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Does *thrive by three*, a quality-building intervention in childcare centres, strengthen children's language skills?

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ABSTRACT

This study examined the effectiveness of the *Thrive by Three* intervention for 1- to 3-year-old's language development. Data from 78 childcare centres, 187 toddler classrooms, and 1561 children (91.4% native Norwegian) were included. Results revealed that children in the intervention group had slightly steeper language development than those in the control group, but the difference was not statistically significant. Since previous studies find language stimulation in childcare to differ based on gender, we also examined if the Thrive by Three intervention affected boys and girls differently. We found that effects of the intervention were only present for girls' language development. Girls in the intervention group had an increase of 17 more words from baseline to post-intervention than those in the control group. There was no statistical difference in change of boys' language development between the intervention and control group. Results are discussed in light of theories and literature that may explain our findings.

KEYWORDS

Language development; random control trial; toddlers; Thrive by Three; childcare quality

Introduction

Children's language development during their pre-school years has significant long-term consequences for their academic achievement, reading comprehension, and general well-being (Aro et al. 2012; McCoy et al. 2017; Stangeland 2017; Suggate et al. 2018). Language development is one of the most fundamental milestones during the early years and develops rapidly during the first years of their life. By age six, most children will have learned much of the complexities of language (Perlovsky and Sakai 2014). However, this development is highly influenced by children's linguistic environments (Zauche et al. 2016).

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Early exposure to a language and the amount of communication children have with adults, have been found to be critical to language development (Hart and Risley 1995). There are several strategies adults can pursue to facilitate children's language development. These include labelling, recasting, and expanding children's language – for instance, labelling objects in the child's environment to help the child make links between objects and words (Behme and Deacon 2008). It is well known that children who receive plenty of language stimulation from adults – where adults frequently talk to the child using rich language, describe their surroundings and events, and where the adult and child share a common focus with the adult acting as a guide for the child – often have more advanced language skills (Behme and Deacon 2008; Harris 1992; Hart and Risley 1995; Hoff-Ginsberg 1991; Huttenlocher et al. 2007). Although siblings and peers also play a role (Ribeiro, Zachrisson, and Dearing 2017; Segal et al. 2018), for children who participate in childcare outside the home, language spoken by their teachers is also likely to be significant to their language development (Mashburn et al. 2008; Mashburn et al. 2009).

Today there is relatively solid evidence that high-quality childcare, where meaningful interactions occur and children's learning and emotional development is supported, may be beneficial for children's short- and long-term cognitive development, including language skill acquisition (e.g. Apps, Mendolia, and Walker 2013; Barnett 2011; Bustamante et al. 2022; Camilli et al. 2010; Duncan and Sojourner 2013; Havnes and Mogstad 2011; Keys et al. 2013; Lim, Levickis, and Eadie 2022; Melhuish et al. 2015; Sibley et al. 2015; Sylva et al. 2011; Vandell et al. 2010; Van Huizen and Plantenga 2018). More specifically, studies have shown that children attending childcare centres with high-quality language milieus, have better vocabulary skills than peers attending centres with lower quality (Hansen and Broekhuizen 2021). Likewise, high-quality teacher – child interactions have been linked to better language development (Yang et al. 2021). In other words, it appears that a child's language development can be influenced by the quality of the childcare they attend. Thus, having access to good quality childcare, with staff who offer rich language stimulation and support for learning, is essential for children's development. Such stimulation and support should include open-ended questioning, repetition and extension, back-and-forth-exchanges, self and parallel talk, labelling and using a variety of words and descriptive vocabulary, when interacting with the children (La Paro, Hamre, and Pianta 2012).

Due to the great potential that lies in high-quality childcare, universally accessible, high-quality education and care have been placed on the international agenda (European Commission 2018), and put forward as a possible universally protective intervention. Today, in countries part of the Organisation for Economic Co-operation and Development (OECD), a third of all children under 3 years attend professional childcare (OECD 2019). In Norway, as much as 87% of this age group are in formal childcare, most attending for long hours (Statistics Norway 2022).

With the combination of a large proportion of young children attending childcare, and widespread knowledge of the importance of high-quality settings for children's language development, securing consistently high-quality across centres is crucial. Unfortunately, caregiver–child interactions around the world, including Norway, are typically representative of low- to medium-level quality (e.g. Bjørnestad and Os 2018; Bjørnestad et al. 2020; Buøen et al. 2021; Egert, Dederer, and Fukkink 2020). More

specifically, interactions indicative of good language stimulation and support for learning are generally seen to be of lower quality compared to other process quality indicators such as warmth and connection (Slot 2018), underscoring the need to improve support for language stimulation.

Because requirements for high-quality childcare are not sufficiently met, models of intervention are necessary to improve caregiver–child interactions and, in turn, enhance children's development (Markussen-Brown et al. 2017; Siraj, Kingston, and Neilsen-Hewett 2019). Research into the use of professional development programmes is therefore on the rise (for a review see, for example, Egert, Fukkink, and Eckhardt 2018; Jensen and Iannone 2018). Professional development in childcare refers to activities that promote staff's skills and knowledge, as well as how staff use this during interactions with children (OECD 2009; Sim et al. 2019). Programmes usually involve training to support staff in providing high-quality, purposeful interactions (Markussen-Brown et al. 2017) and resources should be applicable to both children and staff (e.g. Kirova and Henning, 2013). These programmes consist of complex models typically including coursework, lectures, workshops, use of training materials, mentoring, coaching, reflective supervision, and on-site support (Brunsek et al. 2020; Jensen and Iannone 2018).

The literature has often indicated that professional development models have positive impacts on staff practice and that interaction quality in childcare can be enhanced with the help of such programs (e.g. Egert, Fukkink, and Eckhardt 2018; Egert, Dederer, and Fukkink 2020; Eurofound 2015; Markussen-Brown et al. 2017; OECD 2019; Werner et al. 2016). However, studies of these programmes are often observational in design, not always, but often unsuitable for making causal inferences about the effects of the programme (Bleses et al. 2020). Complex professional development models, involving randomized controlled trial (RCT) designs, are necessary to accurately evaluate the effects of these programmes (Egert, Fukkink, and Eckhardt 2018; Eurofound 2015; Siraj, Kingston, and Neilsen-Hewett 2019). Moreover, there is a large lack of knowledge on the effectiveness of such professional development programmes for toddler outcomes (Egert, Fukkink, and Eckhardt 2018; Markussen-Brown et al. 2017; Siraj, Kingston, and Neilsen-Hewett 2019), since much of the existing research is dominated by professional development for staff working with older children (Egert, Fukkink, and Eckhardt 2018; Siraj, Kingston, and Neilsen-Hewett 2019). Studies combining an RCT design in settings with infants and toddlers are generally underrepresented (Eurofound 2015). In Egert, Fukkink, and Eckhardt's (2018) meta-analysis on the impact of professional development for quality ratings and child outcomes, only two of the 42 studies from North America were RCT studies with mixed age groups (which included infants and toddlers), and there were none exclusively with infant and toddlers. Likewise, Ragni et al.'s (2021) systematic review of 18 intervention programs to promote the quality of caregiver–child interactions, included just three exclusively focused on infants and toddlers.

Overall, the existing literature highlights the importance of high-quality childcare for children's language development, the need for well-designed professional development programmes for childcare staff working with infants and toddlers, as well as for rigorous experimental studies to investigate the effectiveness of such programmes on children's development. This study adds to the existing literature by examining the effectiveness of the *Thrive by Three* intervention – a 10-month, multicomponent, in-service professional development model designed to strengthen the instructional and process

quality of Norwegian childcare centres serving toddlers – for 1- to 3-year-old children's language development.

Intervention

The Thrive by Three professional development model was created in an effort to address two issues. First, the lack of available models of intervention for improving childcare quality for toddlers. Second, the shortage of studies investigating the effectiveness of such interventions on child outcomes. Thrive by Three is an in-service professional development model that aims to increase process quality (caregiver–child interactions) in toddler classrooms that, in turn, is expected to be linked to positive child outcomes such as language development. The model consists of four main components and is implemented during a 10-month period:

(1) *Quality assessment and feedback*: Process quality is observed by certified observers, using the standardized observation method, Classroom Assessment Scoring System (CLASS) Toddler (La Paro, Hamre, and Pianta 2012). Certified observers take part in CLASS training before scoring five videos of toddler classrooms. They are required to reach the required reliability criterion of 80% to be certified. Booster sessions take place before and during data collection periods to maintain reliability. A portion of the observations were also double coded at baseline (T1, 10%) and post intervention (T3, 14%). Staff receive feedback from the observer on their classroom's scores based on observations of eight quality dimensions of the CLASS Toddler, showing strengths and weaknesses of caregiver–child interactions. Five dimensions; positive climate, negative climate [reversed], caregiver sensitivity, regard for child perspectives and behaviour guidance constitute the Emotional and Behavioural Support domain of effective caregiver–child interactions. Facilitation of learning and development, quality of feedback, and language modelling constitute the Engaged Support for Learning domain.
(2) *Supervision and reflection*: All staff in the classroom receive monthly systematic supervision sessions (10 times) with their head teacher based on their scores on the CLASS Toddler and an action plan for improvements. Head teachers in each classroom participate in a 1-day seminar about supervision prior to the start of the monthly supervisions. Supervision follows a step-by-step structure outlined in a supervision manual given to all head teachers. During supervision sessions, staff reflect together with their head teacher on their practice and interactions with children in the group. They do this using the CLASS Toddler dimensions as a starting point. Between supervision sessions, all staff focus on one or two CLASS Toddler dimensions in their daily work with children. In addition, they are asked to write notes about their interactions with children and reflect on them in relation to the CLASS Toddler dimension they are focusing on. All staff receive training and examples of how to write notes about their interactions. However, there was natural variation between staff and centres in how this was done. These reflection notes lay the foundation for each supervision session. During each session, the focus is on one to two CLASS Toddler dimensions. The head teacher, in collaboration with staff, choose which dimensions to start with based on feedback from certified observers. At some point during the 10-month intervention period, each of the eight CLASS Toddler dimension is focused on. Head

teachers themselves also receive supervision (10 times) from a mentor, typically working in educational psychological counselling services or other resource groups in the municipality. The mentors also follow a manual describing the structure of the supervision sessions. Supervision given by childcare professionals to their staff was typically done during planning sessions they already had a structure for in their centre. Supervision by mentors to childcare professionals was done in small groups together with the other childcare professionals from participating centres. These sessions were conducted in dedicated meeting rooms where the mentors work (e.g. offices at the educational psychological counselling services).

(3) *Seminars about caregiver–child interactions, child development, and child mental health*: All staff attend three full-day seminars focusing on research-based knowledge about childcare quality, toddler development, risk-and protective factors, and children's mental health.

(4) *Manuals, booklets, posters, and website*: Manuals about the content and management of supervision are provided to head teachers and mentors. Written materials, based on the Washington State Early Learning and Development Guidelines (State of Washington 2012) and CLASS Toddler (La Paro, Hamre, and Pianta 2012) are provided to parents and staff. Posters describing the CLASS dimension in focus are displayed in the classrooms so that both caregivers and parents can see them. Further, a website with in-depth information about the Thrive by Three model and the written resources is available to all staff (tf3.no).

Present study

A previous RCT study of Thrive by Three, including 187 toddler classrooms, revealed a positive effect on caregiver–child interactions in the intervention group compared to the control group, in terms of both emotional and behavioural support and engaged support for learning (Buøen et al. 2021). In the present study, we explore changes in children's language development (production) after the implementation of the Thrive by Three model. More specifically, we examine two research questions.

Our first research question is as follows: Does Thrive by Three, a quality-building intervention in childcare centres, strengthen children's language skills compared to controls at 1-year follow-up?

Our second research question is based on previous research, including a recent Norwegian study, that found that girls tend to be more involved in language-stimulating, teacher-led, and child-initiated activities in childcare centres than boys (Early et al. 2010; Ruble, Martin, and Berenbaum 2006; Stangeland, Lundetræ, and Reikerås 2018). Because this might, in turn, effect boys' and girls' language skills differently, we ask the following question: Does the possible positive effect of Thrive by Three differ for boys and girls?

Method

Design

The present study is a part of the larger Thrive by Three study and was conducted as a cluster RCT (Lekhal et al. 2020). Randomization was stratified within each municipality

and by size of childcare centre (small vs. large). Within each stratum, half of the childcare centres were randomized to the intervention or control group. Randomization was carried out using a random number generator by a statistician on the research team who did not know the identity of the childcare centres. Childcare centres in the control group were offered participation in the intervention the following year.

Participants

Seven municipalities or city districts were invited and consented to participate, four in Eastern Norway and three in Central Norway. A total of 78 childcare centres, 187 toddler classrooms, and 1561 children were included. The childcare centres were recruited after the municipality or city district had consented to participate. Childcare centres with at least one toddler group (children aged 10–36 months) volunteered to participate. A maximum of 16 childcare centres could participate from each municipality or city district. The leader of each childcare centre received an e-mail including an electronic link with the written informed consent for all childcare professionals and parents in the toddler classrooms. Parents provided written consent for themselves and their children. If parents had shared custody, both had to consent before the child could be enrolled in the study.

Childcare professionals completed questionnaires regarding children's development for 1462 (93.7%) of the toddlers at Time 1 (T1) and 1447 (92.7%) at Time 2 (T2). Toddlers in the sample had a mean age of 21.4 months ($SD = 6.23$), and 48.8% of the sample were girls. Most children were Norwegian (91.4%), 4.2% were from Europe or North America, and 4.4% were from a non-Western country. Just 3.5% of the sample were single parents, and only 4.8% were considered low income. In Norway, the national prevalence of families with low income is 11.7% (Statistics Norway 2022). Further, 75.4% of the parents had a college or university degree at bachelor level or higher. In the general population in Norway, 35.5% had a college or university degree. Childcare staff were mostly woman (91.3%), had worked in childcare centres for a mean of 3.3 years ($SD = 3.82$), and were Norwegian (82.3%). Regarding the education level of the childcare staff, 34.6% had a bachelor's degree in early childhood education and care (ECEC). In general, 44% of childcare staff in Norwegian childcare had a bachelor's degree or equivalent in ECEC (Utdanningsdirektoratet 2022). In Oslo, 39% had formal ECEC education. Most of the childcare centres were organized in stable groups (75.9%), while the rest had flexible groups. Thirty-four percent of toddler classrooms had nine children or less in the group, 57.8% had between 10 and 15 children, and 8.2% had 16 children or more. Norwegian classrooms for one- to three-year-olds are required to have an adult–child ratio of 1:3.

Measures

Descriptive data about the children and childcare centres were collected in September 2018. Data about children's language development were collected before (September 2018) and after the intervention (June 2019).

Children's language outcomes were measured at both T1 and T2 using the Language Development Survey (LDS) developed by Rescorla (1989). The LDS is a vocabulary

checklist of 310 words that is completed in about 10–15 min. The 310 words are arranged into 14 semantic categories (e.g. food, animals, people, vehicles). The childcare professional who knew the child best was asked to circle each word the child uses spontaneously. The LDS has previously displayed excellent reliability as assessed by Cronbach's alpha and test-retest techniques. In previous studies (e.g. Rescorla 1989) the total vocabulary scores as reported on the LDS have also been shown to be highly correlated with performance on the Bayley, Reynell, and Preschool Language Scale expressive vocabulary items. The LDS has also been found to have excellent sensitivity and specificity for the identification of language delay, with a criterion of fewer than 50 words or no word combinations at 2 years yielding very low false positive and false negative rates (Rescorla 1989).

Analyses

To evaluate the effect of the Thrive by Three model on children's language development, we used a linear mixed model with language skills as the dependent variable, time (after intervention versus before) and the interaction time*intervention as fixed effects. In this way, by excluding any systematic main effect of the intervention at baseline, we accounted for the baseline value as recommended by Coffman, Edelman, and Woolson (2016) and Twisk and colleagues (2018). Further, we adjusted for the background variables child age and gender that are plausibly strong predictors of the outcome. Adjustment for background variables likely to be strong predictors of the outcome is recommended (Lydersen 2020). We planned to use a three-level model with child nested within classroom within the childcare centre. However, computations did not converge, so we excluded the classroom level. We kept the childcare centre level because randomization had been done at this level. We then used a two-level model with child nested within the childcare centre. As a sensitivity analysis and robustness check, we also applied the model with only the classroom level, without classroom. The results were practically identical. Normality of residuals was checked by visual inspection of QQ plots. Two-sided p-values under 0.05 were regarded to represent statistical significance. Statistical analyses were conducted in IBM SPSS 25.

Because gender has shown to be related to both language development (e.g. Bleses et al. 2018; Hines 2013; Kristoffersen et al. 2012; Simonsen et al. 2014; Stangeland, Lundetræ, and Reikerås 2018; Zambrana, strom, and Pons 2012) and possible differences in language stimulation in childcare (e.g. Early et al. 2010; Ruble, Martin, and Berenbaum 2006; Stangeland, Lundetræ, and Reikerås 2018), we also examined if the effect of the intervention differed between girls and boys by adding the three-way interaction gender*time*intervention and the two way interaction gender*time in the model.

Results

Baseline measures

At baseline, intervention and control group were similar in terms of the number of children in toddler classrooms, the number of childcare professionals with a bachelor's degree, staff stability, and children's age or language (see Table 1).

Table 1. Baseline characteristics of the intervention and control group, mean and SD.

Variables	Intervention group	Control group
Number of children in toddler classroom	11.6 (2.66)	10.89 (2.84)
Number of childcare professionals with a bachelor's degree	1.64 (1.60)	1.59 (1.66)
Staff stability (scale 1–5)	4.04 (0.93)	4.08 (0.69)
Children's language skills	88.7 (98.0)	91.8 (97.1)
Children's age	21.5 (6.3)	21.3 (6.2)

Intervention effects

In our first linear mixed model, we wanted to examine if Thrive by Three strengthens children's language skills compared to controls after the 10-month intervention. As we can see from the results in Table 2, children in the intervention group had slightly steeper language development than those in the control group, with a difference of seven more words in the intervention group compared to the control. However, this difference in increase between the two groups was not statistically significant (see Table 2).

In our next analyses, we wanted to see if the Thrive by Three intervention affected boys' and girls' language development differently. We therefore conducted separate linear mixed model analyses for boys and girls (see Table 3). No statistical difference in change of boys' language development was found between the intervention and control group. However, the situation was different for girls. Girls' language development skills increased significantly more in the intervention group from baseline to post-intervention compared to the control group. The girls in the intervention group had an increase of 17 more words from baseline to post-intervention than those in the control group (see Table 3). In our final step, we examined if the effect of the intervention significantly differed between girls and boys by adding the three-way interaction gender*time*intervention and the gender*time interaction. The result showed that the three-way

Table 2. Effects of thrive by three on children's language development, controlling for child age and gender.

Time		Intervention group	Control group	Difference (group*time)	*P*- value
		Mean (*SE*)	Mean (*SE*)	Estimate (95% CI)	
Baseline	LDS	86.58 (2.84)	91.57 (2.67)		
Post int.	LDS	189.66 (2.87)	187.23 (2.66)	7.37 (−.78–15.53)	.076

*Children's language skills measured with the Language Development Survey (LDS).

Table 3. Linear mixed model analyses of the effects of thrive by three on language development, separately for boys and girls, and controlling for child age.

		Intervention group	Control group	Difference (group*time)	*P*- value
		Mean (*SE*)	Mean (*SE*)	Estimate (95% CI)	
Boys					
Baseline	LDS	81.76 (3.99)	83.34 (3.84)		
Post int.	LDS	174.31 (4.01)	177.49 (3.81)	−1.59 (−12.82–9.64)	.781
Girls					
Baseline	LDS	91.10 (4.02)	99.86 (3.71)		
Post int.	LDS	205.74 (4.10)	197.08 (3.72)	17.42 (5.63–29.22)	.004

*Children's language outcomes measured with the Language Development Survey (LDS).

interaction gender*time*intervention was significant ($P = .021$). Thus, the effect of the Thrive by Three intervention was only present for girls' language development, not boys'.

Discussion

In this study we looked at the effects of the Thrive by Three intervention on toddlers' language development compared to the business-as-usual control group. In our main effect analyses, we found no difference in changes to children's language skills in the intervention group compared to the control group. Within the CLASS-framework, the Language Modelling dimension captures how teachers encourage children's language development through language-stimulation and language facilitation techniques. Such techniques include open-ended questioning, repetition and extension, back-and forth-exchanges, self and parallel talk, labelling and using a variety of words and descriptive vocabulary, when interacting with the children (La Paro, Hamre, and Pianta 2012). Given that previously published results from the Thrive by Three study shows that quality of Language modelling actually increased (Buøen et al. 2021), we would perhaps expect a positive effect on children's language development. That being said, even though quality increased, most classrooms also scored in the mid-range post-intervention. Several researchers have advocated that it is first and foremost high-quality caregiver–child interactions that may lead to developmental benefits for children in childcare centres (see Ulferts, Wolf, and Anders 2019 for overview). In addition, although the variability between classrooms was reduced, it was still notable post-intervention. It is also important to keep in mind that language modelling was only one of eight quality dimensions in focus during the intervention period. Thus, the focus on language modelling may not have been intense nor specific enough and the increase in quality may not have been large enough to impact all children's language development.

Due to the fact that Thrive by Three targeted all aspects of caregiver–child interactions and not language-stimulating activities with specific children, we had no control over which children would be affected by improved quality due to the intervention (found in Buøen et al. 2021). When looking at boys and girls separately, we found that the Thrive by Three intervention affected girls' language development, but not boys'. There may be several explanations for this finding. One explanation may lie in the context of the present study –Norwegian childcare. In Norway, childcare practice is guided by a common framework plan (Kindergarten Act, 2005; Ministry of Education, 2017). At the heart of this framework plan, and the centre's daily activities, play as a general term, is highly valued. Children spend most of their day in child-led free play, with staff prioritizing this type of play over planned adult-led activities (Lekhal et al. 2013). Daily activities are organized in an informal way, with children moving freely between play themes and activities, often without a staff member nearby (Karlsen and Lekhal 2019; Kleppe, 2018; Sandseter, Storli, and Sando 2020). The learning environment is highly unstructured, which may give boys and girls different learning opportunities due to their self-selected environments.

Research shows that when given the opportunity to decide, children might choose gender-specific activities. As a result, girls tend to be more involved in language-stimulating, teacher-led, and child-initiated activities in childcare centres (Early et al. 2010; Ruble, Martin, and Berenbaum 2006; Stangeland, Lundetræ, and Reikerås 2018).

Boys tend to choose activities involving physical activity and exploration of their surroundings (Early et al. 2010), and engage in more rough-and-tumble play (Sandseter, Kleppe, and Sando 2021). The overrepresentation of female employees in the childcare profession (in our sample 91.3% were female), as pointed out by Stangeland, Lundetræ, and Reikerås (2018), may further corroborate this divide in boys' and girls' activities. Female employees may be biased toward involvement in activities chosen by girls. As a result, boys may experience less staff involvement and stimulation than girls throughout the day. In line with this, greater gains could have been found for the boys in our study if an effort was made for all children to participate in activities with equal staff involvement and language stimulation by, for example, incorporating risky play into caregiver–child interactions.

In addition, a higher ratio of male caregivers may also have changed our results. Indeed, Drange and Rønning (2017) found that *both* boys' and girls' reading skills in first grade were higher if they had attended a centre with higher rates of male employees/caregivers. A final, perhaps more speculative explanation of our findings, may lie in the fact that girls have been found to have an advantage over boys in most cognitive domains in the first 4 years of life (Toivainen et al. 2017). Our findings support this, by showing that girls had better expressive vocabulary at pre-intervention than boys. An important way of stimulating language development in the toddler years is to engage in conversations with the children and provide frequent opportunities for children to use language. Due to girls' more developed language skills, staff may have found it easier to talk with and engage girls in dialog than boys, and girls may have been better equipped to engage in such language-stimulating activities. In line with this, research shows that even young girls tend to have more advanced self-regulatory capacities than boys (Backer-Grøndahl and Nærde 2017; Else-Quest et al. 2006). If staff primarily stimulated children's language use during activities that require the child to listen, sit still, take turns and so on, this may also have favoured the girls. In sum, not only could the girls have been exposed to more language stimulating activities from primarily female staff, but they may also have been better equipped to benefit from these interactions.

Even though the present study is one of few that provides an evaluation of a methodically sound professional development programme in toddler settings, it also has some limitations. One such limitation is the fact that language stimulation provided by staff was the focus, meaning that the recipient of this stimulation was not considered. No data were collected on who (e.g. gender) the staff interacted with. Even though interaction quality improved, these interactions may have primarily been occurring with girls, thus leading to our findings of better language development for girls. This is a likely explanation based on previous findings (e.g. Stangeland, Lundetræ, and Reikerås 2018). Another limitation may be that the sample consisted of toddlers from primarily high socioeconomic status (SES) families in terms of education and income. We may have found clearer effects of the Thrive by Three model in a more diverse sample. Studies have found that children from low SES and higher risk backgrounds typically profit more from high-quality childcare (Van Huizen and Plantenga, 2018; Melhuish et al. 2015). Thus, the effects of Thrive by Three may have been underestimated due to our low-risk sample.

Another limitation is that only children's language production was measured. Children's language development consists of many factors that were not measured in this

study (e.g. comprehension, grammar, and syntax). Additionally, it would have been a strength to have several childcare professionals rate the same child's language development to strengthen the reliability of the results. This was not done in the present study since this would have been more time consuming for childcare staff already under high work pressure.

Finally, although RCT studies are often seen as the gold standard for revealing causal relationships, this design also has strengths and weaknesses. One challenge with RCT studies is that they are conducted under relatively stringent conditions and can be difficult to replicate under more flexible conditions. For instance, field professionals in childcare institutions will draw on a much wider range of sources than formal experimental evidence in order to inform their actions. Thus, while evidence from RCTs is encouraging, other types of studies are also needed to examine the effects of childcare and early education. Here, observational studies can play an important role. Well-designed observational studies with robust analysis techniques can also offer important information to be able to see causal effects of measures taken in childcare in their natural context.

In sum, our results offer support for the Thrive by Three model as a preventative intervention to ensure high-quality interactions between childcare professionals and toddlers in childcare centres. Following the Thrive by Three intervention, childcare staff showed better relational interactions with children in their settings (found in Buøen et al. 2021) and affected language development positively for some children (girls), supporting the use of this professional development model further. However, our findings also point to the need for future studies investigating for whom and how the effects of professional development models that work with staff's general interaction quality, affecting children's development, are distributed to different children. This applies to both boys and girls, including children who have diverse character traits, such as different temperaments and language skills at the start of the professional development model, and children from various SES backgrounds. This is often invisible in more general analyses of interventions with an experimental design.

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