



# Implementation of Early Achievements for Childcare Providers: A cluster-randomized controlled trial

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## ABSTRACT

A research-to-practice gap exists in childcare settings, particularly affecting instruction to children with developmental delays (DD) including those with or at risk for autism spectrum disorder (ASD). This study aimed to improve implementation of evidence-based instructional practices by childcare providers in inclusive center-based classrooms; a secondary aim was to examine effects on social and communication outcomes of toddlers with DD and/or ASD. Forty-eight childcare providers from 27 centers and 46 toddlers with social and/or communication delays (mean age = 28.5 months) participated in a cluster-randomized controlled trial. Providers were randomized, at the center level, to Instruction-As-Usual (IAU) or the Early Achievements for Childcare Providers (EA-CP) condition. EA-CP providers received two workshops and weekly, job-embedded coaching. Providers' use of evidence-based instructional practices delivered within a book sharing activity, and toddlers' cognitive, language, and social communication skills were assessed prior to and following training. Significantly greater gains from pre- to post-training in implementation of EA-CP instructional practices were observed in the EA-CP than IAU group ( $p < .001$ ,  $d = 7.2$ ). Greater social communication gains were observed in toddlers in EA-CP than IAU classrooms ( $p < .001$ ,  $d = 1.02$ ). Results support the conclusion that the short-term EA-CP professional development program improved implementation of evidence-based instructional practices by childcare providers in inclusive childcare settings, with a direct impact on social and communication outcomes of toddlers with DD, including those with ASD.

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## 1. Introduction

Early childhood care and education (ECCE) providers play a vital role in the development and well-being of children. In the United States, center-based providers serve 24% of children under age four whose mothers are employed (Federal Interagency Forum on Child & Family Statistics, 2011). Approximately (about 14%) have a developmental delay (DD) (e.g., learning disability, attention deficit hyperactivity disorder, other developmental delay, autism) (Boyle et al., 2011), though DD is often undetected prior to age three years. Even more (25%) are at moderate to high risk for

a developmental, behavioral, or social delay (National Center for Health Statistics at the Centers for Disease Control, 2012). With the passage of the Americans with Disabilities Act (ADA; Americans with Disabilities Act of 1990, 1990) licensed childcare centers must provide care for children with DD. Despite this policy giving access to community-based opportunities for children with DD, there are limited DD-focused trainings for ECCE providers. Not surprisingly then, ECCE providers' instructional delivery often is not aligned with evidence-based instructional practices for teaching young children with developmental disabilities (Mandell et al., 2013; Pence, Justice, & Wiggins, 2008; Stahmer, Collings, & Palinkas, 2005). It has been reported that teachers demonstrate difficulty providing clear and appropriate instructions, using prompting strategies, delivering clear and correct consequences, and using error correction procedures in their classrooms, despite explicit training to do so (Mandell et al., 2013). Further, Stahmer et al.'s (2005) data from focus groups with community intervention providers revealed that few clearly understood evidence-based practice and all felt inadequately trained in the use of such prac-

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tices. These problems reflect a gap between what is known about best instructional practices for young children with DD and what is done within the context of community settings. To address this gap, instructional practices shown to be efficacious in clinical investigations must be translated for implementation by providers in authentic ECCE settings to instruct children with DD. The importance of doing so is particularly relevant for children with autism spectrum disorder (ASD) because core impairments interfere with social engagement and reciprocity, communication, and play. Such impairments affect the input they receive from others, and thwart their ability to access the curriculum (Vivanti, Dawson, & Rogers, 2017). The present study was designed to address this research-to-practice gap by examining the effects of a professional development (PD) program designed to support ECCE providers' implementation of evidence-based, child-contingent instructional strategies via a semi-structured social communication intervention package: Early Achievements for Childcare Providers (EA-CP).

### 1.1. Evidence-based instruction in ECCE settings

Early intervention research has identified essential evidence-based intervention strategies that are appropriate for children with developmental disabilities (DD), including those with ASD (Bunce, 1995; Schreibman et al., 2015; Stahmer et al., 2005). These strategies align well with recommended practices endorsed by the Division for Early Childhood of the Council for Exceptional Children (Division for Early Childhood, 2014), and include: integrating children's interests, presenting clear antecedent cues, providing systematic prompting and reinforcement, modeling, and expanding child utterances. Yet research suggests that providers' implementation of such child-responsive, explicit, and routines-based instructional practices remains low over the course of a school year, even for those who have attended workshops that included role playing and guided observation of videos of the teachers' own instructional implementation (Fuller & Kaiser, 2019; Mandell et al., 2013; Pence et al., 2008). As a result, children are offered infrequent opportunities to engage in the types of interactions with educators that support or accelerate development and learning (Diamond, Justice, Siegler, & Snyder, 2013; Early et al., 2010; Girolametto, Weitzman, van Lieshout, & Duff, 2000; Mashburn et al., 2008). A poignant example of this was documented in a study of typical book reading activities with young children wherein providers used group-directed communication and behavior-controlling language, with frequent test questions (e.g., "What color is this?") and directives (Girolametto, Weitzman et al., 2000) rather than child-responsive strategies. Providers also used significantly more directive language and less language-modeling input when addressing children with language delay compared to children with no delays (Girolametto, Hoaken, Weitzman, & van Lieshout, 2000). Such reports highlight the need for interventions that may be feasibly implemented by ECCE providers, supporting their ability to provide instruction using evidence-based strategies.

The tendency of providers to modify evidence-based instructional strategies to match their own teaching style or failure to utilize evidenced-based practices altogether (Mandell et al., 2013; Stahmer et al., 2005) limits their ability to promote positive social, language, and cognitive outcomes for children (Dickinson & Tabors, 2001; Hoff & Naigles, 2002; National Institute of Child Health & Human Development (NICHD) Early Child Care Research Network, 2000). An observational study of providers' interactions with toddlers and preschoolers in a book reading context revealed high levels of directiveness, including frequent behavior and response control statements (Girolametto, Hoaken et al., 2000). The instructional context of book reading was particularly replete with provider directiveness, which inhibited children's participation and was associated with restricted and less complex language

production by the children. Yet book sharing has the potential to serve as a vital tool in advancing children's language (e.g., vocabulary) and literacy development (Marulis & Neuman, 2010; Mol, Bus, & de Jong, 2009).

### 1.2. Current classroom-level treatments for children with developmental delay

Classroom-level interventions for young children with DD exist, but are limited. The most well-studied classroom treatments for children with DD include the *Treatment and Education of Autistic and Communication Handicapped Children* (TEACCH; Mesibov, Shea, & Schopler, 2005), *Learning Experiences . . . An Alternative Program for Preschoolers and Parents* (LEAP; Hoyson, Jamieson, & Strain, 1984), *Strategies for Teaching based on Autism Research* (STAR; Arick, Loos, Falco, & Krug, 2004), and the *Pyramid Model for Promoting Social and Emotional Competence in Infants and Young Children* (Fox, Dunlap, Hemmeter, Joseph, & Strain, 2003; Hemmeter, Ostrosky, & Fox, 2006). Neither TEACCH nor LEAP is designed for use with two-year-olds, and the STAR treatment has been examined only at the classroom level in grades K-2. While the Pyramid Model has been examined in childcare settings, its focus is to support social-emotional functioning and behavior regulation in young children with DD; social-communication and language development are not primary targets of this intervention. The LEAP intervention requires extensive training to reach fidelity and is to be implemented throughout the school day. There is a need for an intervention targeting social-communication and language skills in toddlers with DD and/or ASD who participate in inclusive childcare classrooms that can be easily implemented by childcare providers in these authentic settings.

### 1.3. Shared book reading as model for language intervention

Shared book reading is an empirically supported engagement strategy for promoting young children's language and literacy development (Towson, Fetting, Fleury, & Abarca, 2017). Via books, children are exposed to new vocabulary within varied grammatical contexts and provide a language-rich context for adult supported, child responsive dyadic engagement. Perhaps the instructional strategy used during book sharing with the most empirical support is dialogic reading, which has been used in early childhood settings to promote language and literacy development in children with typical development and those at risk for developmental delays (Towson et al., 2017; Walker et al., 2020). Dialogic reading involves the adult partner's use of a variety of strategies (e.g., asking open-ended questions, commenting, labeling, prompting responses, expanding on the child's utterances) to encourage the child's verbal expression. Book sharing-based interventions reportedly improve language and emergent literacy outcomes for children, including expressive and receptive vocabulary skills, mean length of utterance, verbal participation, and rhyme awareness (Towson et al., 2017; Walker et al., 2020; Wasik, Hindman, & Snell, 2016).

Little is known about childcare providers' use of evidence-based instructional strategies during book sharing activities or the effects on young children in childcare settings. In Walker et al.'s systematic review of language intervention in childcare and education settings (2020), only half of the shared book reading intervention studies implemented in early childhood settings measured implementation fidelity among providers delivering the intervention, a known driver of change for improved child outcomes. Furthermore, the quality of fidelity measurement was weak or inadequate in close to 20% of the studies surveyed. Indeed, in a randomized controlled trial examining providers' fidelity of implementation of the Responsive Early Childhood Program (RECP) and effects on

toddlers in those providers' childcare classrooms, Landry and colleagues (Landry et al., 2014) identified low to moderate fidelity in RECP-trained providers' implementation of academic readiness instructional strategies (including those to target language development) and no RECP effects on the toddlers' language development. In Walker et al.'s systematic literature review (2020), small sample sizes characterized most intervention studies focused on infants and toddlers, with most including no more than 10 children. Despite numerous limitations in the extant early intervention literature, 96% of the studies reviewed by Walker et al. (2020) had the intended effects on children. There is a need for more interventions that can be feasibly implemented in ECCE settings with young children and for more studies of the effects on providers of trainings designed to improve their fidelity of implementation. Further, there is a need for more childcare-based studies of the effects of early interventions on young children's development.

#### 1.4. Early Achievements for Childcare Providers

EA-CP emerged from the 'Early Achievements' classroom-level intervention, which has documented efficacy for improving social and language outcomes in two-year-olds with autism spectrum disorder (ASD) when implemented in a research classroom setting (Landa, Holman, O'Neill, & Stuart, 2011) and for preschool-aged children when implemented in a more simplified and less comprehensive form by public school teachers in preschool classrooms serving children with ASD (Engelstad, Holingue, & Landa, 2020). This evidence-based model was translated for implementation in center-based community early ECCE settings to meet the needs of toddlers with social-communication and developmental delays enrolled in inclusive childcare classrooms, including children with or at risk for autism. EA-CP was conceptualized as a supplemental, not replacement, intervention to complement existing early childhood educational curricula, and packaged for implementation by childcare providers in authentic classroom settings during a group book reading instructional activity.

Early Achievements for Childcare Providers (EA-CP) is a whole classroom-level intervention designed to promote children's meaning construction. EA-CP has four intertwined intervention components (see Method, below) to help providers transform book reading into an *interactive book sharing* experience by actively engaging children to embody story-related concepts via use of props and peer interaction. Together, the intervention components support children's meaning construction and development of social communication skills as well as language during shared book reading. Providers learn to explicitly target (address) the following skills during EA-CP implementation with their students: (1) understanding others' intentions within perspective-taking opportunities such as initiation of and response to others' joint attention bids; (2) socially contingent imitation; (3) initiation and responsiveness within peer-to-peer engagement opportunities; and (4) language (understanding and communicative use of symbol representations via gestures and words). These skills often are not explicitly or consistently addressed in the curricula employed in ECCE settings.

##### 1.4.1. EA-CP instructional strategies

Providers are trained to implement selected naturalistic developmental behavioral intervention (NDBI) strategies (Schreibman et al., 2015) and child-responsive strategies (Bunce, 1995) to target the skills defined above. These strategies include: (a) providing clear antecedent cues, (b) prompting (including modeling and pausing), (c) reinforcing child attempts (providing positive contextually relevant reinforcement when children attempt [successfully or partially successfully] to initiate or respond following an antecedent cue), (d) expanding child utterances (repeating the

child's utterance with more complete syntactic form or extending the child's utterance by providing additional semantic information), and (e) providing event casts (describing an ongoing activity). Table 1 provides definitions and examples of these strategies and illustrate how they align with the DEC's recommended practices (Division for Early Childhood, 2014). Finally, EA-CP includes providing focused stimulation (Cable & Domsch, 2011; Ellis Weismer, Venker, & Robertson, 2017), which occurs during moments of provider-child or child-child shared attention as the provider exposes children to multiple examples of specific targets within the naturalistic, meaningful context of the story.

#### 1.5. Feasible implementation in authentic ECCE settings

Childcare providers face numerous barriers to learning and implementing such evidence-based strategies in their classroom settings. For example, there exists a paucity of pre-service and in-service training for childcare providers targeting the multiple learning needs of and effective instruction for children with DD (Artman-Meeker, Fettig, Barton, Penney, & Zeng, 2015). This results in variable knowledge among childcare providers about the developmental needs of children with DD. The often-limited resources (e.g., time, funding) that exist to support childcare providers in pursuing professional development opportunities further complicates access to high quality training (Sheridan, Edwards, Marvin, & Knoche, 2009). As a result, childcare providers report feeling being bound by the rules of the childcare system, which often focus on classroom ratios and other regulatory issues and less on effective instruction (Gable & Halliburton, 2003). It therefore is not surprising that providers report general feelings of being undervalued in their roles as teachers, citing low wages and poor benefits, but high expectations for performance (Faulkner, Gerstenblatt, Lee, Vallejo, & Travis, 2016). Given these barriers, the EA-CP model was strategically adapted to address the unique needs and challenges faced by childcare providers in their classroom settings.

#### 1.6. The present study

Translation of the EA intervention to ECCE settings requires empirical investigation to evaluate proximal effects (i.e., degree to which childcare providers demonstrate fidelity of implementation), and distal effects (i.e., on toddlers' social and communication development). Thus, in the present study, the following research questions were posed:

- 1 Do providers trained in the Early Achievements for Childcare Providers (EA-CP) intervention demonstrate greater gains in their implementation of evidence-based instructional strategies embodied in the EA-CP intervention within the training period than untrained providers?
- 2 Do toddlers in classrooms of EA-CP trained providers exhibit greater gains in social-communication skills than toddlers in classrooms of untrained providers?

## 2. Method

### 2.1. Design

This study employed a cluster-randomized controlled trial design (Puffer, Torgerson, & Watson, 2005). Data were collected from two cohorts of providers and children, across two years. The intervention phase for each cohort lasted approximately five months. Recruitment and randomization procedures remained consistent across cohorts.

**Table 1**  
EA-CP instructional strategies, definitions, and examples.

Strategy type	Instructional strategy	Definition	Example	Alignment with DEC recommended practice(s)
NDBI and Child Responsive Strategies	Delivering antecedent cues	Delivering a clear event or action designed to immediately elicit a particular type of child behavior.	Adult: The bear is hungry [hold fork and teddy bear in front of child to cue the child to use the fork to feed the bear].	–
	Prompting	After a child's partial or incorrect production of a targeted behavior, the provider pauses and/or models the correct behavior to scaffold child success.	Adult: The bear is [expectant pause].	INT5
	Reinforcing	Delivering positive verbal reinforcement for child's successful or unsuccessful attempt to produce a targeted behavior.	Adult: Say, "bear is hungry." Child: Pats stomach to show "hungry" gesture.	INT3
	Expanding	Following a child's utterance by providing additional syntactic and/or semantic information	Adult: Yes, you're showing me hungry. Child: Bear hungry.	INT3, INT4
	Event casts	Providing a goal-related ongoing description of an activity or event in which the child is engaged	Adult: Yes, the hungry bear wants to eat. Adult: You're feeding the bear honey.	INT4

Note: DEC = Division of Early Childhood of the Council for Exceptional Children. INT3 = interactional practices that support the child's communication development; INT4 = interactional practices that support the child's cognitive development; INT5 = interactional practices that support the child's problem-solving behavior.

## 2.2. Recruitment

Children and providers were recruited from toddler classrooms in childcare centers in and around Baltimore, MD. Licensed childcare centers were identified from a list maintained by the Maryland State Department of Education Office of Child Care Licensing Branch. Childcare directors were contacted via email and/or phone; in person meetings were convened with the directors of interested centers to further explain the study and identify candidate classrooms (one-, two-, and three-year-old classrooms) within their centers. Research study staff met with the childcare providers from these toddler classrooms to explain study procedures and consent providers for participation. Once a childcare provider consented to participate, all children and families from that classroom were invited to participate in the study via a study recruitment flyer. Interested families provided written consent for their children to participate in eligibility testing, which took place at the childcare center. Those children who met the eligibility criteria outlined below were enrolled in the study along with their childcare provider.

## 2.3. Randomization

Intervention assignment occurred at the center level and was accomplished utilizing a random number generator. Childcare centers were randomized to either the Early Achievements for Childcare Providers (EA-CP) intervention condition or Instruction-As-Usual (IAU) control condition. Randomizing at the center level provided protection from contamination across conditions. Post-randomization checks confirmed the balance of treatment and control conditions by the number of participating providers from each center and the childcare center's tuition rate. Childcare cen-

ter tuition rate was categorized as high, moderate, or low, which served as a proxy for the socioeconomic status of families enrolled at a given childcare center. Providers assigned to the EA-CP condition received a five-month professional development (PD) training (two workshops + weekly coaching, described below) designed to increase their implementation of evidence-based instructional strategies in their classrooms, during an interactive book sharing activity. Providers assigned to the IAU control condition were invited to participate in the workshop trainings (no coaching) at the conclusion of the study. All study procedures were approved by the Institutional Review Board at The Johns Hopkins University School of Medicine.

## 2.4. Participants

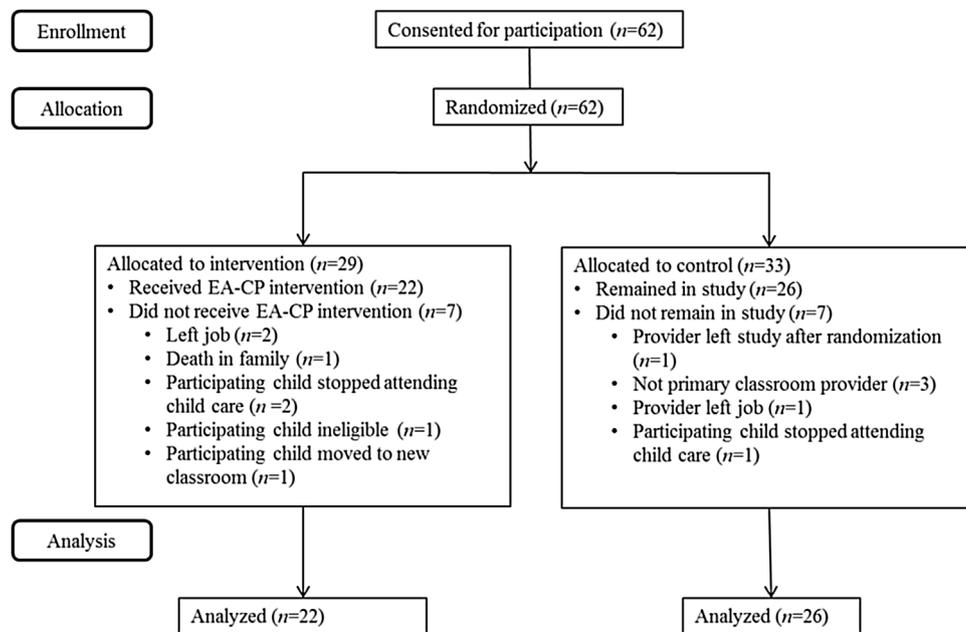
### 2.4.1. Providers

Participating providers were required to: (a) be currently working at a state-licensed center-based childcare and (b) have at least one child with social and/or communication delays (including, but not limited to, ASD) in their classrooms. Table 2 presents demographic characteristics of participating providers. All were female; none were Hispanic/Latino. Fifty two percent were Caucasian, 43% were African American, and 5% identified as Multiracial. Providers' levels of education varied: 28% had a high school degree or GED-equivalent; 33% had an Associate's degree or some college experience; 33% had a Bachelor's degree; and 6% had a Graduate degree. Mean number of years' experience working with infants and toddlers was 11.42 ( $SD = 7.0$ ). None of the participating providers reported having attended previous trainings on supporting learning in young children with autism or other DD. No significant differences were detected between groups in providers' levels of education or experience working with infants and tod-

**Table 2**  
Provider demographic data.

	Group		Total (N = 48)	$\chi^2$	p	t	p
	EA-CP (n = 22)	IAU (n = 26)					
Sex				¥	¥		
%Female	100 %	100 %	100 %				
Ethnicity (n)	13	24	37	¥	¥		
%Hispanic/Latino	0%	0%	0%				
Race (n)	21	23	44	2	.4		
%Caucasian	57.1 %	47.8 %	52.3 %				
%African American	42.9 %	43.5 %	43.2 %				
%Multiracial	.0 %	8.7 %	4.5 %				
Education (n)	18	18	36	6.3	.10		
%High school/GED	27.8 %	27.8 %	27.8 %				
%Associate's degree or some college	44.4 %	22.2 %	33.3 %				
%Bachelor's degree	16.7 %	50.0 %	33.3 %				
%Graduate degree	11.1 %	0.0 %	5.6 %				
State Certification Status (n)	22	26	48				
%Certified	68.2 %	57.7 %	62.5 %				
Number of years working with infants and toddlers, Mean (SD)	9.60 (4.81)	13.02 (8.31)	11.42 (7.04)			-1.7	.10
Number of years working with infants and toddlers with autism, Mean (SD)	8.69 (5.82)	12.72 (9.45)	10.99 (8.21)			-1.3	.20

Note: EA-CP = Early Achievements for Childcare Providers; IAU = Instruction-As-Usual; ¥ denotes no statistics computed because variable is a constant.



**Fig. 1.** Provider recruitment and randomization flow diagram, from consent through data analysis.

dlers. Fig. 1 displays a CONSORT flow diagram (Schultz, Altman, & Moher, 2010) for providers, from enrollment through data analysis.

#### 2.4.2. Children

Children's ages ranged from 12 to 47 months at enrollment; 8% of the treatment group (2/24) and 14% of the control group (3/22) were over 36 months of age. Children above 36 months of age who missed the cut-off for the four-year-old Pre-K classrooms at their ECCE setting were enrolled in the study. No children left the study because they aged into a Pre-K classroom. All children met one or more of the following criteria for social-communication delay: (a) met criteria for autism or ASD, as described below, on the *Autism Diagnostic Observation Schedule, Second Edition* (ADOS-2; Lord, Rutter et al., 2012; Lord, Luyster, Gotham, & Guthrie, 2012) when administered by autism experts with Master's or Doctoral degrees trained to research reliability; and/or (b) demonstrated a delay in language and/or cognitive domains per the *Mullen Scales of Early Learning* (MSEL; Mullen, 1995) by falling  $\geq 1.25$  standard deviations below the mean (T score  $\leq 37.5$ ) on the Receptive Language,

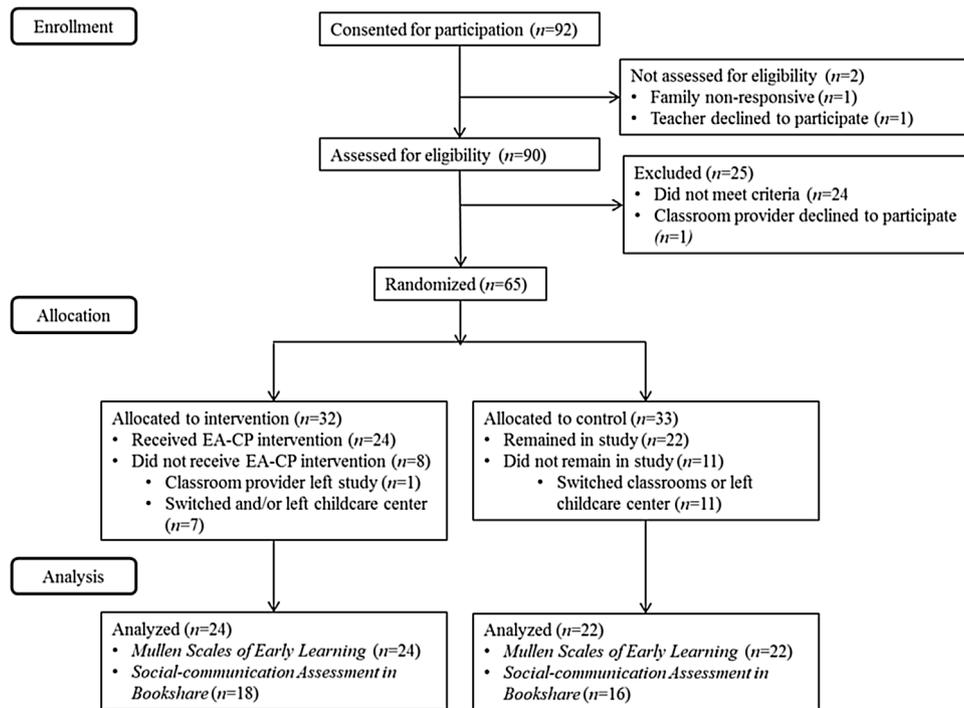
Expressive Language, and/or Visual Reception subscales, respectively. While 28 (61%) of the children met ADOS-2 criteria for ASD or autism, this was not required for participation if children met the criteria listed in (b) above.

Table 3 displays the demographic characteristics of the participating toddlers and their parents. A majority of toddlers (69.6%) were male; 60% were Caucasian, 31.4% were African American, and 8.6% were Hispanic/Latino. A significant difference in toddlers' chronological age at baseline testing was found between toddlers in the EA-CP condition ( $M = 26.5$ ,  $SD = 7.5$ ) and toddlers in the IAU condition ( $M = 30.7$ ,  $SD = 6.1$ ),  $t_{(44)} = -2.11$ ,  $p = .04$ . Parents' education level was: 12.1% having received a high school degree or GED-equivalent, 9.1% having an Associate's or some college completion, 30.3% having a bachelor's degree, and 48.5% having a graduate degree. Annual household income ranged from 23.4% with reported income of  $\leq \$30$  K to 73.5% with reported income  $> \$60$  K. Although no significant differences in parents' levels of education or annual household income were found, there were visible differences between groups. For example, Table 3 shows that parents of

**Table 3**  
Child demographic data.

	Group		Total (N = 46)	$\chi^2$	p	t	p
	EA-CP (n = 24)	IAU (n = 22)					
Sex							
%Male	50.0 %	38.9 %	69.6 %	.70	.40		
Chronological Age in Months							
Mean (SD)	26.5 (7.5)	30.7 (6.1)	28.5 (7.1)			-2.11	.04*
Race/Ethnicity (n)	18	17	35	.44	.80		
%Hispanic/Latino	11.1 %	5.9 %	8.6 %				
%Caucasian	61.1 %	58.8 %	60.0 %				
%African American	27.8 %	35.3 %	31.4 %				
Caregiver's Highest Level of Education (n)	17	16	33	5.31	.15		
%High school/GED	.0 %	25.0 %	12.1 %				
%Associate's degree or some college	11.8 %	6.3 %	9.1 %				
%Bachelor's degree	29.4 %	31.3 %	30.3 %				
%Graduate degree	58.8 %	37.5 %	48.5 %				
Annual Household Income (n)	17	17	34	10.00	.13		
% <10K	.0 %	23.5 %	11.8 %				
%10to15K	5.9 %	.0 %	2.9 %				
%15to20K	.0 %	5.9 %	2.9 %				
%20to25K	.0 %	5.9 %	2.9 %				
%25to30K	5.9 %	.0 %	2.9 %				
%55to60K	.0 %	5.9 %	2.9 %				
%Above60K	88.2 %	58.8 %	73.5 %				

Note: EA-CP = Early Achievements for Childcare Providers; IAU = Instruction-As-Usual; \* denotes significance at the  $p < .05$  level.



**Fig. 2.** Child recruitment and randomization flow diagram, from consent through data analysis.

children in the EA-CP group were comprised of 87% having a bachelor's and graduate degree in comparison to 68% for the IAU group. Similarly, household income for families in the EA-CP group was 88% above \$60,000 with 0% under \$10,000, while the IAU group had 59% above \$60,000 and almost 24% under \$10,000 (see Limitations section). Fig. 2 displays a CONSORT flow diagram (Schultz et al., 2010) for children, from enrollment through data analysis.

### 2.5. Child assessments

All child assessments were administered at the childcare centers, with pre- and post-intervention testing aligning with the seasons of the fall and spring. Testing was conducted in a quiet

space identified by the childcare center director, away from classroom-based group activities. Only children for whom parents provided consent to participate in the study were assessed for eligibility. The ADOS-2 (Lord, Rutter et al., 2012; Lord, Luyster et al., 2012) was administered at pre-test as part of the eligibility assessment; the MSEL (Mullen, 1995) was administered at pre-test (as part of the eligibility assessment and as a baseline measure, see 'Child social and communication outcomes' below) and post-test. Both assessments were administered by research clinicians with master's or doctoral degrees, trained to research reliability on test administration and blinded to group assignment. Eligibility and pre-testing occurred on the same day, approximately one week prior to the start of the intervention phase. Post-testing occurred

**Table 4**  
Children's baseline performance, for full sample (n = 46).

	Group		Significance	
	EA-CP (n = 24)	IAU (n = 22)	t	p
Age at baseline in months, Mean (SD)	26.5 (7.5)	30.7 (6.1)	-2.11	.04*
MSEL: T score, Mean (SD)			F	p
Visual Reception <sup>a</sup>	44.3 (10.5)	39.2 (11.5)	2.40	.13
Receptive Language <sup>a</sup>	40.1 (11.2)	35.2 (11.8)*	2.06	.16
Expressive Language <sup>a</sup>	33.6 (10.2)*	33.5 (9.4)*	.00	.95
Early Learning Composite <sup>b</sup>	80.1 (15.0)*	73.6 (14.9)*	2.14	.15

Note: EA-CP = Early Achievements for Childcare Providers; IAU = Instruction As Usual; MSEL = Mullen Scales of Early Learning; <sup>a</sup>Mean = 50, SD = 10. <sup>b</sup>Mean = 100, SD = 15. (\*p < .05).

within one week following the provider's final coaching session. On average, approximately 24 weeks passed between pre- and post-test on the MSEL ( $M = 24.81$ ,  $SD = 4.22$ ).

### 2.5.1. Autism Diagnostic Observation Schedule, second edition (ADOS-2)

The ADOS-2 (Lord, Rutter et al., 2012; Lord, Luyster et al., 2012) is a semi-structured, standardized assessment of a child's communication, reciprocal social interaction, and restricted and repetitive behaviors. Different modules are administered based on a child's language ability; in our sample, 69.5% (32/46) of children were administered the Toddler Module (due to being age 12–30 months); 19.5% (9/46) were administered a Module 1 (age >30 months but not having phrase speech); and 11% (5/46) were administered a Module 2 (age >30 months and having phrase speech).

ADOS-2 criteria for autism or Autism Spectrum Disorder (ASD) included: scoring in the mild-to-moderate range of concern or higher on the Toddler Module (Luyster et al., 2009) or having a calibrated severity score (CSS)  $\geq 4$  on Modules 1 or 2 (Gotham, Pickles, & Lord, 2009). The ADOS-2 CSS provides a standardized metric of autism spectrum-related symptoms. CSS ranges from 1 to 10; higher scores indicate greater autism symptom severity. Scores of 1–3 represent non-spectrum classifications, 4–5 represent ASD classifications, and 6–10 represent autism classifications (Gotham et al., 2009). Consistent with previous research, we classified children as meeting criteria for an ASD diagnosis as having a CSS  $\geq 4$  (Gotham et al., 2009). For Modules 1 and 2, sensitivity ranges from 86% to 98% and specificity ranges from 80 to 100% for the ADOS-2 algorithm autism cutoff and for classifying autism from non-spectrum (Gotham, Risi, Pickles, & Lord, 2007; Gotham et al., 2008).

In our sample, 60.9% (28/46) of all enrolled children met these ADOS-2 criteria for autism. In the EA-CP condition, 50.0% (12/24) of children met ADOS-2 criteria for autism or ASD; in the IAU condition, 72.7% (16/22) met ADOS-2 criteria for autism or ASD. No significant difference in proportion of children with autism or ASD status was observed between groups,  $X^2 = 2.49_{(1)}$ ,  $p = .12$ .

### 2.5.2. Mullen Scales of Early Learning (MSEL)

The MSEL (Mullen, 1995) is a standardized developmental assessment for children ages birth to 68 months. The MSEL has documented strong internal consistency reliability ( $r = .53$ – $.91$  for administered subscales, across age ranges of children assessed in the present study) and convergent validity with the Preschool Language Assessment (PLA; (Zimmerman, Steiner, Evatt, & Pond, 1979) ( $r = .85$  and  $r = .80$  between the MSEL Receptive and Expressive Language scales and the PLA Auditory Comprehension and Verbal Ability subscales, respectively). Table 4 displays toddlers' MSEL baseline performance, reported as T scores (mean of 50, SD 10), for the full sample ( $N = 46$ ). No significant between-group differences in toddlers' performance on any of the MSEL subscales were observed at baseline.

## 2.6. Intervention procedures and adaptations for implementation in ECCE settings

### 2.6.1. EA-CP procedures

EA-CP has four intertwined components delivered during a book sharing instructional activity. Component one involves using the story book to (a) provide multiple story-embedded (e.g., occurring within the book sharing activity) opportunities (Gray, 2003) for children to embody story-related concepts (Toub et al., 2018), initiate engagement with, and communicate about, concepts that the provider is targeting (see component 3 below) and (b) adapt visual scenes and linguistic input for the child's developmental level (Vygotsky, 1997). Component two involves environmental engineering wherein the provider uses strategically selected and pre-arranged placement of props (story-related pictures and objects) to provide children with direct experience with book-related concepts and event sequences. Component three involves explicitly targeting specific social communication and language skills in toddlers (see Early Achievements for Childcare Providers section above). Component four involves use of NDBI and child-responsive strategies to explicitly target the skills defined in component three.

Childcare providers in the EA-CP group were trained (description of training procedures below) to deliver EA-CP in a group setting, at the whole classroom level, at least three times per week. To do so, providers were given five book sharing activity bundles across the 20-week intervention phase. Each book sharing bundle consisted of: a commercially available storybook strategically selected to represent developmentally appropriate concepts and routines for toddlers (e.g., taking a bath, making cookies) without highly abstract illustrations; a book mascot (e.g., plush toy representation of the story book's main character); story scripts with suggestions for simplification of visual scenes and linguistic input to support differentiated instruction for toddlers with social-communication or developmental delays; two-dimensional joint attention targets (e.g., brightly colored and laminated photographs and line drawings representing targeted book vocabulary) for strategic placement within the book sharing area; and sample extension activities to embed the story book concepts into classroom routines beyond book reading (e.g., dramatic play). Providers were permitted to keep these classroom-level supports at the conclusion of the study.

Book sharing began by bringing the children to the designated book sharing area within the classroom setting, introducing the book and corresponding mascot, and delivering the instructional strategies across each page spread of the storybook. Providers were trained to embed opportunities for the following child instructional targets (goals) on each story book page spread: (a) understanding of story-related concepts (receptive language), (b) children's use of targeted book-related vocabulary (expressive language), (c) initiation of and (d) response to story-related joint attention targets placed within the book sharing area, (e) socially contingent motor imitation for story-related concepts (e.g., gestures represent-

ing targeted book vocabulary), and (f) peer-to-peer interaction (e.g., showing, sharing story-related objects with peers). Providers were permitted to select which instructional targets to embed within each page spread but were asked to address each instructional target (receptive language, expressive language, initiation of joint attention, response to joint attention, motor imitation, and peer interaction) a minimum of three times each during book sharing delivery. Providers were encouraged to make the books and materials readily available to the children during their day in the classroom library and center-based activity stations as appropriate, outside of the book sharing context.

### 2.6.2. Adaptations for implementation in childcare settings

Because the EA intervention model was designed for implementation in a clinical setting or, with adaptations, in special education classrooms (Early Achievements for Education Settings [EA-ES] (Engelstad et al., 2020) for preschool children with autism, the model required several adaptations for implementation in childcare settings. Most notably, we reduced the number and type of activities in which providers were asked to implement EA-CP. We focused solely on EA-CP implementation during one interactive book sharing activity. Also, providers were not trained to implement elements of the EA-ES intervention such as providing sensory regulation supports for children nor how to systematically augment spoken language for children with severe expressive language impairment. These adaptations were made to accommodate the younger and more diverse set of children identified with social communication and/or developmental delays (including those with or at risk for autism) found within childcare settings, while also supporting providers' differentiated instruction for the inclusive setting having a higher proportion of neurotypically developing children than did the preschool autism classrooms. In addition, the adaptations were needed to accommodate the larger classroom size often found within childcare classroom settings (e.g., up to 18 children per classroom in the present study) and to address the different curricular expectations that exist within childcare settings compared to special education curricula.

Because childcare providers often have few resources to obtain classroom supplies, the EA-CP model was designed to incorporate readily available, inexpensive materials found in everyday childcare classroom settings (e.g., play food, paper plates/cups, toy cars/trains). Additionally, materials were created to promote provider-parent communication (e.g., worksheets, notes) about new strategies being implemented in the classroom. Finally, we addressed providers' reported feelings of being undervalued in their roles as teachers by promoting their empowerment and self-efficacy as they ventured into implementation of the new intervention package. This included providing explicit supportive feedback, eliciting providers' self-identification of effective implementation of the EA-CP practices, encouraging providers to specify direct impact of their implementation practices and emergence of new skills in their students, delivering weekly "Way to go!" messages from the trainers and coaches, and developing a community of practice among the providers via ongoing, supportive group emails.

## 2.7. Training procedures and adaptations for ECCE settings

Adaptations to the EA-ES professional development training were undertaken for two reasons. First, the institutional expectations for what is accomplished by providers during the time the children are in childcare classrooms are markedly different than what is expected of teachers in special education classrooms. Second, the preparedness of childcare providers to implement a highly nuanced intervention also was markedly different than special education teachers working in preschool classroom settings. Therefore,

we adapted the EA-ES training to be feasible for childcare providers to complete and to be effective at supporting their implementation of the evidence-based instructional strategies. The EA-CP training consisted of two workshops plus weekly, job-embedded coaching.

### 2.7.1. Workshops

The two workshops, which represented a reduction in number from the five workshops delivered in the EA-ES training, were six hours each, held at the research center, and occurred during months one and two of the five-month intervention phase. We sought and received approval to offer continuing education hours through the Maryland State Department of Education Office of Child Care for participation in the workshop trainings. The workshop content was strategically scaled, prioritizing foundational knowledge necessary to support childcare providers in teaching children with social-communication and/or developmental delays. Critical information was emphasized, and the desire to 'teach it all' was resisted in effort to enable providers to master implementation within the short professional development timeframe. During each workshop, members of the study team delivered didactic instruction on the EA-CP model, using PowerPoint presentations with multiple video exemplars of each of the EA-CP instructional targets (receptive/expressive language, initiating/responding to joint attention, motor imitation, and peer-to-peer interaction) and instructional strategies (e.g., meaning enhancement and child-responsive strategies). Workshops included group discussion and role-playing activities with reflection and direct feedback. Providers were supplied with book sharing activity bundles, described above. Following the first workshop, providers began implementation of the EA-CP instructional strategies in their classrooms. At the second workshop, providers reviewed videos of their EA-CP implementation in their classrooms, self-evaluated their fidelity of implementation, reflected on their implementation and the acceptability of the intervention, and received feedback from the trainers (research study staff).

### 2.7.2. Coaching

EA-CP providers received approximately 20 ( $M = 19.3$ ;  $SD = 2.65$ ; range = 15–20) weekly, job-embedded coaching sessions by one of two trained members of the study staff. The study objective was to reach, on average, 20 coaching sessions across the five-month intervention phase, regardless of provider fidelity attainment. Two notable exceptions occurred: one provider left her job early and thus received 15 coaching sessions. A second provider's childcare center was closed by the state health department during the intervention phase; this provider reached 17 coaching sessions prior to the center's closure. Providers were coached to use all EA-CP instructional strategies during each book sharing activity. Coaching sessions were scheduled during the providers' typical classroom story time.

A standardized approach to coaching was implemented across providers, following principles of adult learning (Snyder, Hemmeter, & Fox, 2015). Coaches began each session by checking in with the provider and reviewing the prior week's goals. During the book sharing activity, coaches observed the provider, modeling or prompting as deemed appropriate to support providers' implementation of the EA-CP instructional strategies and videotaped the provider's use of instructional strategies as needed for later review during the debriefing discussion (these videotapes were not used for fidelity coding). Following the interactive book sharing activity, the provider and the coach engaged in a 10- to 15-minute de-briefing discussion. The de-briefing discussion was adapted to be 15 min in duration, which is 15 min shorter than in the EA-ES professional development training. This abbreviated coaching session duration was intended to alleviate pressure on the childcare provider to find additional classroom support during

that time spent with her coach. During the debriefing discussion, the coach engaged the provider in guided reflection (Snyder et al., 2015) on her delivery of instructional strategies during the interactive book sharing activity, providing supportive and constructive feedback (Shannon, Snyder, & McLaughlin, 2015). Throughout the coaching session, the coach recorded her own observations and the providers' observations via handwritten notes on a standardized study-generated form; this form was used to align the provider's self-evaluation with the coach's observation of her implementation of EA-CP instructional strategies. Finally, each coaching session ended with the coach and provider co-constructing an action plan for the upcoming week (Snyder et al., 2015). The provider and the coach identified and operationally defined up to three specific goals, generated an action plan to accomplish those goals, and listed resources needed for successful goal attainment. The provider was given a copy of the action plan at the end of the debriefing meeting and/or received a typed version of the action plan via follow-up email.

## 2.8. Outcome measures

### 2.8.1. Provider implementation fidelity

While delivering a book sharing instructional activity in their classroom settings, providers were videotaped by a research assistant blinded to group membership, on days a coach was not present, at baseline and at post-training. Post-training videotaping occurred during the week following the final coaching session ( $M = 3.2$  days, range = 1–9 days between final coaching session and post-training videotaping), with one exception. For one provider, 21 days lapsed between her final coaching session and post-training videotaping, due to the provider's scheduling constraints. Providers' implementation of evidence-based instructional practices, as designed for implementation in the EA-CP intervention, was examined using the investigator-developed *EA-CP Implementation Fidelity Form*. This form and its coding manual were developed to measure fidelity of implementation of the EA-CP instructional ingredients during videotaped book sharing activity on days the coach was not present. The *EA-CP Implementation Fidelity Form* consisted of three sections with 26 total items: arranging the environment (e.g., preparing materials in advance, positioning the book and related materials appropriately within the book sharing space) (4 items); introducing the book sharing activity (e.g., announcing the start of book sharing time, stating the title of the book, introducing the book mascot, allowing children to interact with the mascot) (7 items); and implementing the meaning enhancement and child-responsive instructional strategies (15 items). Each item was rated on a three-point Likert-type scale (0 = no implementation; 1 = attempted but did not meet criteria for full and correct implementation; 2 = full and correct implementation). Percent fidelity was calculated as the sum of points assigned to items 1–26 on the *EA-CP Implementation Fidelity Form*, divided by the number of total possible points ( $52 \times 100$ ). Pre-/post-training fidelity data were available for all childcare providers ( $N = 48$ ). Inter-rater reliability was conducted by two independent, trained coders, blinded to group assignment and data point, on 30% (29/96) of the providers' baseline and post-training videos for fidelity of implementation of the EA-CP instructional practices. The mean weighted  $\kappa$  of .79 ( $SD = .15$ ) indicated high inter-rater reliability.

### 2.8.2. Child social and communication outcomes

Two measures were used to assess change in social and communication outcomes for toddlers in the participating providers' classrooms: (1) pre-/post-test age-equivalent scores on the MSEL Receptive Language, Expressive Language, and Visual Reception subscales, and (2) pre-post-test change in raw scores on the *Social-communication Assessment in Book Sharing* (SABS; (Feuerstein,

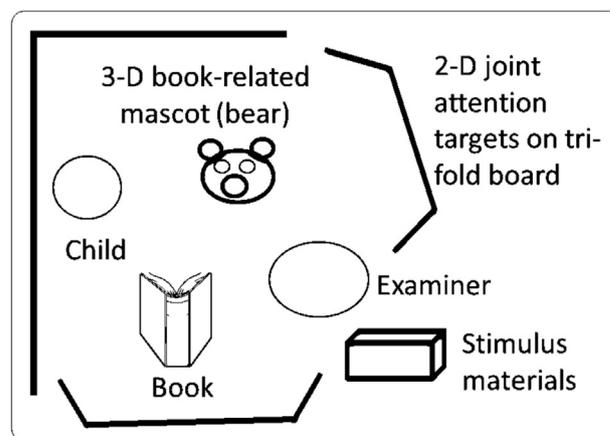


Fig. 3. Schematic of *Social-communication Assessment in Book Sharing* (SABS) administration.

Greenslade, Baker, & Landa, 2017). MSEL age-equivalent rather than T scores were used for examination of intervention effects because some toddlers scored at the floor on T scores ( $T = 20$ ); no such floor effect was observed for age-equivalent scores. Thus, to enable detection of child change, age equivalent scores were used.

### 2.8.3. Social-communication Assessment in Book Sharing (SABS)

The SABS, an experimental measure developed to assess change in specific social communication behaviors in young children, also was administered at baseline (pre-test) and post-test. Pre-/post-test SABS data were collected beginning in year two of the study, and therefore were available for children in cohort 2 ( $n = 34$ ). The SABS was administered by a research clinician at the childcare center in a quiet space away from classroom group activities, in a one-on-one setting with the child. For each SABS administration, the following materials were used: a standard set of toys (story-related objects); a commercially available, adapted story-book different from the books used by the childcare providers during the intervention phase; and a set of eight two-dimensional joint attention targets (high-quality, brightly colored photographs) arranged on two tri-fold boards (four targets per board) to standardize placement of the targets. Fig. 3 displays the environmental arrangement for SABS administration. During SABS administration, the research clinician engaged the child in a shared story book reading, and delivered five structured probes per each of six social-communication behaviors (initiation of joint attention, response to joint attention, motor imitation, expressive vocabulary, receptive vocabulary, and following directions in use of story-related object play). As the examiner read the story, the book was held so that the child was able to see all the illustrations for each page being read. At pre-determined points in the story, the examiner delivered specific probes, pausing after each probe for the child to respond or initiate. If a child responded incorrectly to a probe, the clinician moved on to the next probe (i.e., the clinician did not prompt for a correct response). The probes were logically and meaningfully related to the story and the information being shared on the page spread for which the probe was being delivered. The probes of different types were distributed across the story to ensure that the story and child-engagement opportunities (related to the probes) did not disrupt the story flow or become a distraction. Toddlers' responses to the structured probes were videotaped for later coding by research assistants blind to child group and data point. Responses were scored as incorrect/correct (0, 1). A total score was calculated for each child by summing the number of correct responses. The highest possible total score was 30 points (6 types  $\times$  5 probes  $\times$  1 point per probe = 30 points).

2.9. Data analysis

2.9.1. Randomization

Childcare centers were randomized to either the EA-CP intervention condition ( $n = 13$  centers) or the IAU control condition ( $n = 14$  centers). The EA-CP intervention condition had a mean of 1.69 providers per center (range = 1–4). The IAU control condition had a mean of 1.86 providers per center (range = 1–3).

2.9.2. Clustering

The intraclass correlation coefficient (ICC) for provider fidelity (the primary outcome variable), at the center-level, was significant at .19 (95% confidence interval [.05, .50],  $p = .02$ ). The intraclass correlation coefficient (ICC) for SABS scores (a secondary outcome variable), at the center-level, also was significant at .50 (95% confidence interval [.25, .76],  $p < .001$ ). These coefficients demonstrate observations of providers (implementation fidelity) and toddlers (SABS scores) within centers were more strongly correlated than observations across centers. To account for this clustering, a random effect was placed at the center level. All other potential sources of unobserved clustering were addressed using robust variance (Cameron & Miller, 2015).

2.9.3. Analysis

Using the mixed package in STATA 15.0 (StataCorp, 2017), mixed effects linear regression models were used for all analyses (Stata Press, 2017). To address the primary study aim, a time (pre-post) by group (EA-CP vs. IAU) interaction term was included. This variable can be interpreted as the pre-post difference in outcomes between conditions. Cohen's  $d$ , using the pooled standard deviation, was employed as a measure of effect size. Cohen's  $d$  values are typically interpreted as small (.3), medium (.5), and large ( $\geq .8$ ) (Cohen, 1988).

3. Results

3.1. Provider outcomes

Providers' implementation fidelity was examined at baseline and post-training. At baseline, providers in the EA-CP and IAU conditions were implementing evidence-based instructional practices less than 20% of the time (EA-CP:  $M = 17.2\%$ ,  $SD = 7.9\%$ ; IAU:  $M = 19.2\%$ ,  $SD = 6.8\%$ ) during a group book sharing instructional activity. At post-test, providers in the EA-CP condition were implementing evidence-based instructional practices approximately 80% of the time ( $M = 80.7\%$ ,  $SD = 8.6\%$ ), while providers in the IAU condition continued to implement evidence-based instructional practices less than 20% of the time ( $M = 17.3\%$ ,  $SD = 6.3\%$ ) during the group book sharing instructional activity. Mixed effect linear regression results revealed significantly greater pre-post change in EA-CP providers' fidelity compared to that of IAU condition ( $\beta = .65$ , 95% CI: .60, .70;  $p < .001$ ) (see Fig. 4), with a large effect size ( $d = 7.2$ , 95% CI: 5.6, 8.7) favoring EA-CP trained providers.

3.2. Toddlers' social and communication outcomes

3.2.1. Mullen Scales of Early Learning (MSEL)

Results from the linear mixed effects model was employed on the full sample of 46 children ( $n = 22$  EA-CP;  $n = 24$  IAU) to examine the effect of intervention on change in MSEL age-equivalent scores from baseline to post-test. Results indicated a statistically significant effect of time, but no statistically significant interaction between time and condition on any of the MSEL subscales: *Receptive Language* ( $\beta = -.69$ , 95% CI: -3.98, 2.59,  $p = .68$ ), *Expressive Language*

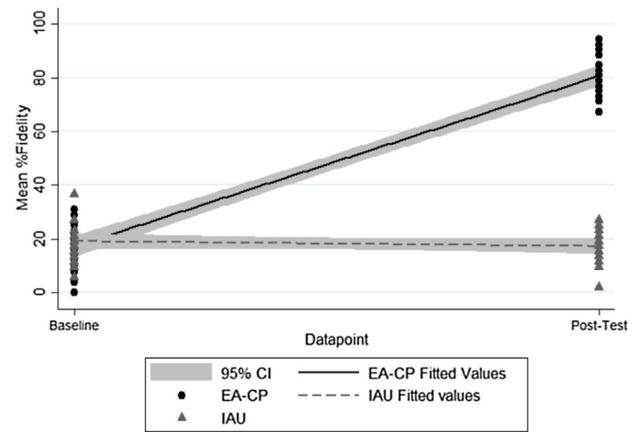


Fig. 4. Providers' mean percent fidelity at baseline and post-test during shared book reading.

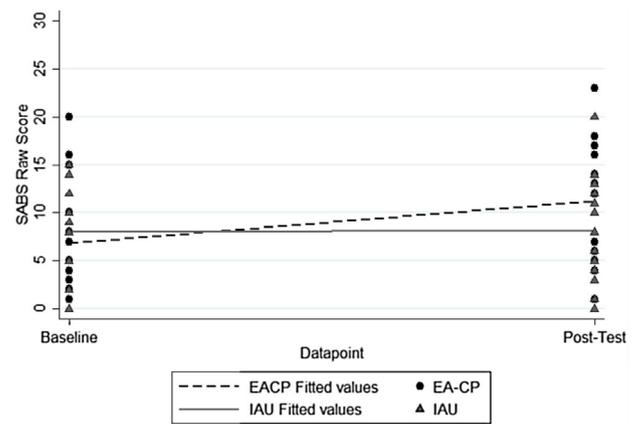


Fig. 5. Children's pre-/post-test raw scores on the Social-communication Assessment in Book Sharing (SABS).

( $\beta = 1.25$ , 95% CI: -1.69, 4.20,  $p = .40$ ), or *Visual Reception* ( $\beta = .9$ , 95% CI: -3.65, 3.83,  $p = .96$ ).

3.2.2. Social-communication Assessment in Book Sharing (SABS)

Procedural reliability for SABS protocol delivery, assessed on 26% (18/68) of randomly selected videotaped SABS administrations, was high ( $M = 96.7\%$ ,  $SD = 3.6\%$ ). Inter-rater reliability for SABS scoring was conducted by two independent, trained coders, blinded to group assignment and data point, on 35% (24/68) of the videotaped assessments. The mean  $\kappa$  value of .88 ( $SD = .14$ ) indicated high inter-rater reliability. A mixed effects linear regression model was run on pre-/post-test SABS raw scores for the 34 toddlers for whom data were available (i.e., beginning with cohort 2; EA-CP:  $n = 18$ ; IAU:  $n = 16$ ). Results documented that toddlers in classrooms of EA-CP trained providers demonstrated significantly greater pre-post change in SABS raw scores ( $M = 4.4$ ,  $SD = 4.6$ ) compared to toddlers in classrooms of IAU providers ( $M = .13$ ,  $SD = 3.45$ ), ( $\beta = 4.26$ , 95% CI: 1.82, 6.70,  $p < .001$ ), with a large effect size ( $d = 1.02$ ) favoring the EA-CP group (Fig. 5).

4. Discussion

This cluster-randomized controlled trial, conducted within authentic, center-based inclusive childcare settings, examined childcare providers' implementation fidelity when delivering evidence-based instructional strategies during an interactive book sharing activity delivered at the whole class level, as part of the Early Achievements for Childcare Providers (EA-CP) intervention

model. A secondary focus was to examine the effect of providers' implementation of evidence-based EA-CP instructional strategies on social-communication outcomes of toddlers with developmental delays in their classrooms. To our knowledge, this is the first study to do so. Results from this study document that childcare providers who were randomized to a professional development training (workshops + weekly coaching) made significantly greater improvements in their implementation of evidence-based instructional strategies in their classroom settings than providers who did not receive this training. Further, toddlers in the classrooms of providers who were trained to implement EA-CP during a group-based instructional book sharing activity made significantly greater gains in specific social and language outcomes compared to toddlers in classrooms of untrained providers.

#### 4.1. EA-CP: impact on providers

At baseline, all providers were implementing low levels of evidence-based instructional practices during instruction delivered via a group book sharing activity, replicating what has been reported by other investigators (Mandell et al., 2013; Pence et al., 2008). At pre-test, providers' book sharing instructional delivery was teacher directed, with children in a passive, listener-only role. Exceptions occurred when providers were reciting books as song-stature games such as in "Wheels on the Bus" or "Going on a Bear Hunt;" some providers did not use books during such activities. After participating in two workshops and receiving weekly job-embedded coaching, coaches observed that EA-CP providers began using more evidence-based instructional practices, grounded in the behavioral and developmental sciences, to transform their book sharing activities into interactive, child-contingent, and highly potent learning opportunities for the toddlers in their classrooms. While we have only pre-post fidelity measurements in the present study and cannot empirically validate these observations, we recently reported monthly teacher fidelity data from a study of EA-ES in preschool classrooms of children with ASD that demonstrate the validity of this observation (Engelstad et al., 2020). In an ongoing study focused on assessment of the EA-CP professional development program, data on provider fidelity is collected at pre- and post-training, as well as at two points during the 16-week training period. Those data will enable us to determine whether the observations from the present study are replicated.

We hypothesize that several ingredients of our approach to the EA-CP professional development facilitated the dramatic change in the trained providers' classroom instruction. First, the two in-person workshops, based on principles of on adult learning (e.g., Snyder et al., 2015), were designed to be highly interactive; incorporate group discussion, self-reflection, and focused feedback; and foster a supportive and collaborative atmosphere among participants. Our approach aligns with the extant literature, which suggests that effective professional development interventions capitalize on adult learning strategies to improve provider outcomes (Diamond et al., 2013; Snyder et al., 2012). The workshops were then followed by weekly job-embedded coaching (Snyder et al., 2015), during which providers received supportive and constructive feedback from a coach dedicated to supporting their success in EA-CP implementation in their classrooms. The resulting coach-provider relationships fostered a safe and mutually respectful milieu that likely nurtured providers' willingness to try new approaches and ultimately, adopt them. Further, these weekly sessions provided the opportunity for coaches to individualize the support delivered to the providers and make adjustments based upon specific classroom circumstances. These results support previous research, which suggests that coaching, when it includes collaborative partnerships, focused observations, shared goal setting and action planning, and reflection with feedback, is a major

competency driver to support high fidelity of implementation in early childhood settings (Snyder et al., 2015).

Also noteworthy was the reluctance of some providers to utilize the EA-CP practices at first, largely due to concerns that they would lose control over the children in their classrooms. More specifically, providers were concerned that toddlers might become distracted by the objects and want to talk about things unrelated to the story. These concerns did not materialize. Instead, there were several major phenomena that providers reported to (and anecdotally were observed by) coaches as motivation to fully implement the EA-CP approach: (1) toddlers who previously had refused to join the group at book time spontaneously joined the group when providers began using the EA-CP practices; (2) toddlers began attending to the book activity and engaging with the book-related materials in the targeted ways for the entire activity; and (3) toddlers with delays began showing skills that the provider previously did not believe the child would develop during that year. Thus, EA-CP appears to be an adoptable and valued supplemental instructional approach. While further research on the feasibility and sustainability of the EA-CP book sharing approach is needed, our findings are promising. Early Achievements for Childcare Providers represents a first step toward helping childcare providers implement high quality, evidence-based instructional practices into their inclusive classroom settings, during a potent, group-based instructional activity.

#### 4.2. EA-CP: impact on toddlers

The EA-CP intervention is novel, even when compared to existing emergent literacy interventions, where teacher question-asking is a major strategy for fostering child engagement and learning (Wasik et al., 2016). In the EA-CP approach, providers strategically create opportunities for child-initiated communication using targeted book-related vocabulary and object engagement while minimizing the frequency with which they pose questions to the child. Significant treatment effects were observed on social communication performance in toddlers with developmental delays, including autism, in the EA-CP trained classrooms compared to toddlers in the IAU classrooms when assessed using an experimental measure of skills proximal to the EA-CP instructional targets (SABS). Toddlers in the EA-CP group demonstrated increased and generalized socially contingent imitation, initiation of joint and response to joint attention, and social communication skills. However, in the five-month intervention period of the present study, toddlers' growth in language and non-verbal cognitive functioning, as assessed using a standardized, normed-referenced distal measure (MSEL), did not differ from that of toddlers in the IAU condition. This finding is not unexpected in this short-duration, single instructional context intervention and mirrors findings from a recent meta-analysis (Fuller & Kaiser, 2019) and an RCT (Roberts & Kaiser, 2015) related to distal measures of treatment effects. Although attendance data were not obtained during the present study, child absences (or lateness, missing the EA-CP book sharing activity) were observed and anecdotally reported by providers to the coaches during the coaching sessions, likely diluting the magnitude of group differences in toddlers' social communication gains.

Our results highlight the malleability of social and communication development in young children with delayed development in these domains. Furthermore, if such advances in these pivotal areas of child development were observed in the low dose intervention that the EA-CP group received, perhaps more extensive learning and generalization would be detectable by distal measures such as the MSEL if providers implemented EA-CP across multiple instructional contexts, and did so for an entire school year. Research to address this question is of considerable importance given the

known cascading effects of early developmental delays on later school achievement (Catts, Fey, Tomblin, & Zhang, 2002).

#### 4.3. Closing the research to practice gap in early childhood care and education

Results from this effectiveness trial suggest a causal effect between providers' use of evidence-based instructional practices as delivered within the EA-CP package. EA-CP trained providers were able to learn the EA-CP instructional targets and implement the evidence-based instructional practices with high fidelity in their authentic, center-based classroom settings. This provides a first step toward narrowing the research-to-practice gap in early childhood care and education. The EA-CP training empowered providers to integrate evidence-based instructional strategies within their fully inclusive group instructional activities to target social, communication, and concept development skills of young children with DD, including those with or at risk for autism. This is impressive given the complexity of inclusive childcare settings, where children often present with dysregulated behavior, providers experience multiple interruptions during the day, and group dynamics are disrupted when children leave or enter midyear (see, for example the child CONSORT figure [Fig. 2] showing that 27.7% (18/65) of the sample left childcare after randomization, usually due to family relocation or loss of wage to support childcare attendance). Further, policy changes add burden to providers, requiring frequent adoption of new curricula or other procedural protocols (e.g., safety-related), to name just a few.

In the presence of such challenges, providers' implementation of the EA-CP instructional practices during a brief (15- to 20-min) interactive book sharing activity was highly engaging to toddlers. Importantly, toddlers in the classrooms of EA-CP trained providers made greater gains on an experimental social and communication measure than toddlers in the classrooms of untrained providers. This is particularly noteworthy given that developing expertise with new instructional practices occurs over time, meaning that toddlers in the EA-CP group did not receive the full dose of the intervention early in the 5-month professional development period. Overall, the EA-CP intervention package fills a major gap in DD-focused, evidence-based, classroom-level interventions available for ECCE providers working in center-based childcare settings.

#### 4.4. Limitations

Several limitations to the present study must be acknowledged. First, the lack of child attendance data limits our ability to determine if toddlers in the EA-CP condition received the full dose of the intervention. Secondly, there were a few children who were in toddler classrooms but were older than toddler age, perhaps due to functioning at a developmentally younger level. Thirdly, fidelity data were obtained only at pre- and post-training, so we are not able to definitively state that providers demonstrated the same level of fidelity on each book used across the intervention period. Despite this limitation, providers in the EA-CP training condition showed substantive improvement from pre- to post-training, performing at a level we considered to demonstrate mastery in implementation. Fourthly, we did not collect data on additional therapies received by the participating children. While there were no significant between group differences, on average, in family education and income, it is possible that children in the EA-CP group may have had access to additional private therapies and/or other resources to support their children's development, as a higher proportion of these families fell within the highest income bracket and had high levels of education. This study is limited by a small sample size, which may have impacted the ability to detect pre-/post-test differences in MSEL

scores. In addition, though there were no statistically significant differences across groups of children, there were visible differences in some demographic variables. Finally, the lack of data to characterize providers' perceptions of their training experience limited our ability to better understand reasons why some providers made less robust gains than others.

Despite these limitations, the potential impact of these findings is high; EA-CP shows promise as an intervention that increases ECCE providers' implementation of evidence-based instructional strategies during a group-based book sharing activity. The dramatic improvement in fidelity observed in the EA-CP-trained providers shows promise that the EA-CP curriculum can be used at-scale. Such broader implementation of EA-CP could translate into widespread availability and provision of quality inclusive experiences for young children with DD, including those with autism, while in center-based childcare. High quality early educational experiences are a priority for meeting the needs of young children with DD, and address the priorities of parents, administrators, and policy makers. Parents of young children with DD also can benefit, being able to access higher quality childcare and experiencing increased confidence (and less stress) that their child is being appropriately educated. If our findings are replicated in a future randomized controlled trial, there will be support for investing research dollars into examination of implementation components that support community adoption of the EA-CP approach, and for childcare centers to invest in EA-CP training for providers.

A pressing next step is to examine the optimal duration and format for professional development training in community, center-based childcare settings. In addition, there is a need to determine what level of fidelity of implementation is associated with sustained implementation, addressing unanswered questions about level of fidelity of implementation that should be sought for community-based inclusive childcare providers. Investigation of the effects of providers' implementation of EA-CP on children without developmental delays also is needed; this need is currently being addressed by the corresponding author in a federally funded study. Finally, the anecdotal observations made by EA-CP coaches regarding child engagement during book share are being formally examined using mixed methods data in an ongoing study of the effects of the EA-CP professional development program. Such information is essential for research aimed at defining the most efficient and effective ways of supporting high quality and high-fidelity implementation by these providers, most of whom have had little to no training in instructing young children with developmental delays. Given the demonstrated promise of the EA-CP PD, policies and supports should be established at state and center levels to ensure sustained implementation by providers. This will likely require development of information (with illustrative videos) for policy makers, as well as feasible trainings for childcare center directors, about the EA-CP PD and intervention.

## 5. Conclusions

The Early Achievements for Childcare Providers (EA-CP) professional development program enabled providers to attain a high level of fidelity of implementation of evidence-based instruction. This professional development program fills a major gap in existing trainings for childcare providers and equips them to address the needs of diverse learners, especially toddlers with developmental delays, including autism spectrum disorder. The job-embedded coaching component of the EA-CP professional development program was key to providers' implementation success. Providers' implementation of the EA-CP intervention activated acceleration in social communication development of young children with developmental delays.

## Declarations of interest

None.

## CRediT authorship contribution statement

**Julie L. Feuerstein:** Writing - original draft, Data curation, Formal analysis, Project administration, Supervision. **Rebecca J. Landa:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing - review & editing.

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