



Quality of Interactions by Early Childhood Educators Following a Language-Specific Professional Learning Program

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Abstract

Children's language learning is shaped through the social contexts of children's earliest experiences at home and in early childhood education settings with responsive caregivers. Facilitating high-quality interactions between early childhood educators and children affords opportunities to foster language rich exchanges and promote strong language skills. The present study investigated the impact of a language-specific professional learning program on the quality of educator-child interactions and the associated short-term effects on vocabulary knowledge in young children. Educator practice was compared across 38 early childhood education and care services (19 participated in professional learning and 19 were a comparison group). After the professional learning program, significant differences were observed in the instructional quality in services where educators had participated in the *Learning Language and Loving It*TM program compared to those services who had not. More than one educator in a room participating in the professional learning was associated with higher instructional quality, educator qualifications were not associated with higher quality. We conclude that discipline-specific knowledge and individual coaching of teaching strategies enabled an increase in the quality of educator's interactions with young children. No differences were detected in children's vocabulary knowledge between the professional learning and comparison groups following the *LLLI* program. This finding is discussed with respect to minimum levels of instructional support required to impact children's development. Quality improvement programs need to engage with early childhood education services regularly and over sustained periods to ensure the quality of educator interactions reaches levels that impact on children's outcomes.

Keywords Education · Early childhood · Language · Professional learning

Introduction

Substantial evidence details the positive impact early childhood education (ECE) experiences have on children's learning and development, and that this impact is greater for vulnerable children (Duncan and Sojourner 2013; Krieg et al. 2015; van Huizen and Plantenga 2018). The foundations of children's development are established in the first years of life and directly influence the potential for life-long learning. Children's early experiences matter and while learning is genetically influenced, it is also remarkably sensitive

to environmental factors (Asbury and Plomin 2013). The interplay between genes and environmental experiences, in the home and in ECE settings, supports children's earliest learning and cumulative developmental outcomes. Consequently, investments in high-quality ECE have significant long-term benefits for children, families, and communities more broadly (Doyle et al. 2009; Heckman and Masterov 2007). Deeply understanding what constitutes quality in ECE settings is therefore critical to maximizing the learning opportunities for very young children. However, providing high-quality ECE programs is not without challenges and significant research effort has focused on ECE educators' capacity to build into their practice and programs strategies which promote learning for all children, including the youngest in their care. This study presents outcome data for a professional learning program focused on educators' implementing strategies within their programs that support young children's early language and communication skills.

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Children's Development and Socio-economic Disadvantage

Children experience enormous developmental growth in their first years, spanning the physical, cognitive, communication and language, and social-emotional domains. Children's developmental trajectories are determined early (Noble et al. 2015; Shonkoff and Phillips 2000) and have consequences across the lifespan (McCoy et al. 2017). Population screening of children's early developmental outcomes occurs internationally with a variety of tools. In Australia, the Australian Early Development Census (AEDC 2015) completed at school entry, reveals disparities across the socio-economic spectrum. Development measured using the AEDC found that 22% of Australian children were vulnerable on one or more developmental domain, with variation from 15.5% for the least disadvantaged through to 32.6% for the most disadvantaged children.

One of the strongest predictors of school readiness, school engagement, and academic success is children's early language development (Law et al. 2009). Therefore, it is of concern that AEDC estimates suggest 15.4% of children enter school developmentally vulnerable (\leq 10th percentile) or 'at-risk' (10th–25th percentile) in language and cognitive skills (Australian Government 2015). However, this proportion rises to 25.2% for the most disadvantaged children. Enabling all children to commence school with robust language and early literacy skills supports the best possible outcomes for all.

As language development is the result of innate skills shaped through social contexts (Hoff 2006), children's earliest experiences at home and in ECE settings with responsive caregivers are critical (Niklas and Tayler 2018; Romeo et al. 2018). Supporting children's language development in ECE settings relies on educators being responsive to children's interests and communicative behaviors, both verbal and gestural. Shared focus of attention during activities between educators and children is critical for language learning, in particular early vocabulary. Immersing children in language-rich environments, that include talk, story, song, books, and diverse vocabulary, enables children and educators to engage in interactions which model word combinations and language structures, develop concepts such as number and place, and include back and forth exchanges which deepen children's knowledge of the world. Facilitating high-quality practices of early childhood (EC) educators which include these responsive interactions and language rich exchanges is a strategic way of ameliorating early developmental differences due to social dis/advantage. Understanding the components of high-quality ECE including responsive interactions is critical in this process.

Quality in Early Childhood Education

The research literature is remarkably consistent, characterized by two recent reviews (Melhuish et al. 2015; van Huizen and Plantenga 2018), in regard to the impact of quality ECE on all children's developmental outcomes, but particularly for those from vulnerable circumstances. Quality in ECE has long been characterized by two dimensions *structural* and *process* (Dowsett et al. 2008; Mashburn et al. 2008; Vandell and Wolfe 2000). Structural quality is considered foundational to the ECE program (Mashburn et al. 2008) and refers to features such as the classroom environment, teacher qualifications, and child–teacher ratios. In contrast, process quality is conceptualized as children's experiences within programs, with a particular focus on child–teacher interactions. Burchinal (2018) describes a model of ECE quality, where process quality directly impacts children's development and where structural quality, while necessary but not sufficient, has a more indirect impact on children's outcomes. Structural quality parameters are usually addressed through standards of practice developed for local and/or national contexts (Australian Children's Education and Care Quality Authority 2011), while measures of process quality have emerged through observational studies of interactions and experiences within programs (Harms et al. 2005; Pianta et al. 2008). Multiple studies of ECE quality have consistently demonstrated low levels of process quality, more specifically demonstrating moderate to high levels of emotional support and classroom organization, and much lower levels of instructional support (Burchinal et al. 2010; Mashburn et al. 2008; Tayler et al. 2013). Internationally it is evident that there is scope to improve instructional support in early childhood settings. Various researchers in this area are concerned at the low-quality interactions that characterise many ECE programs and note that the potential benefits of ECE can only be realized when quality is sufficiently high.

Instructional Support

Importantly, there is a relationship between the quality of interactions between EC educators and children, and children's outcomes in general cognitive skills, as well as language, reading and maths, where higher quality is strongly related to better child outcomes (Burchinal et al. 2010; Ruzek et al. 2014). These findings suggest that if ECE is to improve the language, literacy and social outcomes for more vulnerable children then high-quality interactions need to be prioritized (Niklas et al. 2018). However, these interactions have been found to be rare in EC services and particularly those located in communities experiencing adversity (Cloney et al. 2015; Ruzek et al. 2014).

Language and Literacy Outcomes

Curriculum and content specific information presented within interactions is now acknowledged as being another dimension of ECE quality (Burchinal 2018). As such, understanding the association between the knowledge and practices of EC educators and children's outcomes in a variety of content areas has been of growing interest. Broadly, research has identified positive associations between the levels of instructional and relational support provided by educators in interactions and children's language and emergent literacy outcomes (Gosse et al. 2013; Han et al. 2017; Mashburn et al. 2008; Niklas and Tayler 2018). Some studies have found a direct relationship between classroom level factors and emergent literacy skills (Han et al. 2017), while others found weak or no association with oral language and literacy skills (Pianta et al. 2017). However, high quality interactions between children and educators in this study buffered the impact of low maternal education on language skills. This differentiated impact of instructional support on children's language outcomes has been investigated with respect to children's vocabulary and expressive language skills on entry to ECE settings (Burchinal et al. 2002; Gosse et al. 2013). Children with higher initial language skills benefit more from high quality instructional support, whereas children with 'at-risk' or poorer language skills benefit more from socio-relational support, specifically with respect to their vocabulary development. The literature is more inconsistent with respect to teacher qualifications and training on children's outcomes, with some studies reporting strong associations (Burchinal et al. 2002; Han et al. 2017), while others report no or limited associations (Early et al. 2007; Lin and Magnuson 2018; Mashburn et al. 2008).

Research has also investigated the impact of different characteristics of EC programs on children's language and literacy outcomes, including teacher self-efficacy (Guo et al. 2010), skill-focused versus child-initiated activities (Chambers et al. 2015), and a sustained approach to professional learning with a focus on the process of instruction (Burchinal et al. 2010; Justice et al. 2008). To ensure impact on children's developmental trajectories, all these studies illustrate the need for professional learning that builds EC educators professional identity and efficacy, enacts a curriculum that balances skill and child-initiated activities, and remains engaged with the educators over a sustained period.

While professional learning to improve process quality in EC programs has been the focus of much research, the literature remains equivocal on the extent and sustainability of change in educators practice and whether these changes translate into better developmental outcomes for children is even less clear (Markussen-Brown et al. 2017). The most recent large scale effectiveness trial of language and literacy professional development in ECE settings, using

a randomized controlled trial methodology, found no impact of professional learning on educator practice outcomes over an 18-month period, and no associations between educator and classroom characteristics (Piasta et al. 2016). Further studies are warranted, particularly those that can elucidate the critical components of professional learning that may ensure practice change.

Professional Learning Programs and Quality in Early Childhood Education Settings

Professional learning (that is manualized for fidelity, sustained and includes coaching) has the capacity to increase educators engagement, interactions with children in general, and their use of communication facilitating strategies, all of which are positively associated with children's vocabulary gains and the complexity of their language (Cabell et al. 2011, 2015; Piasta et al. 2012; Powell et al. 2010). This research highlights the positive impact of professional learning focused on strategies to support children's oral language and print awareness. Significant outcomes were associated with the impact of professional learning on the learning environment, EC educators' support for language and literacy, as well as impacts on child outcomes such as letter knowledge, writing, and concepts of print, and inconsistently oral language skills.

A group of studies concluded that it was not just the components of professional learning, but the number of components present that is important to achieving positive outcomes (Domitrovich et al. 2008; Slot et al. 2015). Components included multi-faceted professional learning, enriched curriculum implementation, coaching, and intensity of delivery. Coaching, in particular, has been demonstrated to be important to growth in educators supportive behaviors, both emotional and instructional (Pianta et al. 2014). Both the amount of coaching and the type, video for emotionally supportive behaviors, and prompts for instructionally supportive behaviors, were associated with more improvement in classroom interactions. Taken together these findings suggest that there are key components of professional learning programs, however, which ones should be considered the 'active ingredients' requires further investigation.

The Current Study

Over the last decade many studies have responded to the conclusion of Early et al. (2007) that in order to raise the quality and effectiveness of ECE there was a need to focus on a range of professional development activities that target EC educators interactions with children, including facilitative strategies, curriculum, and coaching. There is still a lack of consistency around the impact of structural quality factors such as teacher qualifications, as well as a need to further

understand the differential relationship between children's language skills on entry to ECE and instructional support. The research literature, taken in conjunction with data from the Australian context which found significant socio-economic gradients associated with quality of ECE programs (Cloney et al. 2015), suggests there is a need to determine the impact of different components of professional learning programs on quality interactions between EC educators when the children in their programs are from communities experiencing adversity and disadvantage.

Despite the evidence associating professional learning for EC educators focused on communication and language development and changes in quality of practice, there is still limited research with educators of infants and toddlers (birth to 3-year). The current study aimed to measure the impact of one such program, specifically targeting these very young children, on improved EC educator practice, particularly in their interactions and instructional support, and whether there was flow on effects in the short-term in children's language outcomes.

Materials and Methods

Background to the Every Toddler Talking Project

Every Toddler Talking (ETT) was a Victorian State Government initiative implemented between 2015 and 2017 in Victoria, Australia. The evaluation of ETT utilized a pre- and post-test cluster-controlled model and included the delivery of the Hanen Centre *Learning Language and Loving It*TM (LLLI) professional learning program (Weitzman and Greenberg 2002).

Selection of Regions and Services

Seven local government areas (LGAs) in the state of Victoria were selected to participate in the ETT project. The selection of locations was made by Victorian Department of Education and Training (DET) regional offices. Community Health (CH) services and ECE services within study locations responded to a call for expressions of interest in November 2015. Selection criteria included: the co-location and proximity of three suitable ECE and CH services; socioeconomic disadvantage measured using the Australian Bureau of Statistics SEIFA index of relative social disadvantage (Australian Bureau of Statistics 2001); and the proportion of children within the LGA who were developmentally vulnerable, as per the AEDC (Australian Government 2015). Two LGAs were categorized as rural, two as regional, and three as metropolitan.

To be eligible to participate, all ECE services needed to: be located within one of the seven selected LGAs (clusters);

be providing center-based long-day care; have at least three EC educators working with children under 3-year; and have a minimum rating of 'meeting' in all standards of the National Quality Framework (Australian Children's Education and Care Quality Authority 2011). Professional learning services were selected by the DET, Victoria based on eligibility. The comparison services were selected using a cluster sampling approach, with services from each cluster being ranked on SEIFA (most disadvantaged) and AEDC (highest proportion of children developmentally vulnerable), being recruited first. In two clusters with smaller populations, comparison services were recruited from neighboring LGAs. Thirty-eight ECE services were selected to participate 19 in the professional learning group and 19 in the comparison group.

The evaluation was conducted under the approval and protocols sanctioned by the University of Melbourne Human Research Ethics Committee (ID 1646484) and in accordance with linked approvals provided by the Victorian DET (2016_003028).

Participants

Educator and child participants in the ETT study were recruited from 38 ECE services located in the seven local government areas. Children were recruited provided they attended an infant or toddler room within the service where educators were completing the professional learning program or from similar rooms in comparison services. The participants were the children in both professional learning and comparison groups whose parents consented to participate and returned completed study surveys at baseline ($N=234$).

Participant Characteristics

One-hundred and eighty-one EC educators participated in ETT from 38 ECE services, 71 educators were in the professional learning group and 110 educators were in the comparison group at baseline (T1). During the 14-week professional learning program six educators withdrew from the study following resignation from their place of work. Most EC educators in both the professional learning and comparison group held Certificate or Diploma qualifications, 62% and 86% respectively, compared to 7% and 2% respectively who had a bachelor's degree or higher.

Two-hundred and thirty-four families consented for their children to participate in the study and returned a complete and valid study survey at T1, 129 children were in rooms where EC educators completed the professional learning program and 105 children were attending ECE services from the comparison group. There were no significant differences on any child characteristics, except for SEIFA disadvantage (see Table 1). Of the recruited families, 25% spoke more

Table 1 Child participant characteristics, pre- and post-professional learning

	Pre-professional learning (T1)		Post-professional learning (T2)	
	Comparison (n = 105)	Professional Learning (n = 129)	Comparison (n = 57)	Professional Learning (n = 83)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Gender (% male)	61.0%	62.0%	56.1%	59.0%
Age (months)	27.2 (7.09)	27.3 (5.2)	31.0 (4.2)	30.8 (4.5)
Days attending ECE per week	2.9 (1.2)	2.9 (1.3)	3.0 (1.4)	3.0 (1.3)
Language other than English (%)	13.9%	15.1%	16.1%	17.3%
2011 SEIFA home suburb (percentile)	32.1 (22.5)*	41.0 (27.84)*	34.3 (18.5)	39.1 (27.3)

*Differences significant at $p < .05$ level

than one language in their home, with respondents listing 27 different languages.

Methodology

EC educators who participated in *Learning Language and Loving It*TM provided consent to be observed in their practice in the ECE services' infant and toddler rooms. EC educators in comparison ECE services provided consent to be observed in their routine practice in the infant and/or toddler rooms in which they worked. Research assistants blind to service group completed observations at baseline (T1) and following the professional learning program (T2) in the rooms of participating EC educators from both the professional learning and comparison services.

Parents and/or caregivers completed communication inventories for their child at baseline (T1) and again after the professional learning took place (T2) in both professional learning and comparison ECEC services.

Professional Learning Program

The professional learning program that was delivered as part of the ETT project was the Hanen Centre's *Learning Language and Loving It*TM (Weitzman and Greenberg 2002). A speech pathologist and an early childhood educational leader from each of the seven LGAs completed the *LLLI* facilitator training course with staff from the Hanen Centre and co-facilitated the program in each location. *LLLI* is a manualized program with a prescribed schedule and specific content for each of the eight professional learning sessions. Facilitator training ensures familiarity with the content and fidelity in delivery of the program across facilitators.

LLLI was designed to provide EC educators with practice strategies that build language and social skills in all children in natural contexts during learning activities, routines, and play. Research has demonstrated positive outcomes among EC educators working in countries that have similar

characteristics to Australia, including Canada, the United States of America and Ireland (Cabell et al. 2015). Pilot research in Australia has shown promising, but not statistically significant, improvements in EC educators practice following the *LLLI* program (Scarinci et al. 2014). *LLLI* required educator attendance over 14 weeks, with eight 2-h professional learning modules and six individual video coaching sessions that took place in the ECE services.

Measures

EC Educator Demographics

Information about EC educators' level of qualification and their role or position within their ECE service was collected by research assistants during the T1 observation visits. Qualifications provided a structural quality measure and were one way to reflect educators prior learning in child development and pedagogical practice; and were considered when analyzing EC educators' practice change.

Outcome Measure for EC Educator Practice

In order to measure change in EC educator practice, the Classroom Assessment Scoring System (CLASS) (Pianta et al. 2008) was utilized. CLASS PreK provides a valid and reliable measure of room level quality across the domains of Emotional Support, Classroom Organization and Instructional Support, and the CLASS Toddler provides a measure of room level quality across the domains of Emotional and Behavioral Support and Engaged Support for Learning. A systematic review and meta-analysis of studies that have used the CLASS tool found small but positive associations between CLASS domains and child outcomes (Perlman et al. 2016).

Previous Australian based research (Tayler et al. 2013) documented consistent and relatively poorer performance in the Instructional Support (in 3- and 4-year-old rooms)

and Engaged Support for Learning (in infant and toddler rooms) domains. These domains map well on to the aims of *LLLI*, as the CLASS dimensions for these domains include language facilitation, concept development, quality of feedback, and language modelling. The CLASS tool maintains high levels of validity and reliability through training and certification processes. A team of research assistants certified as reliable in the use of the CLASS tool completed observations. Research assistants worked to a specified data collection protocol to ensure consistency while in the field. In line with this protocol, a minimum of four and a maximum of six 20-min observation cycles were completed at each time point in each room. The time (morning, midday or afternoon) of observations was kept consistent between T1 and T2 in an effort to minimize the impact in variation in instruction practice (Cabell et al. 2013).

At baseline, prior to commencement of the professional learning program (T1), CLASS observations were completed in 52 rooms, 27 allocated to the professional learning group and 25 to the comparison group. CLASS PreK was used in 40 rooms and Toddler in 12 rooms. At T2 CLASS observations were completed in 51 rooms, 26 allocated to the professional learning group and 25 to the comparison group. CLASS PreK was used in 42 rooms and Toddler in nine rooms. The resignation of one educator resulted in one less room from the professional learning group at T2. Three further rooms from the comparison group were excluded from the analysis comparing T1 and T2 because different versions of CLASS had been used.

Child and Caregiver Demographics

The parents and caregivers of children who participated in ETT completed a survey at the baseline (T1) data collection. This survey asked respondents to provide: their child's date of birth, gender, Aboriginal and Torres Strait Islander status, place of birth, and language(s) spoken at home. Respondents were also asked to provide information about the child's mother, father and/or primary caregiver, including their level of education, and Aboriginal and Torres Strait Islander status. Families were asked to provide the postcode of their home address to calculate a mean SEIFA decile for the groups. A shorter survey was distributed at follow up (T2), to document change in their child's ECE service enrolment.

Outcomes Measure for Children's Language

The MacArthur-Bates Communicative Development Inventories (MacArthur-Bates CDI) (Fenson et al. 2007) were used to measure child vocabulary as an outcome. The MacArthur-Bates CDIs are parent report instruments that have been widely used in international studies of child language development (including Australian versions of the

vocabulary checklists) (Bavin et al. 2008) and have well documented validity and reliability based on correlation studies of face-to-face assessment with MacArthur-Bates CDI outcomes (Heilmann et al. 2005). The use of the MacArthur-Bates CDI enabled consistent and scalable parent report across the possible age range specified within ETT. It provided total scores and percentile ranks suitable for comparison across time points. Versions of the MacArthur-Bates CDI are available for Infants (Words and Gestures, 8–18 months), as well as Toddlers (Words and Sentences, 16–30 months). In addition, a shorter upward extension (MacArthur-Bates CDI-III) (Fenson et al. 2007) is suitable for children between 30 and 37 months. Parents and caregivers were asked to report on their child's vocabulary across all languages that were spoken, enabling percentile scores to represent total vocabulary across languages. Approval was granted by Brookes Publishing for adaptations of the MacArthur-Bates CDI into an electronic checklist using Redcap (Harris et al. 2009) for parents to complete online if they chose.

Analyses

First, descriptive statistics of CLASS domain scores and the dimension scores in the Instructional Support subscale will be presented to determine performance of EC educators (at room level) on each CLASS domain at baseline (T1) and immediately following professional learning (T2) for the professional learning group and comparison ECE services. Comparisons using t-tests determined if there were significant differences between the professional learning and comparison group, and to determine if there were significant differences within the professional learning group between T1 and T2. Repeated measures analysis of covariance (ANCOVA) was used to analyze the associations between change in CLASS domain scores relative to confounder variables, namely, the EC educators' qualification level and number of EC educators within a room completing professional learning. The MacArthur-Bates CDI scores were similarly analyzed to provide descriptive statistics of child vocabulary size at baseline (T1) and immediately following professional learning (T2) for both groups of children (i.e., where educators had participated in professional learning, and comparison ECE services). Comparisons using t-tests determined if there were significant differences between children's vocabulary in the professional learning and comparison group at T1 and T2 and to determine if there were significant differences within the professional learning group between T1 and T2. Repeated measures ANCOVA was used to understand if there was an association between language spoken in the home and measured change in child vocabulary size scores, while controlling for a range of confounder variables.

Results

Early Childhood Educators Practice

Means and standard deviations for the CLASS domains are reported for each time point in Table 2 (PreK) and Table 3 (Toddler). At baseline (T1) there were no significant differences on CLASS Toddler or Pre-K domains between the comparison and professional learning groups. As we detected no differences in quality of educator practice at baseline, we subsequently analyzed T2 data to look for differential change between the comparison and professional learning groups.

Mid to high range scores, all above 5, were observed for Emotional and Behavioral Support on the Toddler version and for Emotional Support on the Pre-K version at T1 and T2. Mid-range scores (4–5) were observed for the Classroom Organization domain at both time points. Low to mid-range scores were observed for the subscales Engaged Support for Learning (Toddler) and Instructional Support (Pre-K). Low to mid-range scores were observed for all of the dimensions in Instructional Support, that is, concept development, quality of feedback, and language modeling.

Table 4 provides the means and standard deviations for the Instructional Support dimension scores at each time point.

Within Group Comparisons

ECE services in the comparison group had CLASS PreK scores that were lower at T2 than in T1 but not significantly different. CLASS Toddler scores did not change significantly between T1 and T2 (see Table 3), nor did the Pre-K dimension scores for Instructional Support change significantly (see Table 4) for the comparison group.

ECE services in the professional learning group had CLASS PreK scores that changed significantly ($p < .001$) for the domain of Instructional Support between T1 and T2 with a large effect size ($d = 1.53$). The CLASS PreK scores for Emotional Support and Classroom Organization did not significantly change between T1 and T2. CLASS Toddler domain scores improved between T1 and T2 but were non-significant due to the small sample size. However, the differences in the domain scores, emotional and behavioral support, and engaged support for learning, were associated with mid to large effect sizes ($d = 0.31$ and 1.03 respectively) (see Table 3). ECE services in the professional learning group had CLASS PreK, Instructional Support dimension scores

Table 2 CLASS Pre-K domain scores, pre- and post-professional learning program

CLASS domain	Pre-professional learning (T1)		Post-professional learning (T2)		d*	d#
	Comparison (n = 17)	Professional learning (n = 23)	Comparison (n = 20)	Professional learning (n = 22)		
	Mean (SD)		Mean (SD)			
Emotional support	5.83 (0.72)	5.86 (0.51)	5.52 (0.7)*	5.98 (0.72)*	0.65	
Classroom organization	5.03 (1.0)	4.96 (0.69)	4.06 (0.73)*	4.57 (0.8)*	0.66	
Instructional support	1.82 (0.39)	1.79 (0.49)#	1.79 (0.72)*	2.61 (0.68)*,#	1.17	1.53

Significant between group differences at $p < .05$; d^ effect size between group

#Significant within group differences at $p < .001$; $d^{\#}$ effect size within group

Table 3 CLASS Toddler domain scores, pre- and post-professional learning program

CLASS domain	Pre-professional learning (T1)		d^*	Post-professional learning (T2)		d^*	$d^{\#}$
	Comparison (n = 8)	Professional learning (n = 4)		Comparison (n = 5)	Professional learning (n = 4)		
	Mean (SD)			Mean (SD)			
Emotional and behavioral support	5.54 (0.77)	5.53 (0.75)	0.01	5.24 (0.32)	5.79 (0.56)	1.21	0.31
Engaged support for learning	2.54 (0.49)	2.42 (0.61)	0.21	2.59 (0.66)	3.24 (0.71)	0.95	1.03

d^* Effect size between group

$d^{\#}$ Effect size within group

Table 4 CLASS Pre-K Instructional support dimension scores pre- and post-professional learning program groups

CLASS instructional support dimensions	Pre-professional learning (T1)		d^*	Post-professional learning (T2)		d^*	$d^\#$
	Comparison (n = 105)	Professional learning (n = 129)		Comparison (n = 57)	Professional learning (n = 83)		
	Mean (SD)		Mean (SD)				
Concept development	1.49 (0.43)	1.41 (0.51) [#]	0.16	1.42 (0.55)**	2.06 (0.59)** [#]	1.12	1.0
Quality of feedback	1.87 (0.65)	1.71 (0.66) [#]	0.24	1.91 (0.86)*	2.55 (0.79)** [#]	0.77	1.06
Language modeling	2.11 (0.53)	2.26 (0.66) [#]	0.25	2.04 (0.87)**	3.09 (0.76)** [#]	1.28	1.18

*Significant between group difference at $p < .05$

**Significant between group differences at $p < .001$

d^* Effect size between group

[#]Significant within group difference at $p < .001$

$d^\#$ Effect size within group

that changed significantly ($p < .001$) between T1 and T2 (see Table 4).

Between Group Comparisons

Professional learning and comparison group ECE services were similar in CLASS Domain scores at baseline (T1) with no statistically significant differences. CLASS PreK domain scores were statistically different between the professional learning and comparison groups at T2; that is there were significantly higher scores ($p < .05$) in Emotional Support, Classroom Organization, and Instructional Support in ECE services for those that completed *LLLI* (see Table 2). Changes in EC educator practice, as measured by CLASS, were associated with medium to large effect sizes (Cohen's $d = .65$ to 1.17) indicating that they were of pedagogical importance.

While differences were found in favor of the professional learning group compared to the comparison group for the CLASS Toddler Domain scores of Emotional and Behavioral Support and Engaged Support for Learning at T2, these were not statistically significant. However, these differences were associated with large effect sizes (Cohen's $d = 1.21$ and $.95$ respectively), suggesting the analysis was underpowered to detect what appear to be pedagogically important differences. Differences between the professional learning and comparison group on the instructional support dimension scores were all significant, that is Language Modelling and Concept Development at the $p < .01$ and Quality of Feedback at the $p < .05$, with large effect sizes (see Table 4).

Associations Between CLASS Domain Scores and Educators' Qualifications and Number of EC Educators

Positive correlations were found between CLASS scores and the qualifications of educators as well as the number of

LLLI trained educators in each room in professional learning services. However, most of these correlations were small and not significant except for Classroom Organization at T2 ($r = .397$, $p < .05$). The number of *LLLI* trained educators in a room was significantly associated with all CLASS Domains at T2, Classroom Organization ($r = .401$, $p < .05$), Emotional Support ($r = .409$, $p < .01$), and Instructional Support ($r = .571$, $p < .01$).

Results of the ANCOVA analysis revealed a significant association between CLASS PreK Instructional Support scores and the number of trained educators in a room ($F(1,31) = 6.31$; $p < .05$; $\eta^2 = .17$). In summary, where there was more than one *LLLI* trained educator in a room, Instructional Support scores improved to a greater extent than in rooms where one or fewer educators were trained.

Child Language and Communication Outcomes

Analysis utilized the vocabulary percentile scores from the MacArthur Bates CDI Words and Gestures, Words and Sentences and/or Short Form versions depending on the child's age. Vocabulary percentile scores were available for 234 children across both groups at baseline (T1), 129 in the professional learning group and 105 in the comparison group. At T2 there were 134 valid vocabulary percentile scores which represented retention of 57% of the baseline sample (83 in the professional learning group and 51 in the comparison group). There was significant individual variability in scores of children within and across groups (range 0th–99th percentile) (see Table 5).

Within Group Comparisons

Children in the professional learning group did not differ significantly in their vocabulary percentile scores across

Table 5 McArthur Bates CDI percentile scores, pre- and post-professional learning program (all available data at T1 and T2)

	Pre-professional learning (T1)			Post-professional learning (T2)		
	Comparison (n = 105)	Professional learning (n = 129)	<i>d</i> *	Comparison (n = 57)	Professional learning (n = 83)	<i>d</i> *
	Mean (SD)			Mean (SD)		
CDI	36.85 (27.78)	33.53 (29.31)	0.12	38.96 (30.11)	37.53 (30.56)	0.05

*d**Effect size between group

baseline (T1) to T2/ neither did the children in the comparison group.

Between Group Comparisons

Using all available CDI data at T1 and T2, there were no significant differences between the two groups at baseline (T1) and following *LLLI* (T2). This data is presented in Table 5.

Vocabulary percentile difference scores were then considered for the children in both groups who had valid scores at both T1 and T2. This group consisted of 76 children in the professional learning group and 57 children in the comparison group. Children in the professional learning group gained on average more than one percentile score between baseline (T1) and T2, whereas children in the comparison group had percentile scores on average that were four percentile points lower across the same period. These differences in vocabulary percentile scores were not statistically significant with a small effect size ($d = .23$).

Associations Between CDI Scores and Child, Family and Environment variables

Analysis of Covariance (ANCOVA) was conducted to compare the vocabulary development between professional learning and comparison groups taking into account the set of variables known to influence child development (i.e., child age, gender, main language spoken at home, number of average days of ECEC attendance across the study period, and socioeconomic status of the home address). There were no statistical differences between the groups ($F(1,124) = 2.53$; $p > .05$), with small effect sizes in favor of the professional learning group.

Associations Between CDI Scores and Language Spoken at Home

Children whose first language was a language other than English (LOTE) were significantly outperformed by their peers at T1 ($p < .05$; $d = .47$) and still showed lower vocabulary percentile scores at T2 ($p < .07$; $d = .42$) that were not significant, but with moderate effect sizes. Children whose first language was a language other than English (LOTE)

who attended an ECE service in the professional learning group, gained an average of 7.3 percentile points in their vocabulary between baseline (T1) and T2. Further, English-speaking children in the professional learning group gained 0.2 percentile points between T1 and T2, whereas children in the comparison group showed a weaker performance at T2 compared to T1 (− 1.8 percentile points for LOTE children and − 4.4 percentile points for English-speaking children). However, no significant differences were found when comparing the four groups in ANOVA analysis.

Discussion

The present study investigated the impact of a professional learning program on educator practice and associated short-term effects on vocabulary knowledge in young children. The analyses were targeted at identifying both within and between group differences for structural quality (e.g., educator qualifications) and process quality, with a focus on the language strategies EC educators used in their interactions with young children following professional learning and coaching specifically targeting language development and teaching strategies (*Learning Language and Loving It*).

Educator-child interactions were assessed using the CLASS tool (Pianta et al. 2008). Consistent with earlier research, baseline CLASS data illustrated EC practice was characterized by relatively high levels of emotional support, moderate to high levels of classroom organization, and low levels of instructional support (Burchinal et al. 2010; Tayler et al. 2013). Within group analysis demonstrated that practice was improved in the short-term based on room level measures of CLASS domains prior to and following the implementation of *LLLI*. EC educator practice was compared across the professional learning and comparison ECEC services and found to be significantly different when using the CLASS PreK, in favor of the *LLLI* participants. We conclude that the *Learning Language and Loving It*TM program, that provides both discipline-specific knowledge and one-to-one coaching using video samples of practice, enabled an increase in the type and overall amount of instructional support provided by educators to young children. However, we were not able to detect similar statistically significant change

in the CLASS Toddler scores. This was most likely due to the small numbers of observations completed in rooms using this version of CLASS, rendering our analyses underpowered to detect statistical differences. The large effect sizes associated with the scores on CLASS Toddler Engaged Support for Learning domain suggests that changes observed in the professional learning group compared to comparison ECEC services were pedagogically meaningful, despite not reaching statistical significance.

Our finding that practice change was supported when more than one EC educator in a room completed *Learning Language and Loving It*TM has important implications for the future delivery of similar professional learning programs. EC educators within a room reported encouraging and supporting each other to implement the professional learning strategies with children in their care. Peer learning and peer support for implementation of new teaching strategies was a key feature noted by educators in the professional learning program and significant in our analyses. Of equal interest is the null finding with respect to educator qualifications. While qualifications of educators have been of consistent interest in quality improvement programs, in this study, they did not impact on the likelihood of practice change by educators. This finding is consistent with the recent work of Lin and Magnuson (2018) and others (Early et al. 2007; Mashburn et al. 2008), but at odds with Han et al. (2017) where the educational qualification of educators was associated with increases in children's emergent literacy skills.

We looked more closely at the dimensions of Instructional Support, as these descriptors of educator practice (i.e., concept development, quality of feedback and language modelling), are closely aligned with the language strategies taught in *LLLI*. The improvements we observed in Instructional Support between groups at T2 indicated that educators had increased their use of all the language strategies in interactions with children. We were interested in whether change in one dimension may have been driving the overall domain change. This was not the case, in fact, all three dimensions were significantly improved following *LLLI*, with somewhat greater change noted in concept development and language modelling. The dimension, quality of feedback, relates to sustained interactions that include new information through quality feedback loops that promote children's thinking and problem-solving skills. This dimension is arguably more challenging for educators to use in practice (Pentimonti and Justice 2010) and consequently, it was encouraging to detect positive change in what are considered low- and high-level instructional support strategies in this study.

Whilst we were able to document educator practice change following completion of the professional learning program, we did not observe significant shifts in children's vocabulary development. It is worth noting that we used CDI percentile scores to compare across time. A percentile

score that remains constant over time indicates that a child's vocabulary is growing at an average rate compared to children of the same age. Clearly children's vocabularies were growing across the study period and more particularly at an average rate, but we did not observe the change in educator practice confer an additional boost to children's vocabulary growth over the study period. Children who experience increased levels of instructional support, particularly frequent conversations with repetition of new vocabulary and expanding word combinations, are assisted in expanding their current vocabulary and expressive language skills through structured scaffolding. Given that changes in children's language have been found with increasing instructional support (Gosse et al. 2013; Niklas and Tayler 2018), we discuss several plausible explanations for our null finding in this study. First, the use of a parent report instrument of vocabulary, that is an indirect assessment of children's language, may not be adequately sensitive to the rapid changes that are occurring in all children's vocabulary development across this age range. In addition, it is possible that other language measures, rather than vocabulary alone, may have been more sensitive to detecting changes in children's development because of increased levels of instructional support provided by educators.

Second, it is likely that insufficient time had been allowed between T1 and T2 to observe differential change in children's vocabulary development subsequent to educators changed practices. While it is clear that high-quality ECE has enduring benefits for children (Sylva et al. 2010) especially those from disadvantaged backgrounds, longer-term follow up of cohorts may be necessary to detect changes. It is feasible that our null vocabulary results may also be explained by previous research which found a strong association between increases in young children's language skills and the levels of socio-relational support provided by educators for vulnerable children at risk for poorer language skills (Burchinal et al. 2002). In our sample, there were moderate-high levels of emotional support provided across both groups of educators, professional learning and comparison. These relatively higher levels of emotional support may have impacted vocabulary development for all children in our disadvantaged sample, for example, the larger percentile increase found in vocabulary for the children with a LOTE compared to English-speaking children.

Third, and perhaps most notably, is that while instructional support was improved as a result of educators participating in professional learning, the mean Instructional Support score at T2 was only approaching previously published minimum thresholds for CLASS domain scores, identified as necessary to impact upon children's outcomes (Burchinal et al. 2010). Burchinal et al. (2010) investigated the relationship between instructional quality and children's outcomes and found that there was no parallel relationship between

quality and children's outcomes until minimum thresholds were reached (e.g., 3.25 for Instructional Support on CLASS). The magnitude of the association between quality and children's outcomes is greater with higher levels of quality educator–child interactions, that is, improved child outcomes were larger at higher levels of observed quality in CLASS domains.

While some services in the professional learning group in the present study reached this threshold for Instructional Support, the mean score at T2 was 2.6. We suggest that to realize significant benefits to child language outcomes, the change in practice following professional learning needs to be of a greater magnitude and sustained over time. The findings were much more encouraging for the Emotional Support domain, where scores were consistently higher than the threshold (CLASS score of 5) determined to benefit children's social outcomes and in previous research, the language skills of 'at-risk' children (Burchinal et al. 2002; Gosse et al. 2013). Most of the services in both groups in the present study were consistently at or above this level, and as such, benefits of participation in ECE to children's social skills and behavior would be anticipated despite not being directly measured in this study. Monitoring educator practice throughout professional learning programs and during coaching, needs to take account of minimum threshold levels for instructional support within educator–child interactions, as well as the emotional support provided to children, to be confident that practice change is sufficient to impact children's development and is sustainable for educators.

The findings of this study are strengthened by the systematic matching of services across the professional learning and comparison groups. Low attrition amongst the educators and the independent observations of educator practice provides rigor in the standardized CLASS data. Despite conducting multiple comparisons within and between groups we did not correct for multiple tests, instead p values were interpreted in an exploratory approach with effect sizes, to look for meaningful differences rather than focusing on specific statistically significant results (Perneger 1998). While parent-reported vocabulary was a convenient and efficient measure for the scale and scope of this study, it also had limitations. Participating children were all in a window of rapid vocabulary development, making the detection of differences between groups problematic. Direct assessment of multiple domains of children's language may have been a more robust approach and should be considered in future research. In addition, sample size with respect to rooms observed using CLASS Toddler reduced our ability to detect changes, and the retention of children providing vocabulary data at follow up, were limitations.

It is our contention that the implementation of quality improvement programs should be flexible enough to respond to service needs. Evidence based professional learning

programs should be delivered with fidelity, include individual coaching, and regularly observe practice to determine when improvements reach threshold levels. Ongoing support should be offered to services enabling them to sustain change within thresholds. Sufficiently adaptable professional learning programs, with well-developed and consistent content, may hold the greatest potential to mitigate against the cascading effect of poor early language experiences on children's later academic and social outcomes.

Conclusions

Future efforts to improve quality practice in early childhood education and care must consider the 'active ingredients' of successful educational programs and practice (van Huizen and Plantenga 2018). Burchinal (2018) states that models of ECE quality need to 'include evidence-based curricula and professional development that focus on teacher-scaffolded learning through rich conversations and hands-on activities designed to promote children's unconstrained skills'. This evaluation of the impact of the *Learning Language and Loving It*TM professional learning program confirmed the successful impact of discipline-specific professional learning on EC educator practice, specifically, in the instructional support for language learning in very young children. Professional learning delivered to groups of educators working together in ECE services which provides (i) content knowledge, (ii) practice strategies that support and strengthen EC educator–child interactions, (iii) high quality coaching, and (iv) video feedback to support implementation, will be best placed to produce sustained quality improvements. The systematic and sector wide integration of these features of professional learning programs into initial EC educator training programs also warrants careful consideration.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethics 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 Helsinki declaration and its later amendments or comparable ethical standards.

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

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