides, materials, and practice-based coaching and the other group receiving training only after we had collected *Pyramid Model* implementation fidelity data over an academic year (Hemmeter et al., 2016). The teachers in the experimental condition received workshop training in *Pyramid Model* practices, implementation guides and classroom materials, and between 7 and 17 sessions of PBC (mean of 13.4

Table 3 Comparison of TPOT mean percentage key practices implementation data for intervention and BAU conditions over the course of a study across two studies

Study	Mean percentage (SD) TPOT key practices implementation							
	Wave 1 (preintervention)		Wave 2 (during intervention)		Wave 3 (during intervention)		Wave 4 (post-intervention)	
	I	BAU	I	BAU	I	BAU	I	BAU
Hemmeter et al. (2016, N = 40)	37.0 (13.9)	45.6 (14.8)	43.2 (13.3)	41.3 (11.3)	56.3 (18.9)	44.6 (13.4)	69.9 (17.5)	44.2 (14.8)
Hemmeter et al. (2017, N = 92)	47.79 (15.77)	49.37 (14.77)	54.07 (14.67)	47.30 (17.35)	60.62 (17.32)	47.00 (17.63)	59.33 (17.57)	47.84 (17.10)

I = Pyramid Model professional development intervention, BAU = business-as-usual professional development

sessions) that were scheduled to occur on a weekly basis. We had four measurement waves where the TPOT was used to assess implementation of the *Pyramid Model* practices with the first administration occurring before training and coaching. The first TPOT measure was used as a covariate in the examination of differences between teachers in the experimental and control conditions. For each of the three subsequent administrations of the TPOT over the academic year, there were statistically significant and noteworthy differences between teachers who received PBC following workshop training and teachers in the control condition. Teachers who received PBC implemented more practices with fidelity (Hemmeter et al., 2016).

The second study was conducted in classrooms in Florida and Tennessee and involved 92 preschool classroom teachers within public schools. They were randomly assigned to receive workshop training, implementation guides, materials, and practice-based coaching or to receive workshop training and implementation guides and materials at the end of the academic year following data collection. In this study, each of the 45 teachers in the intervention condition received 16 sessions of PBC. We used the TPOT to examine teaching practices at four points in time over the first year of coaching and have analyzed these data using a single-level multivariate ANCOVA with the first measurement point score (gathered prior to training and coaching) as the covariate. At each measurement point, we found that teachers who received training and PBC showed significant and noteworthy differences in practice implementation when compared with teachers in the control conditions with moderate to large effect sizes (Hemmeter et al., 2017).

Discussion

The information presented in this article demonstrates the utility of the TPOT for use as a tool for measuring fidelity of practice implementation and changes in teacher practice implementation. In addition, the TPOT can be used in professional development to guide coaches in their work with teachers. Consistent with tenets of implementation science about the importance of the competency drivers for supporting implementation of evidence-based practices, our findings show a professional development intervention that includes workshops/training, implementation guides and materials, and practice-based coaching increased teachers' implementation of social-emotional teaching practices as measured by the TPOT. TPOT scores over the course of the studies demonstrated teachers in the intervention condition made progress toward implementation benchmarks (defined as $\geq 60\%$ fidelity of practice implementation). Teachers in the BAU condition, on average, did not grow in their adherence

to *Pyramid Model* practices or the quality of their practice delivery.

Further, our data indicate that the TPOT may be used as an instrument to provide actionable information about practitioners' competence with respect to a defined set of intervention practices. Data from the TPOT can be used formatively to inform PD, including practice-based coaching (Snyder et al., 2015). Data from the TPOT can be used to identify strengths and needs related to practice implementation and inform the development of individualized goals and action plans used by coaches and those being coached to enhance or refine practice implementation. TPOT data can also be used for summative purposes to characterize the adherence, quality, and differentiation of delivery of *Pyramid Model* practice implementation for an individual teacher, for a set of classrooms, for a program, or for a group of programs or to examine changes in levels or trends of implementation over time following PD that includes practice-based coaching.

At the program level, the TPOT can be used to examine the implementation of practices across teachers. When the TPOT is used in this manner, data on practice implementation are summarized across teachers to provide average scores on key practice areas. School or program personnel can use these data to (a) identify key practice areas to address in professional development activities, (b) provide guidance related to curriculum or lesson planning, and (c) design other professional development strategies or supports (e.g., community of practice, book study). For example, a program or school might use TPOT scores to determine which teachers need the most intensive form of support (e.g., individual, intensive delivery of practice-based coaching) versus teachers who might benefit from less intensive forms of support (e.g., group coaching).

In programs or schools that are implementing Multi-Tiered Systems of Supports, the TPOT provides an essential tool for assessing the implementation of universal social, emotional, and behavioral teaching practices and teachers' capacity to implement explicitly designed tier 2 and tier 3 interventions for small groups or individual children. Data from the TPOT can be used by the MTSS implementation team to assess current capacity and growth in the implementation of social, emotional, and behavioral teaching practices.

States and local regions have also identified the TPOT as a valuable measure for examining classroom quality. In several states and local communities, the TPOT is used as a classroom quality measure that contributes to the evaluation of overall quality of a program within a quality rating system. When the TPOT is used in this manner, it provides an incentive to early care and education programs to focus on the implementation supports needed to strengthen classroom implementation of the *Pyramid Model*.

Although the TPOT has been used primarily to measure the implementation of *Pyramid Model* practices in early childhood classrooms, it could be used to measure changes in classroom practices as a result of professional development on other sets of social–emotional teaching practices or as a measure of the implementation of universal social–emotional curricula. As described earlier, the *Pyramid Model* reflects high-quality developmentally appropriate practices (Copple & Bredekamp, 2009) and as a result, the TPOT is aligned with those practices and could be used in the context of other social–emotional interventions. We have evidence (Snyder et al., 2013) that TPOT scores are moderately to strongly correlated with the domains and dimensions on the Classroom Assessment Scoring System (CLASS; Pianta, LaParo, & Hamre, 2008). The CLASS is a more general measure of classroom quality and has been used in a number of studies to measure changes in teacher practice and the relationship of those practices to child outcomes (e.g., Chien et al., 2010).

In summary, the TPOT is one of only a few tools that has the potential to be used in a variety of ways and settings to measure the implementation of teaching practices designed to support young children’s social and emotional competence. Given the increased emphasis on young children’s social and emotional competence for current and future success, we believe that the use of this measure by professional development providers, classroom coaches, implementation leadership teams, and systems can lead to the use of evidence-based practices that will result in important social and emotional outcomes for young children.

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Compliance with ethical standards

Conflict of interest Mary Louise Hemmeter, Patricia Snyder and Lise Fox have received funding from the Institute of Education Sciences. Mary Louise Hemmeter, Patricia Snyder and Lise Fox receive royalties from sales of the Teaching Pyramid Observation Tool (TPOT) from Brookes Publishing Company.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Animal Rights This article does not contain any studies with animals performed by any of the authors.

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