Reasoning as a pedagogical strategy in infant-addressed talk in early childhood education centres : Relationships with educators' qualifications and communicative function

Hu, Jiangbo, Degotardi, Sheila, Torr, Jane and Han, Feifei

Hu, J., Degotardi, S., Torr, J.and Han, F. (2019). Reasoning as a pedagogical strategy in infant-addressed talk in early childhood education centres : Relationships with educators' qualifications and communicative function. *Early Education and Development*, 30(7), pp. 872-886. https://doi.org/10.1080/10409289.2019.1607449.

Abstract

Research Findings: This study examines the frequency of reasoning talk used by 56 educators during their naturally occurring play interactions with infants in their early childhood education and care (ECEC) centres. Using Hasan's semantic framework, reasons were coded as social (based on social rules) or logical (based on rules of nature). The communicative function of reasoning talk was coded as regulatory (when the reason served to regulate infants' behaviour) or non-regulatory. On average, educators' reasoning talk comprising only 4.43% of their total talk, with social reasoning used slightly more frequently than logical reasoning. Educators used significantly more social reasoning when regulating infants' behaviour, whereas logical reasoning occurred more frequently during non-regulatory interactions. Educators' qualification level explained individual differences. Bachelor-qualified educators used significantly more reasoning talk than lower-qualified educators, and this finding was explained by their more frequent use of both social and logical reasoning when regulating infants' behaviour. *Practice or Policy:* The study identifies reasoning talk as an important element of language environment quality in ECEC infant rooms, and highlights the learning potential of language used for different communicative purposes. Findings demonstrate that well-qualified educators appear well versed to capitalise on the educative potential of this type of talk.

Keywords: educator-infant interactions, childcare, reasoning, teacher qualification, communicative function

The importance of providing a language-rich environment for infants attending early childhood education and care (ECEC) centres is widely recognised (National Institute of Child Health and Human Development Early Child Care Research Network, 2000, 2002; Vernon-Feagans, & Bratsch-Hines, 2013). A significant determinant of the quality of the language environment relates to educators' infant-addressed talk, the quantity and quality of which is related to infants' current and future language development (Burchinal, et al, 2000; Zauche, Thul, Mahoney, & Stapel-Wax, 2016). This study will focus on one type of talk, reasoning talk, and the factors associated with its use by infant educators in ECEC centres. Educators' use of reasoning provides young children with a model of the type of analytical, reflective and explanatory talk associated with intellectual inquiry and academic success (Dickinson & Smith, 1991, Peterson & French, 2008). Little is known about the extent to which educators use reasoning when interacting with infants, who are in the earliest stages of learning their mother tongue(s). This study will investigate the association between infant educators' use of reasoning talk, the communicative function of this talk and their level of professional early childhood qualifications.

Reasoning talk and learning experiences

Educators' use of reasoning talk is a significant area to investigate, as reasoning is one of several features comprising a literacy-oriented oral language register referred to as academic talk (Barnes, Grifenhagen & Dickinson, 2016; Nagy & Townsend, 2012; Snow & Uccelli, 2009; Van Kleeck, 2014). The ability to understand and use the academic register, including reasoning, is essential for success in formal schooling, and preschool teachers are encouraged to foster children's development of this type of register prior to school entry (Barnes, Grifenhagen & Dickinson 2016; Dickinson & Porche, 2011; McKeown & Beck, 2003; Nagy & Townsend 2012;; Van Kleeck 2008, 2014). Little is known about educators' use of

reasoning talk with children under two years of age in ECEC centres, however, despite its importance for later academic achievement.

Research undertaken in the home environment has demonstrated an association between parents' use of reasoning talk and children's language development. Rowe (2012) investigated parents' use of decontextualized language such as explanation, narrative and definition and its influence on children's subsequent ability to use these language forms. The term *explanation* referred to "talk that requested or made logical connection between objects, events, concepts or conclusions *(e.g. because lights have to be on for the remote to work)"* (p. 1767). Fifty young children and their families participated in Rowe's (2012) longitudinal study. They were observed for 90 minutes during typical everyday activities when the children were 18, 30 and 42 months of age. Rowe (2012) found that, controlling for socioeconomic status and amount of parental input, the children of parents who provided more explanatory talk during everyday conversations achieved better results in vocabulary tests a year later.

Reasoning talk also appears to have implications for children's cognitive development. Slaughter, Peterson and Mackintosh (2007) investigated how parents' language use may predict their children's ability to explain behaviours with reference to mental states and processes. The researchers audiotaped the language that 30 mothers used when asked to narrate the story from a wordless picture book to their pre-school-aged child. They coded incidences of mothers' references to cognition, desire and affect and perception, further coding as *clarification* when a phrase was added which clarified the reason behind this mental reference (e.g., '*He puts all the makeup back so Mummy doesn't know what they've been up to*' (p.843). Results showed that mothers' use of cognitive clarification statements correlated with their children's performance in theory of mind tasks that assessed their

understanding of their own and others' mental states. The researchers propose that the presence of explanatory talk in this context may serve as an important scaffold for children's developing understanding of the psychological reasons behind people's behaviours.

Such research suggests that reasoning used during adult-child conversations provides positive learning experiences for young children. The research above, though, has been in home or experimental contexts. As increasing numbers of infants attend ECEC centres for a proportion of their waking hours (Baxter, 2015), it is significant to investigate the language learning opportunities that are naturally available to them in this context.

Young children' understanding of causal relations

The fact that infants under two years of age are in the earliest stages of their language development may raise questions regarding the pedagogical appropriateness of educators using reasoning talk with infants. Experimental evidence from cognitive psychological research indicates that infants are able to understand physical casualty (Hickling & Wellman, 2001; Lewis & Mitchell, 2014; Spelke, Breinlinger, Macomber, & Jacobson, 1992). Sobel and Kirham (2006) conducted experiments with infants and toddlers where they observed whether a "blicket detector" machine was activated when certain objects were placed on it. The researchers found that 24-month-old children could use causal inference to activate the machine when requested. Nineteen-month-old infants demonstrated similar inferential ability when the causal property that activates the machine was presented directly, but lacked the ability of retrospective inference when the causal property was presented indirectly (e.g. an object that did not activate the detector was demonstrated). Even at eight months of age, infants have been shown to demonstrate an awareness of cause and effect. In an experiment where infants were shown a sequence of the events on a stimulus screen, their eye movements indicated that they understood that a certain event can predict another event

(Sobel & Kirkham, 2006). Although this research examined children's causal understanding using experimental methods where language was not involved, it is relevant to the current study because it provides evidence that infants under two years have the aptitude to understand causal relationships in the physical world.

Particularly pertinent to the present study, research also shows that, by 18 to 30 months of age, children recognize causal relationships when stated in language. In an experiment undertaken by Bonawitz, Horowitz, Ferranti, and Schulz (2009), toddlers watched how a toy airplane was made to spin and light up when a block was placed on the base of a device. After watching the demonstrated, toddlers were asked to make the airplane go. Researchers found that, when experimenter use causal language such as *the block makes it go* to describe the casual mechanism underlying the observed relationship in the device, toddlers performed significantly better than they did in the absence of such language support. However, language that simply drew the toddlers' attention, such as *look at the block,* did not improve toddler's performance. This research shows that language plays a critical role in facilitating toddlers' ability to understand causal information and act accordingly.

Unlike the experimental research outlined above, Frazier, Gelman and Wellman (2009) undertook research in a natural interactional environment that investigated how slightly older children (two to four-years-old) asked their parents explanation-seeking questions. The researchers found that the children sought causal explanations, and appeared satisfied or showed more agreement when parents provided a reasonable explanation addressing their *why* and *how* questions. For example, a child asked *why you put yogurt in there*; the parent answered *yogurt's part of the ingredients*. If parents did not provide any explanation, children tended to re-ask the question or created their own explanation. For example, a child asked *do you know why he's giving to live next to the mine*? The parent didn't give any answer, and then the child said *because he likes it next to the mine.* Though this research focuses on

children above two years, it indicates that young children use language to seek and understand causal relationships in daily conversations. When paired with the experimental research above (Bonawitz et al., 2009), these findings suggests that infants' experience with reasoning talk prior to the age of two may well support their ability to subsequently use reasoning talk as means of learning.

Theoretical Framework

This study employs Hasan's (2009) theoretical framework to analyse educators' use of reasoning talk with infants. In this study, the term *reasoning talk* refers to educators' provision of an explanation or justification to supplement a statement. Following Hasan (2009), reasoning talk is understood to comprise four elements: a statement, or *claim,* that is then supplemented by a *reason* which provides an explanation or justification for the claim. The *principle* provides further support for the reason by generalising beyond the immediate individual instance under consideration. Finally, the principle may be supported by the *grounding,* which provides the conceptual validation for the principle. These four elements are presented in Example 1.

Example 1: [An educator is preparing an infant to dress up properly before going outside. She is looking for a bodysuit in the infant's locker while explaining her actions to the infant] *"Yeah, I'm just going to see if I can find you a different bodysuit, because it's too hot for a long sleeve."*

Claim: I'm just going to see if I can find you a different bodysuit

Reason: It's too hot for a long sleeve

Principle: Long sleeves are not suitable for a hot day

Grounding: Law of nature (Human beings need to dress up according to the temperature of weather to maintain comfortability)

As seen in the example above, in everyday talk, the claim and the reason are stated explicitly, while the principle and the grounding usually remain implicit. However, the validation embedded in the *principle* and *grounding* are inherent in reasoning talk, regardless of whether they are explicitly articulated or not. According to Hasan (2009), *grounding* is the most significant element as it determines the validation of the whole reasoning chain. To determine the implicit meanings in speakers' reasoning talk, the *grounding* should therefore be taken into account.

Based on the grounding behind reasons, reasoning talk can be distinguished into logical and social (Hasan, 2009). *Logical reasoning* justifies the reason in terms of universal physical laws of cause and effect, while *social reasoning* justifies the reason in terms of social and/or cultural values. Logical grounding is powerful as physical laws have unchallengeable authority. Social grounding, on the other hand, can be disputed and challenged more readily, as it is based on social conventions and values which are relative and culture-specific. Social reasons can be further categorized into: (1) *cooperative* (grounded on the value of harmonious relationships between people; (2) *institutional* (grounded on the authority of institutions); (3) *communal* (grounded on the shared rules or principle of a community); (4) *local* (grounded on a rule agreed by a small group of people under a certain conditions); and (5) *coercive* (grounded on a threat, bribe or emotional blackmail that reflects the personal power of the speaker).

Examples of educators' reasoning talk based on these six types of grounding are presented in Table 1. Please note that, in most instances, the educators only articulated the *claim* and the *reason*. The actual words used by educators are presented in italics.

(Table 1 should be inserted here)

Hasan's framework makes explicit the underlying natural and social rules that are embedded in everyday reasoning talk. They provide explicit evidence to support Halliday's (2004) insight that, when learning language, children are simultaneously "learning through language and learning about language" (p. 308). Hasan's framework explains one pathway through which children are socialised into the values of their culture through language.

The present study

In this study, we use Hasan's (2009) theoretical framework to examine the prevalence of social and logical reasoning talk during educator-infant interactions. In many situations, there is not a one-to-one relation between claims and reasons. For example, one educator's directive (*hold on, don't step in, hold on, it's slippery)* has three claims supported by one reason (it's slippery). Conversely, another educator's statement (*oh no, it's too big, the magnets are attracted to each other and they're sticking)* comprises one claim (*oh no)* supported by three different reasons. Our analysis focuses on the number of reasons rather than the number of claims produced by educators, because the presence of a reason is the defining feature of reasoning talk. We then investigate whether individual differences in infant educators' use of reasoning talk can be explained by reference to i) the communicative function of the talk, and ii) the educators' level of early childhood qualification.

Firstly, studies on educator-child conversations suggest that particular communicative functions present different language learning experiences to young children (Cabell et al, 2011; Dickinson, Hofer, Barnes, & Grifenhagen, 2014; Dickinson & Smith, 1991; Grigenhagen, Barnes, Collins, & Dickinson, 2017). For example, educators' use of directive language tends to dominate turn taking and inhibit children's verbal responsiveness, while informational exchanges tend to encourage children's talkativeness and lexical diversity (Girolatmetto, Weitzman, Lieshout, & Duff, 2000). Although no research currently exists to

examine whether communicative function is relevant to educators' use of reasoning talk, one home-based study suggests that this may be the case. Specifically, in their study of the language interactions of Chinese mothers and their preschool aged children, Hu and Torr (2016) found mothers used more social reasoning when the statement functioned to regulate children's behaviour, while logical reasoning was more likely to occur in non-regulatory reasoning statement.

Secondly, many studies have demonstrated that the level of educator qualification is significantly related to the quality of their interactions with very young children (Degotardi, Han, & Torr, 2018; Degotardi, Torr, & Nguyen, 2016; Manlove, Vazquez, & Vernon-Feagans, 2008; National Institute of Child Health and Human Development Early Child Care Research Network, 2002). While these studies have not examined reasoning talk specifically, Hasan's (2009) study of mother-child talk revealed that mothers' educational background is associated with their reasoning talk. Specifically, mothers who held post-secondary professional qualifications tending to use more reasoning talk based on logical rules in their daily conversations with their children than those who completed high school as their highest educational level. Likewise, in ECEC centres, Hu, Torr, Degotardi and Han (2017) found that university-qualified educators were more likely to supplement their directives with reasons, compared with diploma and certificate qualified educators. These findings lead us to predict that higher qualified educators will use more reasoning talk than their less qualified counterparts.

The present study therefore addresses the following two research questions:

1. To what extent do infant educators use reasoning talk during their interactions with infants, and what kinds of reasons do they provide?

2. What is the relationship between educators' use of reasoning talk, the communicative function of the talk (regulatory or non-regulatory) and the educators' level of early childhood qualification?

Method

Participants

Participants

This study forms part of a larger research project investigating the language environment experienced by infants attending ECEC centres. To recruit participants, we sent emails which included participant information statements and consent forms to ECEC centres with rooms for under two-year old children situated in or around Sydney, Australia. To be eligible to be invited, centres had to be approved centre-based providers of early childhood education and care meaning that they met the minimum quality standards stipulated by the Australian National Quality Framework (Australian Children's Education and Care Quality Authority, 2018). We invited participation from large not-for-profit and for-profit early childhood providers who then sought interest to participate from their centres. We also invited centres who were listed on a university data base used for early childhood student practicum placement.

In total, 89 centres were invited, and we received positive replies from 59, resulting in a 66% of response rate. Three centres were excluded due to scheduling and technical difficulties, leaving a total of 56 centres (34 not-for-profit, 18 privately owned, and 4 work-based). One focus educator was recruited from each participating infant room. All educators were female and ranged in early childhood education professional experience from 1.6 to 30.5 years (M=9.92, SD = 7.85 years). The educators' length of time employed at the present centre ranged from less than one year (10%), one to three years (39%), four to five years (14%) to

over five years (37%). While all spoke at least conversational English and spoke English to the infants in their room, 36% spoke at least one other language at home with a wide range of European, Asian and Arabic language represented. Educators' attained qualifications in early childhood education ranged from a 6-month vocational certificate (*N*= 18), a vocational diploma (*N* = 25) to a bachelor degree (*N* = 13).

Data Collection

We obtained ethics approval from the Macquarie University Human Ethics Research Committee. The signed consent forms from the focus educators, all other educators and the parents of the infants in the room were gathered before data collection. The demographic details of the focus educators were collected by Research Assistants (RAs) during an initial visit. In two following visits, the RAs videorecorded the focus educators during their normal daily activities for approximately 3 hours (1.5 hours each visit). The educators also wore a blue-tooth microphone to ensure that their language was captured clearly and accurately.

Data Selection

Twenty-minute episodes of the educators' talk during infants' naturally occurring play were selected. To be included, the focus educators had to be present for the entire 20 minutes and actively interacting with one or more infants during play. If the activity was interrupted for any reason (e.g., an infant accident), this section of the data not included. The reason for the data being selected from play activities is based on the nature of Australian practices of ECE centres that heavily relies on play based approach, and substantial educator-infant individual interactions occurred during play. An RA watched each videorecording and selected the first 20-minute episode that met the above criteria. The selected episodes were transcribed verbatim, and the talk addressed to other adults was excluded.

Data Coding

Identification and coding of reasoning talk

The educators' infant-addressed talk was initially divided into messages. A message is a semantic unit approximately equivalent to a clause. One sentence may include more than one messages, such as *come here as there's more space and then you can see*, which comprises three messages: *come here/ as there's more space/and then you can see.* Each message was then reviewed to identify incidences of reasoning talk, defined as a message which provided an explanation or justification for an educator's command, offer, question or statement. Following the definitions provided in Table 1, each instance of reasoning talk was then categorised as Logical or Social, including the five subcategories of social reasoning; cooperative, institutional, communal, local or coercive.

Coding of the communicative function

We then coded each instance of reasoning talk according its communicative function. To do this, it was necessary to examine both the message coded as reasoning talk as well as its preceding claim, as it is the claim-reason combination that establishes the communicative function. Reasons were coded as *regulatory* when it was used when educators used language to direct and manage the behaviour of infants (e.g., *Wait a moment - It's Charlie's turn; Please wash your hands because it's lunch time*). *Non-regulatory* reasoning talk was coded for reasons which were used in the context of knowledge construction (e.g., *I think we might get Julie to bring out our water bottles, because I think it's good to make sure we don't get dehydrated).*

Inter-coder Reliability

To check the reliability of the coding, a second coder independently coded approximately 20% (transcripts of 11 focus educators) of randomly selected data. The Cohen's kappas were calculated. For the identification of reasoning talk, *k* was .965, *k*s were .957 and .943 for types of reasoning talk and communicative function of the reasoning talk respectively. These values indicated that the coding was reliable.

Data Analysis

The variables used in the data analysis were proportions of total reasoning talk, different types of reasoning talk, focus educators' qualifications (certificate, diploma, and bachelor), and the communicative function (regulatory vs. non-regulatory). The proportions of reasoning talk and different types of reasoning talk were calculated by dividing the number of total reasons, and the number of different types of reasons, by the total number of infant-addressed messages. Calculating these proportions enabled the analyses to take into consideration the fact that the number of infant-addressed messages in the 20-minute episodes varied (range = 280 to 494, *M*=415.11, *SD*=32.87) among the focus educators.

We performed data analyses using IBM SPSS 21. We calculated the descriptive statistics to address the first research question. To address the second question, we conducted a 2 × 2 × 3mixed MANOVA using communicative function (regulatory vs. non-regulatory) and type (logical vs. social) as within-subject independent variables, qualifications (certificate, diploma, and bachelor) as a between-subject independent variable, and proportions of reasoning talk as the independent variable.

Results

The extent to which focus educators use reasoning talk and different types of reasoning talk

The descriptive statistics in Table 2 shows educators' use of reasoning talk varied greatly, with a minimum of 0.51% to a maximum of 11.45% of all infant-directed messages within the 20-minute play episode (M = 18.125, SD = 10.171), accounting for only 4.43% (SD = 2.59%) of all messages talk addressed to the infants during this time. The average proportion of the logical reasoning talk was 1.99% (SD = 1.81%) and the average proportion of the social reasoning talk was 2.44% (SD = 1.46%). Among the five sub-types of social reasoning talk, apart from cooperative reasoning talk (M = 1.74%, SD = 1.30%), the rest of four sub-types comprised less than 1%. Thus, we combined all subtypes of social reasoning talk for the analysis of our second research question.

(Table 2 should be inserted here)

The use of reasoning talk by interactional context and educator qualification level

The results of a mixed MANOVA found that communicative function (regulatory versus non-regulatory) had a significant main within-subjects effect on the proportions of educators' use of reasoning talk (F (1, 53) = 174.931, p < .001, partial η^2 = .767). The proportion of regulatory reasoning talk (M = 3.56%, SD = 1.97%) was significantly higher than non-regulatory reasoning talk (M = 0.86%, SD = 0.99%). However, there was no significant effect for the type of reasoning (logical vs. social) (F (1, 53) = 3.174, p = .081, partial η^2 = .057).

There was a significant interaction effect between communicative function and reasoning type (F (2, 53) = 61.516, p < .001, partial η^2 = .553), which is depicted in Figure 1. We then conducted two repeated ANOVAs, and the results showed that the proportion of the two types of reasoning talk types differed according to its communicative function; regulatory (F (1, 55) = 26.441, p < .001, partial η^2 = .325) and non-regulatory (F (1, 55) =

21.781, $p < .001$, partial $\eta^2 = .284$). For regulatory reasoning talk, the proportion of social reasoning ($M = 2.35\%$, $SD = 1.46\%$) was significantly higher than that of logical reasoning ($M = 1.21\%$, $SD = 1.08\%$). For non-regulatory reasoning talk, the reverse pattern was observed: the proportion of logical reasoning ($M = 0.74\%$, $SD = 0.96\%$) was significantly higher than that of social reasoning ($M = 0.12\%$, $SD = 0.22\%$).

Figure 1. The interaction between communicative function × type on proportions of reasoning talk

(Figure 1 should be inserted here)

In terms of the between-subjects effect, qualification had a significant effect on proportions of total reasoning talk (F (2, 53) = 12.142, $p < .001$, partial $\eta^2 = .314$). Post-hoc analyses showed that the educators holding a bachelor qualification ($M = 6.77\%$, $SD = 2.92\%$) used a significantly higher proportion of reasoning talk than the educators with a diploma qualification ($M = 4.08\%$, $SD = 1.92\%$) and a certificate qualification ($M = 3.06\%$, $SD = 1.75\%$). There was no significant difference in the proportions of using total reasoning talk between the educators with certificate and diploma qualifications.

The two-way interaction between qualification × reasoning type was not significant (F (2, 53) = 0.174, $p = .840$, partial $\eta^2 = .007$), but the interaction between qualification × communicative function was significant (F (2, 53) = 8.282, $p < .005$, partial $\eta^2 = .238$). This interaction is visualized in Figure 2.

Figure 2. The interaction between qualification × communicative function on proportions of reasoning talk.

(Figure 2 should be inserted here)

We further conducted two separate ANOVAs to compare the proportions of non-regulatory and regulatory reasoning talk used by educators with different qualifications. This indicated significant differences in proportions of regulatory reasoning talk used by differently qualified educators (F (2, 53) = 13.637, $p < .001$, partial $\eta^2 = .340$). Post-hoc analysis revealed that bachelor-qualified educators (M = 5.47%, SD = 2.11%) used significantly higher proportions of regulatory reasoning talk than both diploma (M = 3.21%, SD = 1.51%) and certificate-qualified (M = 2.55%, SD = 1.33%) educators. The difference between diploma and certificate-qualified educators was not significant. For non-regulatory reasoning talk, the effect of qualification was not significant (F (2, 53) = 2.681, $p = .078$, partial $\eta^2 = .092$).

Finally, the three-way interaction between communicative function × reasoning type × qualification was also significant (F (2, 53) = 4.497, $p < .050$, partial $\eta^2 = .145$). This effect is visually displayed in Figure 3. For regulatory reasoning talk, educators with a bachelor degree (M = 1.88%, SD = 1.18%) used a higher proportion of logical reasoning talk than educators with a certificate (M = 0.93%, SD = 0.99%) (F (2, 53) = 3.960, $p < .050$, partial $\eta^2 = .130$). There was no significant difference between educators with a bachelor degree and with a diploma (M = 1.04%, SD = 0.94%) and between educators with a diploma and with a certificate. Similarly, for regulatory reasoning talk, educators with a bachelor degree (M = 3.59%, SD = 1.90%) used a higher proportion of social reasoning talk than both diploma (M = 2.17%, SD = 1.13%) and certificate-qualified educators (M = 1.62%, SD = 0.73%) (F (2, 53) = 9.958, $p < .001$, partial $\eta^2 = .273$). There was no significant difference between diploma and certificate-qualified educators. For non-regulatory reasoning talk, neither the proportion of logical (F (2, 53) = 2.663, $p = .079$, partial $\eta^2 = .091$) nor social reasoning talk (F (2, 53) = 2.539, $p = .089$, partial $\eta^2 = .087$) differed according to educators' qualification level.

Figure 3. Regulatory and non-regulatory talk: Educators use of logical and social reasoning talk by qualification level

(Figure 3 should be inserted here)

Discussion

Educators' child-addressed talk provides children with the opportunity to experience and use the types of language which are valued in academic contexts. When educators use reasoning talk when interacting with infants, they are providing infants with opportunities to learn about the use of language as a vehicle for learning about the social and physical world (Halliday, 1994), which resonates with infants' own early explorations of language as a vehicle for learning about their world in their second year of life (Halliday, 2004; Painter, 1999). Reasoning talk is associated with the development of children's ability to make generalisations based on specific here-and-now experiences, to draw connections between cause and effect, to explain and justify their views, and to learn about the social and cultural values of their community. It is therefore important to explore educators' use of reasoning when interacting with infants in ECEC rooms.

The prevalence of reasoning talk

Our results demonstrate that reasoning talk does not occur frequently during educator-infant interactions, comprising only 4.43% of infant-addressed messages. This result is in line with Hamre's (2014) review of the literature which found an absence of the type of preschool teacher-child interactions which supported children's intellectual development. Hamre proposed that the teachers' focus on children's emotions and classroom organization limited their use of talk which fosters children's ability to use logical reasoning. However, our findings indicate that reasoning talk can occur in many contexts, including those focussing on

emotional care and classroom organisation, as can be seen in the following examples; *Elli is upset because Noah threw sand into her eyes (emotional care)*; or *we pack away toys properly, so we know where they are and can easily find them later (classroom organization)*. For very young children, our findings suggest that emotional and organisational talk still has the potential to have pedagogical value in that it serves to alert infants of the reasons behind others' emotional reactions or their directives.

In this study, the educators used slightly more social reasoning than logical reasoning. The majority of reasons used to support social claims were grounded in cooperative and local principles. This may well be because of the educational importance assigned to group socialisation practices in Australian ECEC programs (Degotardi, Sweller, & Pearson, 2013). Cooperative and local reasoning talk explicitly communicate information about social rules and expectations (e.g., *You can't grab that doll because that's Alice's; You need to put your hat on, because 'no hat – no play!')*, and thus provide educators with an important pedagogical means of realising a socialisation educational goal. The other three social reasoning types, institutional, communal and coercive, were rarely used by the educators in this study. Institutional and communal reasoning may be rare because of the relative abstraction of these reasons from infants' immediate experience. Educators therefore may be responsive to infants' overall level of development by using the more readily relatable cooperative or local forms of reasoning. The very low level of coercive reasoning indicates that the Australian educators employ pedagogical practices which promote infant agency and self-regulation, and thus heavily discourages the manipulation of children by adult authority (Department of Education Employment and Workplace Relations, 2009).

While less prevalent than social reasoning, most educators in the study used some logical reasoning talk. For example, one educator explained to an infant *you can't walk through there, because the gap is too narrow* as he tried to push a wheelbarrow through a gap

between two pieces of equipment. Although the infant may have learnt this "lesson" through trial and error, the educator's language may draw attention to the reason behind her statement, and thus scaffold the infants' understanding of the causal relationship as well as the development of their own causal language register. As Bonawitz et al. (2009) suggest, whilst hand-on experiences are essential for young children's learning of causal relationships between certain events, the supplement of causal language may extend their understanding and increase the effectiveness of learning.

Explaining variation in educators' use of reasoning talk

In terms of the factors that may influence educators' use of reasoning talk, we found that the communicative function was an important predictor of the frequency and the types of reasoning talk used by educators. Educators produced more regulatory than non-regulatory reasoning talk. This perhaps relates to the fact that educators need to use a considerable amount of language to direct infants to settle into daily routines and group activities, which thus generates more opportunities for the use of regulatory talk and, in turn, social reasoning. In contrast, the finding that non-regulatory reasoning talk tended to incorporate more logical reasoning resonates with Hu and Torr (2016) who found that the function of the reasoning talk triggered different types of reasoning talk. This finding has the potential for educators to develop an awareness of language used for different communicative purposes. Creating opportunities to use language in a non-regulatory context may increase the opportunities to use logical reasoning talk.

Another factor explaining variation in educators' use of reasoning talk was educators' early childhood professional qualifications. Educators with bachelor qualifications used more reasoning talk overall than did educators with diploma and certificate qualifications, supporting previous research that has shown that educators' qualification level is associated

with the type of language they habitually use when interacting with children (Davis & Torr, 2016; Degotardi et al., 2016; Son, Kwon, Jeon, & Hong, 2013). It also indirectly supports research which demonstrates an association between parents' education and the patterns of talk they use when interacting with their children (Bernstein, 2000; Hasan, 1992).

Perhaps the most informative findings from the study were the interaction effects of communicative function, qualification and reasoning type, which demonstrated that, when regulating children's behaviour, higher-qualified educators, used more logical and social reasoning talk than lesser qualified educators. This finding echoes previous research exploring educators' use of commanding language when directing infants' behaviours, which found that bachelor qualified educators were more likely to supplement their commands with reasons, compared with diploma and certificate III qualified educators Hu et al. (2017). While some research has downplayed the learning potential of regulatory talk with very young children (Girolametto, Weitzman, Lieshout, & Duff, 2000; Halle & Shatz, 1994), this finding demonstrates that well-qualified educators appear well versed to capitalise on the educative potential of this type of talk.

Conclusion and implications

Before discussing its implications, it is important to acknowledge that this study's limitations. First, the number of bachelor-qualified teachers in our sample was small compared to those with lower qualifications. In Sydney, Australia, it remains relatively rare for bachelor-qualified educators to be employed to work with children under two, so our study distribution likely reflects the qualification profile of the larger infant-educator population. Therefore, our findings related to significant differences in reasoning talk between differently qualified educators should be interpreted with the relatively small bachelor-qualified group size in mind.

Second, these data were derived from one 20-minute episode of educator-infant interactions during free play. Further analysis of different activities, such as routine-time interactions and shared reading may provide a more comprehensive view of infants' experience of reasoning talk across the range of activities that make up their early childhood centre day.

Third, this study focused on educators' language and did not analyse infants' verbal and non-verbal initiations and responses. An analysis of infants' responses would provide more solid evidence about how educators' language use and infant communicative behaviours may interact to shape early learning experiences.

These limitations considered, the findings of this study have important implications for educators who wish to provide a language-rich environment which will support infants' language and literacy learning, and for pre-service teacher educators and policy makers. Firstly, our findings add to a growing body of work that draws attention to the different quantities and qualities of facilitative talk in ECEC settings (e.g., Degotardi et al., 2018; 2018; Dickenson et a., 2014; Hu et al., 2017; National Institute of Child Health and Human Development Early Child Care Research, 2000; Vernon-Feagans & Bratsch-Hines, 2013) Within this context, when educators recognise the educational affordances of reasoning talk, they can increase children's learning opportunities through more frequent use of this type of talk.

Second, this study suggests that, even with very young children, the non-regulatory context may trigger more reasoning talk based on logical grounding. Initiating talk which is focused on knowledge creation rather than children's behaviours may create more opportunities to use logical reasoning; for example, *it's a bit slippery, isn't it? The grass is a bit wet*. Sometimes clarifying other people's behaviours, or even self-behaviours, can lead to more logical reasoning such as *I have to leave and check the oven because I don't want our*

cookie to get burnt. This kind of language may at times sound like a monologue, however it will help infants to gain more understanding about why people behave as they do.

Finally, the study reveals that a bachelor early childhood qualification is beneficial when it comes to enhancing the frequency of reasoning talk. Our findings add to a growing body of research that demonstrates the advantage of employing university qualified educators in ECEC centres (Davis & Torr, 2016; Degotardi et al., 2016 ; Gong, 2015; McMullen & Alat, 2002). We therefore advance the need for Australian government's policy makers to recognise that high-qualified educators are best positioned to create more effective learning opportunities for very young children, not only through organized programs and activities, but through their spontaneous, informal interactions characterised by the use of "language for learning".

Acknowledgements

The authors thank the educators, infants and families for their willingness to participate in this study and generously allowed our RAs to observe and film their practices.

Funding

This research was supported under the Australia Research Council discovery projects funding scheme [grant number DP140101238].

References

Australian Children's Education and Care Quality Authority (2018). *Guide to the National Quality Framework.* Accessed on 5th April, 2019, from https://www.acecqa.gov.au/sites/default/files/2018-11/Guide-to-the-NQF_0.pdf

Bernstein, B. B. (2000). *Pedagogy, symbolic control and identity: Theory, research critique* (Rev Ed.). Lanham, MD: Rowman & Littlefield Publishers.

Barnes, E. M., Grifenhagen, J. F. & Dickinson, D. K. (2016). Academic language in early childhood classrooms. *The Reading Teacher, 70*(1), 39-48. doi:10.1002/trtr.1463

Baxter, J. (2015). *Child care and early childhood education in Australia*. Retrieved from https://aifs.gov.au/publications/child-care-and-early-childhood-education-australia.

Bonawitz, E. B., Horowitz, A., Ferranti, D., & Schulz, L. (2009). The block makes it go: Causal language helps toddlers integrate prediction, action and expectations about contact relations. In N. Taatgen and H. van Rijn (Eds.), *Proceedings of the Thirty-first Cognitive Science Society* (pp. 81-86), Amsterdam: Cognitive Science Society.

Burchinal, M. R., Roberts, J. E., Riggins, R., Zeisel, S., Neebe, E., & Bryant, M. (2000). Relating quality of center child care to early cognitive and language development longitudinally. *Child Development, 71*, 339-357. doi:10.1111/1467-8624.00149

Cabell, S. Q., Justice, L. M., Piasta, S. B., Curenton, S. M., Wiggins, A., Turnbull, K. P., & Petscherd, Y. (2011). The impact of teacher responsivity education on preschoolers' language and literacy Skills. *American Journal of Speech-Language Pathology, 20,* 315-330. doi: 10.1044/1058-0360(2011/10-0104)

Davis, B., & Torr, J. (2016). Educators' use of questioning as a pedagogical strategy in long day care nurseries. *Early Years: An international Research Journal, 36*(1), 97-111. doi:10.1080/09575146.2015.1087974

Degotardi, S., Han, F., & Torr, J. (2018). Infants' experience with 'near and clear' educator talk: individual variation and its relationship to indicators of quality. *International Journal of Early years Education, 26*(3), 278-294. doi:10.1080/09669760.2018.1479632

Degotardi, S., Sweller, N., & Pearson, E. (2013). Why relationships matter: parent and early childhood teacher perspectives about the provisions afforded by young children's relationships. *International Journal of Early years Education, 21*(1), 4-21. doi:10.1080/09669760.2013.771325

Degotardi, S., Torr, J., & Nguyen, N. T. (2016). Infant-toddler educators' language support practices during snack-time. *Australasian Journal of Early Childhood, 41*(4), 52-62.

Department of Education Employment and Workplace Relations. (2009). *Belonging, belonging and becoming: The early years learning framework for Australia*. Canberra, ACT: DEEWR.

Dickinson, D. K., Hofer, K. G., Barnes, E., & Grifenhagen, J. F. (2014). Examining teachers' language in Head Start classrooms from a systemic linguistics approach. *Early Childhood Research Quarterly, 29*(2014), 231-244. doi:10.1016/j.ecresq.2014.02.006

Dickinson, D. K., & Porche, M. V. (2011). Relation between language experiences in preschool classrooms and children's kindergarten and fourth-grade language and reading abilities. *Child Development, 82*(3), 870-886. doi:10.1111/j.1467-8624.2011.01576.x

Dickinson, D. K., & Smith, M. W. (1991). Preschool talk: Patterns of teacher-child interaction in early childhood classrooms, *Journal of Research in Childhood Education, 6*(1), 20-29. doi: 10.1080/02568549109594819

Frazier, B. N., Gelman, S. A., & Wellman, H. M. (2009). Preschoolers' Search for explanatory information within adult-child conversation. *Child Development, 80*(6), 1592-1611. doi: 10.1111/j.1467-8624.2009.01356.x

Girolametto, L., Weitzman, E., Lieshout, R. V., & Duff, D. (2000). Directiveness in teachers' language input to toddlers and preschoolers in day care. *Journal of Speech, Language, and Hearing Research, 43,* 1101-1114. doi: 1092-4388/00/4305-1101

Gong, X. (2015). *Does Having a Preschool Teacher with a Bachelor's Degree Matter for Children's Development Outcomes?* (Doctoral dissertation, Columbia University). Accessed on 5th April, 2019, from https://search.proquest.com/education/docview/1667771141

Grifenhagen, J. F., Barnes, E. M., Collins, M. F., & Dickinson, D. K. (2017). Talking the talk: Translating research to practice. *Early Child Development and Care, 187*(3-4), 509-526. doi:10.1080/03004430.2016.1246444

Halliday, M. A. K. (1994). *An introduction to functional grammar*. 2nd ed. London: Arnold.

Halliday, M. A. K. (2004 [1980]). Three aspects of children's language development: Learning language, learning through language, learning about language. In J. Webster (Ed.), *The language of early childhood* (The Collected Works of M. A. K. Halliday, Volume 4.) (pp. 308-326). London/ New York: Continuum.

Hamre, (2014). Teachers' daily interactions with children: An essential ingredient in effective early childhood program. *Child Development Perspectives, 8*(4), 223-230. doi:10.1111/cdev.12184

Hasan, R. (1992). Meaning in sociolinguistic theory. In K. Bolton & H. Kwok (Ed.), *Sociolinguistics today: International perspectives* (pp.80-119). London: Routledge.

Hasan, R. (2009). Rationality in everyday talk: From process to system. In J. Webster (Ed.), *Semantic variation: Meaning in society and sociolinguistics* (pp. 309-344). Portland, OR: Ringgold Inc. (Reprinted from Directions in corpus linguistics, by J. Svartik, Ed., Berlin, Germany: Mouton de Gruyter).

Helle, T., & Shatz, M. (1994). Mothers' social regulatory language to young children in family setting. *First Language, 14*, 83-104. doi: 10.1177/014272379401404006

Hickling, A. K., & Wellman, H. M. (2001). The emergence of children' causal explanations and theories: Evidence from everyday conversation. *Developmental Psychology, 37*(5), 668-683. doi: 10.1037/0012-1649.37.5.668

Hu, J., & Torr, J. (2016). A study of reasoning talk between Australian Chinese mothers and their preschool children: What messages are mothers sending? *Journal of Language, Identity and Education, 15*(3), 180-193. doi:10.1037/0012-1649.41.1.251

Hu, J., Torr, J., Degotardi, S., & Han, F. (2017). Educators' use of commanding language to direct infants' behaviour: Relationship to educators' qualifications and implications for language learning opportunities. *Early Years: An international Research Journal, 1-15*. doi:10.1080/09575146.2017.1368008

Lewis, C., & Mitchell, P. (2014). *Children's early understanding of mind: Origins and development*. New York, NY: Psychology Press.

Manlove, E. E., Vazquez, A., & Vernon-Feagans, L. (2008). The quality of caregiving in child care: Relations to teacher complexity of thinking and perceived supportiveness of the work environment. *Infant and Child Development, 17*, 203-222. doi:10.1002/icd.547

McKeown, M., & Beck, I. (2003). Taking advantage of read-aloud to help children make sense of decontextualized language. In A. Van Kleeck, S.A. Stahl, & E. Bauer (Eds.), *On reading books to children: Parents and teachers* (pp. 159-176). Mahwah, NJ: Erlbaum.

McMullen, M. B., & Alat, K. (2002). Education matters in the nurturing of the beliefs of preschool caregivers and teachers. *Early Childhood Research & Practice, 4*(2), 17. Retrieved from http://ecrp.uiuc.edu/v4n2/index.html

Nagy, W., & Townsend, D. (2012). Words as tools: Learning academic vocabulary as language acquisition. *Reading Research Quarterly, 47,* 91-108. doi:10.1002/RRQ.011

National Institute of Child Health and Human Development Early Child Care Research Network (2000). The relation of child care to cognitive and language development. *Child Development 71*(4), 960-980. doi:10.1111/1467-8624.00202

National Institute of Child Health and Human Development Early Child Care Research Network. (2002). Child-care structure - process - outcome: Direct and indirect effects of child-care quality on young children's development. *Psychological Science, 13*(3), 199-206. doi:10.1111/1467-9280.00438

Painter, C. (1999). *Learning through language in early childhood*. London: Cassell.

Peterson, S. M., & French, L. (2008). Supporting young children's explanations through inquiry science in preschool. *Early Childhood Research Quarterly, 23*(3), 359-408. doi:10.1016/j_ecresq.2008.01.003

Rowe, M. L. (2012). A longitudinal investigation of the role of quantity and quality of child-directed speech in vocabulary development. *Child Development, 83*(5), 1762-1774. doi: 10.1111/j.1467-8624.2012.01805.x.

Slaughter, V., Peterson, C.C., & Mackintosh, E. (2007). Mind what mother says: Narrative input and theory of mind in typical children and those on the autism spectrum. *Child Development, 78*(3), 839-858. doi:10.1111/j.1467-8624.2007.01036.x

Snow, C. E., & Uccelli, P. (2009). The challenge of academic language. In D. R. Olson & N. Torrance (Eds.), *The Cambridge Handbook of Literacy* (pp. 112-133). New York: Cambridge University Press.

Sobel, D. M., & Kirkham, N., Z. (2006). Blickets and babies: The development of causal reasoning in toddlers and infants. *Developmental Psychology, 42*(6), 1103-1115. doi:10.1037/0012-1649.42.6.1103

Son, S. H. C., Kwon, K. A., Jeon, H. J., & Hong, S. Y. (2013). Head start classrooms and children's school readiness benefit from teachers' qualifications and ongoing training. *Child & Youth Care Forum, 42*(6), 525-533. doi: 10.1007/s10566-013-9213-2

Spelke, E. S., Breinlinger, K., Macomber, J., & Jacobson, K. (1992). Origins of knowledge. *Psychological Review, 99* (4), 605-632. doi:10.1037/0033-295X.99.4.605

Van Kleeck, A. (2008). Providing preschool foundations for later reading comprehension: The importance of and ideas for targeting inferencing in book-sharing interventions. *Psychology in the Schools 45*, 627-643. doi:10.1002/pits.20314

Van Kleeck, A. (2014). Distinguishing between casual talk and academic talk beginning in the preschool years: An important consideration for speech-language pathologists. *American Journal of Speech-Language Pathology, 23*(4), 724-741. doi:10.1044/2014_AJSLP-14-0032

Vernon-Feagans, L., & Bratsch-Hines, M. E. (2013). Caregiver-child verbal interactions in child care: A buffer against poor language outcomes when maternal language input is less. *Early Childhood Research Quarterly, 28*(4), 858-873. doi:10.1016/j.ecresq.2013.08.002

Zauche, L. H., Thul, T. A., Mahoney, A. E. D., & Stapel-Wax, J. L. (2016). Influence of language nutrition on children's language and cognitive development: An integrated review. *Early Childhood Research Quarterly, 36*, 318-333. doi:10.1016/j.ecresq.2016.01.015