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Quality Talk Interactions in Preschools

by

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ABSTRACT

Teacher-child interactions in early childhood education settings can have a strong influence on children's emerging literacy and language abilities which are essential for life-long learning and productive engagement in society. In this study, teacher-child quality talk interactions were examined from videos of three different teacher-led literacy activities in 23 preschool rooms in the children's year before primary school - rooms selected for the preschools' excellent reputation. A socio-cultural approach focusing on children learning to *think* is followed throughout. Specifically, participation by *turns* during episodes of Sustained Shared Thinking (SST) (Siraj-Blatchford et al., 2003) and *complexity of talk* in terms of Mean Length of Utterance (MLU) and Type Token Ration (TTR) were compared to ordinary talk. Teachers' use of questions, acknowledgments, Gricean maxims and leadership of child concept development, or *blending*, were also counted. Based on these measures, six quality indicators were selected, averaged and used to rank rooms for further comparisons. Coded transcripts were subjected to a quantitatively dominant mixed methods analysis which found significant relationships within and between classes. Children's MLU and TTR increased in SST talk, whereas teachers ranked higher tended to decrease their complexity of language while using a higher ratio of words in relation to the children, especially at the start of SSTs. Other indications of intentionality led to the conclusion that teachers higher on the overall ranking were more systematically purposeful in adjusting their goals, activities, and language than those of lower ranking. Quality talk in three distinct patterns emerged from among these same top ranked teachers. The approach used by the majority of teachers had high numbers of open questions and blends and was termed "Expansive" to capture

the dialogic process and goal of concept development. A clearly defined minority approach using high numbers of closed questions and Gricean maxims was termed "Focusing" to capture the dialogic process and goal of refining the clarity of thinking encapsulated at the level of the utterance. A third approach did both, but with low levels of acknowledgements. The usefulness of distinguishing and gaining further understanding of these approaches for measuring and improving teacher-child talk interactions is discussed.

DECLARATION

This is to certify that:

i. the thesis comprises only my original work towards the PhD,

ii. due acknowledgement has been made in the text to all other material used,

iii. the thesis is fewer than 64,000 words in length, exclusive of tables, figures, bibliographies and appendices.

Signed: _____

Date: _____

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DEDICATION

I dedicate this work firstly to my parents, both of whom specialized in engaging children. My mother graduated from Johns Hopkins Medical School, first as a paediatrician and then as a child psychiatrist, and exposed me to academic journals and thinking. She encouraged me by praising my effort and trained my mind by giving me things to read like Teilhard de Chardin's *The Phenomenon of Man* (1959) when I was 12 years old. My father was a puppeteer turned photographer who specialized in children. The happy photos were simply the final evidence of a skilled engagement while setting up his equipment in their homes. My parents also wisely sent me to a John Dewey inspired primary school which was the "laboratory school" for the state of Maryland's research on education and teacher training (Committee on history, 1941). My religious experience was Quaker, where we engaged in debates about the meaning of the Bible and life, on an equal footing with an adult "teacher". After four years of an equally respectful sharing of minds at a Quaker co-ed boarding school, I entered a Quaker liberal arts college where I was greatly influenced by the writings of two Eastern philosophers. When my uncle heard I was planning to enrol in a course on education, he sent me a book by Krishnamurti (1955) who lived in his same small California town. I also dedicate this work to 'Abdu'l-Bahá whose writings principally guided my engagement with my three daughters' and seven grandchildren's education for the last 40 years. About 100 years ago, 'Abdu'l-Bahá finished a three-year tour of Western Europe, the United States and Canada where he spoke to many audiences including academics at places like Oxford, UK on topics such as education.

> "These children must be given a good training from their earliest childhood…[m]any elementary sciences must be made clear to them in the nursery; they must learn them in play, in amusement. Most ideas must be taught them through speech, not by book learning… Oral questions must be asked and the answers must be given orally… One child must question the other concerning these things, and the other child must give the answer… In this way, they will make great progress" ('Abdu'l-Bahá, 1913/1916).

The Cambridge scholar E. G. Browne co-published with this author ('Abdu'l-Bahá & Browne, 1891) and the British conferred upon him a knighthood (KBE) in 1920 for services to the people of Palestine during the war. He seems to have predicted not only what could be done at nursery school age (learn science), but how it could be accomplished (through talk and questioning) and within what context (play and amusement). This reminds me to walk with humility down the pathways of knowledge, mindful to be curiously respectful of other cultural wisdom and allow it into my legitimizing purview.

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CHAPTER 1: INTRODUCTION

Children's early school achievement is a strong predictor of later academic and mental health outcomes (F. A. Campbell et al., 2008; Webster-Stratton, Reid, & Stoolmiller, 2008; Zero to Three Policy Centre, 2005). Much research has focused on child and family contributions to early achievement (Tough, 1969; Wells, 1980). Most Australian states report more than 80% of children participating in some form of early childhood education in the year prior to full-time school, even in remote indigenous communities and with the most disadvantaged and the most advantaged children varying in participation by only 1% (Baxter & Hand, 2013). Therefore it is important to enhance the understanding of the contribution that preschools can make to school readiness (Burchinal et al., 2008; Hamre & Pianta, 2007; Siraj-Blatchford, Taggart, Sylva, Sammons, & Melhuish, 2008). In particular, adult-child talk interactions in these early years are now known to make the most difference for children's future academic and social adjustment in school (Clay & Cazden, 1999; Dickinson & Tabors, 2001; Dickinson, Watson, & Farran, 2008; Howes et al., 2008; Pianta, Hamre, & Stuhlman, 2003). Researchers using longitudinal designs have found that children who experience higher levels of instructional support in teacher-child interactions gain more in achievement (Hamre & Pianta, 2005; Pianta & Stuhlman, 2004), with a review of research (Sabol & Pianta, 2012) showing a single relationship outside the family, often a teacher, can be the most important element protecting children who have multiple risks or vulnerabilities in their lives.

In Australia, 22% of "children enrolled in their first year of formal fulltime school are developmentally vulnerable" (Australian Government, 2012, p. 26). Studies in the United States (Lavigne et al., 1996) have shown that up to 20% of

preschool children were diagnosed with emotional or behavioural problems at moderate to clinically significant levels. A relationship outside the family with at least one caring adult, often a teacher, can be “the single most important element in protecting young people who have multiple risks in their lives” (Sabol & Pianta, 2012, p. 213) with “teacher-child relationships have begun to emerge as a central agent of change for improving the quality of education” (p.225). Johnston (2004, p. 2) says that the intellectual life which Vygotsky says children grow into “is fundamentally social”, linguistically created and also “relational and emotional”, and further claims that accomplished teachers are impressive because of their ability to orchestrate organisational, emotional and instructional support all at the same time. This has been shown to be the case (Curby et al., 2009) and the skills involved are trainable using effective teacher professional development (Hamre, Pianta, Mashburn, & Downer, 2012). Despite these advances Rimm-Kaufman and Ponitz (2009, p. 201) say that "much remains to be learned about how early educational settings relate to children's learning and development".

Rowe’s (2003) analysis of the data shows that “quality” education, although a problematic term and concept, is less about the school, teacher education or professional development or even teaching methods, and more about talk interactions, and that “measures of quality should focus on the quality of opportunities for learning that teachers are providing for their students” (p.16). Most current measures are global and do not dissect the moment-by-moment details that create these learning opportunities (Dickinson, 2006). These “critical moments” (Siraj-Blatchford & Sylva, 2004, p. 723) occur when the teacher increases the thinking in the interaction and where the “teacher both selects examples and focuses attention at the moment of

encounter" (Cazden, 1992, p. 306). Lifting the developmental trajectory of children's abilities to better engage in learning at the start of school, even by a small amount, can make a profound difference to their and society's futures.

Chapter 2 will review the pertinent literature starting with a broad history of how theory, research and practice interacted to reach the current understanding, and then will focus on parts of this where further work could add to the knowledge of what would enhance these teacher-child talk interactions. Unanswered questions arise mainly from a lack of detail and quantitative support for:

1. Conners and Eisenberg's (1966) conclusion that it was not "different patterns of questions" but the "total pattern of intellectual stimulation" that was required to induce intellectual growth (p.10),
2. Rogoff's (1990, p. 195) "deep problem" of how the external lessons cross the barrier into the child's mind from an "apprenticeship in thinking" (p. 7) within "shared thinking and guided participation" (pp. 8, 189), which I will argue is addressed by blending theory (Fauconnier & Turner, 1996),
3. Mercer and Littleton's (2007) claim that little is known about how language functions specifically as a cultural tool in children's transformation from intermental to intramental thinking, an outstanding question for Vygotsky as well, voiced in *Thought and Language* (1934/1962) and,
4. The "conspicuous" absence of "discussions that focus on the constituent elements of *teacher quality* in terms of what teachers should *know* and be able to *do*" (Ingvarson & Rowe, 2008, pp. 6-7) and the need for new

> research on: "the measurement of teaching quality" which "should focus on the quality of the opportunities for learning that teachers are providing for their students" (p.16).

These challenges frame the task of measuring key indicators of teacher-led quality talk. This was done in 23 preschool rooms in the year before primary school during literacy learning activities. The question is asked as to how did 23 Australian preschool teachers create quality talk interactions in dialogue during three teacher-led activities? This will be addressed in terms of: 1) questions (Raban, Scull, Nolan, & Paatsch, 2010), 2) acknowledgements (Carr & Dweck, 2011; Rosenshine, 1971), 3) Gricean maxims (Grice, 2002/1967), 4) blends (Fauconnier, 1997) and 5) children and teacher *turns* within episodes of Sustained Shared Thinking (SST) (Siraj-Blatchford et al., 2003). This follows Dickinson's injunction (2006, p. 186) to examine "classrooms with a microscope" for detailed descriptions of children's language experiences.

Chapter 3 outlines a methodology that attempts to overcome the challenge Mercer (2008a, p. 44) voiced that talk mediating "joint intellectual activity poses a considerable methodological challenge for a discourse analyst". Because no one has ever measured all of these particular quality indicators in preschool dialogue in fine-grained detail before, this study was always going to be about discovery. In such studies, insights come from "illuminative" rather than "evaluative" research (Trow, 1967, p. 25), through direct observation of the "pedagogical forces" associated with the "genuinely effective aspects of education practice". These kinds of observations, according to Parlett and Hamilton (1972, p. 31), concentrate on processes "within the learning milieu, rather than on 'outcomes' derived from a specification of the

instructional system". Therefore the primary concern is description and interpretation. The approach taken here is a quantitative dominant mixed study (Johnson, Onwuegbuzie, & Turner, 2007) with primarily an outsider's view of the phenomena where the researcher-observer or "etic" view (Onwuegbuzie, Johnson, & Collins, 2011) is mixed with the "emic" or insider viewpoint coming from the participants' actual dialogic interaction as transcribed. The legitimacy of this approach operates not as a procedure, but as a "continuous iterative, interactive, and dynamic process" (Onwuegbuzie et al., 2011, p. 1253), and relies on coherent arguments at each step and when integrating results from quantitative and qualitative steps.

Therefore, the results chapters are laid out as the analysis unfolds through increasingly complex hierarchical levels where the discoveries and questions arising at each step inform and guide the next. The first results in Chapter 4 are mainly descriptive of the variety of extended conversations that occur in three different teacher-led activities of a storybook reading, a "writing" exercise which is mostly drawing at this age, and a teacher-selected "literacy" activity. The analysis in this chapter was by turns per minute within episodes of Sustained Shared Thinking (SST) and also in terms of length and frequency of these episodes and their distribution across rooms and across the three activities. Because SST episodes occurred without pattern across activity types, the transcripts of three activities were united into one for each of the 23 rooms. The qualitative analysis showed that SST dialogue varied greatly in quality of thinking elicited from children. Therefore, other indications of quality were added to test the proposition that doing so would distinguish quality.

Chapter 5 shows the systematic process of selecting five indicators of quality that were closely associated with the creation of SSTs and supported by the literature as important in talk interactions and children learning to think. An analysis of the five additional indicators association with SST activity provided the rationale of including each of the five along with SST turns per minute, as having some distinct and independent contribution toward SST construction.

In Chapter 6, SST dialogue was compared to non-SST dialogue in terms of: (a) the identified quality indicators and (b) children/teacher talk ratio in terms of number of total words.

Chapter 7 continues the comparison between SST and non-SST dialogue in terms of two markers of quality or complexity of language production – Mean Length of Utterance (MLU) and Type Token Ratio (TTR). The analysis of these data reveals the possibility that the 23 teachers' differential use of the quality indicators divides them into three distinct approach-groups. All three approaches produce a variety of Sustained Shared Thinking episodes of high quality. Two distinct dialogic goals are clearly evident and associated very differently with the three approaches.

The discussion in Chapter 8 includes the main findings derived from these last two differences among the teachers in terms of their goal intentionality and approaches. Teacher intentionality is *purposefulness* within culturally meaningful human activity which was foundational to Vygotsky's (1934/1962, 1978) contribution to understanding development during childhood (Kozulin, 1986). Wells (1993, p. 2) explains this developmental process whereby children acquire all higher mental functions as dependent on cultural practices that are "first encountered intermentally

in purposeful joint activity" wherein the child also learns to "read" the adult's communicative intention (Tomasello, 2000). The importance of early childhood teachers being systematically purposeful in adjusting their goals, activities, language and teaching has been highlighted (NBPTS, 2012). It seems likely, therefore, that the teachers who changed their interaction behaviour more as context changed, or when moving into SST dialogue, or who exhibited a consistent set of favoured tools of engagement (patterns or approaches), were doing so with some intentional plan, purpose or concept of what they were doing. The discussion in Chapter 8 argues that these data support the idea that the overall pattern of engagement is what counts (Conners & Eisenberg, 1966).

Chapter 9 argues that the most significant implications are likely to arise from the finding of three approach-groups which appear to organize the previous levels of indicators and measures of quality talk interactions into patterns of intellectual stimulation orchestrated by the teacher. These results could contribute to training teachers to better orchestrate extended dialogue with children needing to learn both expansive open questioning routines to explore concepts, as well as precise utterance construction to communicate their thinking clearly. Using markers of the different approach-groups could be used as a guide to more efficient and precise teacher assessment leading to better targeted professional development, for example, refining a web-based system of professional development using the Classroom Assessment Scoring System (CLASS) subscales (Kinzie et al., 2006; Pianta, Mashburn, Downer, Hamre, & Justice, 2008).

The main limitation of this study was that it was confined to teachers who were trained to a certain level and all preschools except two had children from an SES

neighbourhood in the top 30%. Claims of generalizable phenomena are not possible in this study with its low numbers of cases and non-random selection at levels of school choice, teacher agreement to participate, parents' permission and choice of activity for study. There was, however, sufficient meta-legitimation in numbers, coherence and within cases results, to suggest that the discoveries here may exist more widely. These limitations and their implications are also explored in the final chapter.

This study demonstrates how a new mix of methodological approaches to discourse analysis using quantitative and qualitative methods was used to accomplish a fine-grained analysis of teacher-child talk within preschool settings and unveil hitherto unsuspected relationships of quality indicators useful for advancing practice and research.

CHAPTER 2: LITERATURE REVIEW

The opening of Chapter 1 showed the need to understand adult-child talk interactions if preschool experiences are to be understood and enhanced in preparation for the challenges of schooling. The pertinent literature will be reviewed here starting with a broad history of how theory, research and practice evolved to the present. Then follows a focused look at how the most recent evidence leads to some unanswered questions and productive areas of investigation.

SECTION ONE: Historical development of early childhood education

In Western cultures, up to the seventeenth century, there was limited understanding that children learned their culture and language through interactions with more mature individuals, nor was there high awareness as to how much such interactions influenced their future behaviour, thinking and life course. The prevailing idea was that observed differences came from breeding, class, national, racial, ethnic or religious origins and were immutable. The underlying principles of education that would eventually inform the establishment of early childhood education came in the seventeenth and eighteenth centuries with ideas from John Locke, Jean-Jacques Rousseau and David Hume about how children learned skills and values of their cultures from experiences in their environments (Beller, 1973, pp. 530-531), with the implication that adults had a duty to actively and consciously teach toward the higher valued goals of society.

Pestalozzi (1746–1827) took up Rousseau's ideas and applied them in a succession of experimental schools in Switzerland, culminating in the influential 'Pestalozzi Method' where children were taught how to use their own abilities of

observation, judgement and reasoning to discover things themselves rather than be given ready-made answers (Silber, 1976). His aim was to improve social conditions through educating the whole child by balancing three elements of hands, heart and head to discover three areas of knowledge: form, number and words (Kessen, 1965). Pestalozzi especially emphasized sensory experience from a teacher-constructed environment.

Froebel, one of Pestalozzi's students, founded the Play and Activity Institute for young children in 1837 with its emphasis on constructive play, use of play materials and self-activity, and developed the concept of *kindergarten* soon after to describe this now well-known system (Bruce, Findlay, Read, & Scarborough, 1995; Froebel, 1887/1907; Lawrence & Smith, 1969; Robson, 2010). Pestalozzi and Froebel had a strong influence on teacher education from the mid-1800s (Committee on history, 1941, p. 160) and in many ways their influence can still be seen today.

Froebel's wish to introduce the kindergarten into the United States was fulfilled particularly in Boston (Baylor, 1965) with the setting up of the second kindergarten in America in 1860 only eight years after Froebel's death. By 1874 the accelerating movement had its own publication and in 1909 the state of Massachusetts required every community of more than 10,000 inhabitants to have a kindergarten with the training of kindergarten teachers formally established in what was to become Lesley University (Lesley University Archives, 2013). The importance of this institution for early childhood education research was greatly enhanced between 1948 and 1957 with their acquisition of three schools (the first was a pre-kinder to year 8) as laboratory schools for training teachers and researching effective practice.

Thorndike, Watson and later Skinner developed these theories further and they added to the increasingly common view that early experience could have a large influence on children. Although the whole of the twentieth century could be said to include the idea that research informed education, the earlier confidence that there was a "science of education" whereby children could be easily shaped, gave way to a more modest approach of "educational research" when it began to become apparent from increasing evidence, largely from the social sciences, that influences on children were much more complicated than claimed by the then dominant approaches (Clifford, 1973).

Morsh and Wilder's (1954) review of 360 research articles showed that with regard to studies which included systematic observations in the classroom, there was some evidence that better student outcomes were related to: (a) *teacher questions* based on student interest and experience, (b) *teacher challenges* that students support their ideas (argument and evidence) and (c) the *amount of spontaneous student discussion* (p. 4). The review concluded, therefore, that a broad range of communicative abilities of the instructors would be a fruitful area for further research.

An early and insightful indication of the problem of integrating the prevailing psychological viewpoints with education was articulated by Smith (1957) in his address as president to the Philosophy of Education Society, titled "Logic, thinking, and teaching" where he stated that "the mistrust of language by psychologists" had "infected educational thought in spite of the fact that both teaching and human learning are practically impossible without it" (p. 227) and proceeded to argue that language, particularly its rules, if explicated, would be essential for understanding and

integrating learning, logic and thinking in education. Unfortunately, Smith was unable to cite support for his arguments from theory and research in his address.

Skinner's attempt to explain language development in children from the behaviourist perspective in the same year (Skinner, 1957) failed to impress a large number of educators and linguists (Cazden, 1967) who continued searching for an organising framework. Two decades later, this divide remained, partly due to problems of making generalisations when there was a lack of clear operational definitions of teacher independent variables and the lack of a common understanding of what was important, with one main divide between variables derived in the laboratory versus attempts to define variables observed in classrooms (Travers, 1971, pp. 29-33). This conclusion was supported by Rosenshine (1971) who claimed in a review of 51 studies comparing teacher behaviours in interactions with students to their achievement, that there had not yet been enough research on teaching to create a "list of do's and don'ts for teacher education" (p. 13).

Miller's (1966) randomized experimental in-class testing of a "partial theory" of a collaborative transactional system between teacher and student showed the best student outcomes came from a system where "leadership is shared" and "the relationship is collaborative" (p. 339) and that children become "active rather than passive agents in the teacher-student transaction" (pp. 342-3). These findings, operating within an evolving social culture in the classroom, did not gain enough attention to change the prevailing assumptions about what made schools succeed in education amongst educators in the USA at that time.

The prevailing assumptions were reflected in the choice of variables for the largest study up until that time to assess inequality in education in the USA surveying 4,000 schools and 645,000 pupils (Coleman et al., 1966). Variables included the context of the school and characteristics of teachers and children, with no regard to teacher-child interactions in individual classrooms. Decades more research would be needed to establish interactions as the most salient variable in the context of where differences mattered the most – the individual classroom, as will be shown (Hattie, 2003; Rowe, 2003).

The stage was set for this to change, with one important development being the coming together of linguists and psychologists at a conference sponsored by the Social Science Research Council in the summer of 1951 at Cornell (Tanenhaus, 1988). At this conference the participants agreed that psychological methodologies and theories could be used in linguistics, with another conference two years later adding anthropologists and communications engineers to the mix (Carroll, 2008, p. 11).

Theoretical understanding started to change when the predominant behaviouristic view of learning, with its idea that all learning was the same across species and across the life span within a species, was challenged (T. S. Kendler & Kendler, 1959). Behaviourism as applied to language, summarized in the book *Verbal Behavior* (Skinner, 1957), was challenged first by Brown (1958, pp. 82-109), then more substantially by Chomsky (1959) and later by others (H. H. Kendler, 1963). One great benefit of Chomsky's (1957) approach was that the study of language acquisition in preschool age children became a "central topic in psycholinguistics in the early 1960s" (R. W. Brown, 1973, p. 97).

The data that would eventually provide evidence for further changes in the understanding of learning beyond behaviourism was fuelled in the latter half of the century by a large increase in research support in the US. The US federal government funding increased from $1 million a year in 1957 to $100 million a year by 1966 (United States Office of Education, 1969), with the Education Resources Information Centre (ERIC) document collection increasing 10-fold over the period of 1966–1969. The then director of program planning and evaluation in the preface to this report stated that educational research was "going through a period of agitation, ferment, and perhaps even crisis" and that the "present excitement" was coming from the number of studies being published, the diversity of agencies and institutions involved, and the breadth of their scope and interest, and he further suggested that this might "herald an imminent take-off to new levels of support and a great degree of impact" on the educational system (United States Office of Education, 1969, p. v).

It was in this optimistic climate that the following story unfolds, despite warnings from 1965 onward (Sarason, 1965, 1971, 1995; Souter, 2006) that school reform would fail without a social historical/cultural understanding of schools, close attention to the teachers' role and training, and changes to the "intellectual-behavioural-social regularities in the classroom" (Sarason, 1997, p. 775). More recently Cole (2010) claimed that as far as he could tell "nothing has happened to change Sarason's gloomy assessment" (p. 464). As shall be shown, a general lack of an agreed-upon coherent theoretical approach, taking social and cultural factors into account, caused a delay in attention to research results that in retrospect, should have led the way to effective practice much earlier.

Opening the debate for alternative explanations

The popular perception of the Coleman (1966) report's findings was that schools did not make a difference to the family background advantages or disadvantages that children brought with them (Gamoran & Long, 2006), despite the original report warning that it: 1) contained partial information and "only fragmentary evidence" of the school environment (Coleman et al., 1966, p. 8) and 2) neglected variability between individual pupils in the same school which was "roughly four times as large as the variability between schools" (p. 23). This was clearly a signal to discerning researchers that individual experiences in classrooms might be a place to look for the elusive educational opportunities that *did* make a difference. With research funding increased and the public driving the US Congress to demand answers to address inequalities in educational outcomes, a space was created for alternative theories and practices for those convinced that a particular classroom's teacher-child interactions held the key to effective education.

For the early childhood education community, a large shift in perspectives on child development in the 1960s was provided first by Piaget's cognitively oriented stage theory of child development (Piaget, 1964) which acted as an additional counter to the pervasive behavioural approach already being challenged by researchers such as Chomsky (1959). Some credit Piaget with doing much "to break the behaviorist's long stranglehold on the study of cognition" (Beilin, 1992, p. 202). This was generally welcomed by the early childhood education community as it provided an alternative theoretical basis to support the commonly held idea that children interacting with peers in play, where interesting materials were available for extended periods, was important for children's cognitive development.

A second welcomed understanding came with attachment theory (Ainsworth, 1964; Bowlby, 1958) which provided the theoretical and research support for long-held beliefs that children needed warm and supportive relationships with teachers. Piaget's and the attachment theorists' coherent and attractive challenges to behaviourism lent support to various streams of practice which focused on early childhood experiences revolving around rich environments for play and social interaction, predictable routines and a variety of activities (Dickinson, 2002).

During the 1960s and 70s children's acquisition of language, pre-academic and pre-literacy skills were generally not understood as something that needed particular types of nurturing or interactions to develop more fully (Dickinson, 2002). The conception of child development at this time focused on broad developmental domains of cognition, motor functioning, health, and social development; whereas including skills training associated with "pre-academic" knowledge, such as letters and numbers in the early childhood curriculum, was viewed with suspicion, partly through association with the challenged behaviouristic views (Dickinson, 2002).

For mainstream education, this started to change in the 1980s and 1990s (Dickinson, 2006) with the accumulating contributions of language acquisition theory (Bruner, 1974; Halliday, 1969), social learning theory (Bandura, 1977), social cognitive theory (Bandura, 1986), socio-cultural theory derived mainly from Lev Vygotsky (1934/1962, 1978) which conceptualized child development in socio-historical terms, and Urie Bronfenbrenner's bio-ecological model (1977) which emphasized that learning and development were enhanced if mutually positive conversations between children and adults progressively increased in complexity with a gradual shift in power towards the learner (Bronfenbrenner, 1979).

Evidence supporting further theoretical shifts: 1960–1990

To find out if preschool experiences made a difference long term, a longitudinal study in Great Britain (Douglas & Ross, 1964) that was started in 1950 with 224 children all born in the same week in 1946, who spent at least 2 hours per day in Local Authority Nursery Schools, and who then entered primary school in 1951 at the age of 5, concluded that the initial advantage in measured ability compared to the whole survey sample of 5,362 children from a larger study (Douglas, 1964) disappeared between the ages of 8 and 11.

From 1962 in the US, a number of short longitudinal research projects had been attempting to determine if a variety of preschool programs for three- and four-year-olds made a difference in school performance, intelligence and other abilities (Berzonsky & Reidford, 1967; Deutsch, 1968; Di Lorenzo, Salter, & Brady, 1968; Gray & Klaus, 1969; Hodges, McCandless, Spicker, & Craig, 1967; Karnes, Teska, & Hodgins, 1968), with the main result being less than hoped for, based on what the then accepted theories would have predicted, although there was some evidence that more structured or task oriented programs were able to create some immediate gains (Weikart, 1969).

There were studies of three programs started at this time designed for low-income families that followed their participants to adulthood: the Perry Preschool Project (Weikart, Deloria, Lawser, & Wiegerink, 1970), Project CARE (Bryant, Ramey, Sparling, & Wasik, 1987), and the Abecedarian Project (Ramey et al., 1974), with the last two explicitly tracking home differences in addition to preschool program factors. These studies helped clarify that many benefits of early intervention did not become apparent until much later in life.

An analysis of results when the children from Project CARE and the Abecedarian Project reached eight years old indicated that optimal cognitive performance was related to intensive preschool engagement, responsive and stimulating care at home and higher maternal IQ, with part of the benefit coming from increased responsiveness to people and objects associated with preschool experiences where increased interactions with responsive adults occurred (Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997). Analysis of intelligence tests of only the Abecedarian young adult sample found that by age 21 the intellectual test score performance was wholly accounted for by the earlier measures of language and literacy development (F. A. Campbell & Burchinal, 2008). This seems to indicate that the main long-term effect of early program intervention relates to enhancement of language ability.

In 1966, Weikart and colleagues began the Perry Preschool Study testing long-term effects on children at three to four years old of three different theoretical approaches to preschool (Schweinhart & et al., 1985) based on their own experience of testing preschool curricula from 1962 (Weikart, Deloria, et al., 1970). These were: (1) their own Cognitively Oriented Curriculum open interaction approach where both child- and teacher-initiated actions were followed through on, both physically and verbally; (2) a behaviourist Direct Instruction pre-programmed learning model; and (3) the pervasively used Nursery School curriculum approach where the teacher initiated little and just responded to child initiations. By the time the children from the Cognitively Oriented Curriculum and Direct Instruction programs were 10 years old, the expected fade-out of IQ and academic gains did not appear as had been the case from previous longitudinal research on the effect of nursery school (Douglas &

Ross, 1964) and from Weikart's own experience, with Direct Instruction showing a significant difference to the Nursery School model of 10 points on IQ. The conclusion at this point was that either of the well-planned programs of Direct Instruction or Cognitively Oriented Curriculum was of benefit to IQ and academic gains (Weikart, Deloria, et al., 1970).

This began to change, however, after the children reached 15 years old (Schweinhart, Weikart, & Larner, 1986), and continued to more recent measures at the age of 41, with the Cognitively Oriented Curriculum preschool program having significantly better positive effects than either Direct Instruction or Nursery School on school achievement, subsequent educational success, economic success in early adulthood, and reduced number of behavioural problems in school and of criminal arrests throughout their lives (Schweinhart, 2003).

The claim by proponents that the Cognitively Oriented Curriculum was mainly based on and followed Piaget's theory was disputed at the time by Kaufman and Banet (1975) because of the proponents' insistence that there was a "verbal level of operation" which Kaufman and Banet said was "totally alien to the Piagetian epistemology" (p.16). However, careful analysis of the most complete description of how the teachers were trained and acted in the Cognitively Oriented Curriculum classrooms, with some examples of dialogue from Weikart, Rogers, Adcock, and McClelland (1970), showed that in light of current knowledge what the teachers actually did bore a striking resemblance, not to Piagetian understandings as claimed, but to recently described optimal teacher-child verbal interactions that predict comparatively higher language and literacy outcomes for this age group (Curby et al., 2009; Siraj-Blatchford et al., 2003), particularly as described in the observation

protocol in the Classroom Assessment Scoring System (CLASS) domain of "instructional support" (Pianta, La Paro, & Hamre, 2008).

Research on specific dimensions of the three global domains of CLASS has provided some evidence that only moderate levels of *emotional support* and *classroom organization* are required to support increased gains and that certain elements of *instructional support* are the most highly associated with greater gains in children's language and literacy in the preschool years (Ponitz, Rimm-Kaufman, Grimm, & Curby, 2009). These elements included the teacher focusing on and giving specific feedback on the process of learning, and increased opportunities for reasoning, particularly related to children's everyday experiences, during extended conversations. The instructional domain subscale of *concept development*, which measures the teacher's promotion of students' higher order thinking skills and cognition was correlated to gains in language and problem solving (Curby et al., 2009).

In addition to this, in at least six places in the description of practice in the Cognitively Oriented Curriculum (Weikart, Rogers, et al., 1970, pp. 35, 38a, 38e, 43, 44, 59), it is close to describing Vygotsky's (1978) Zone of Proximal Development (ZPD), with such statements as: "the teacher tries to pair her *language behaviour* with what the child is attending to as well as with the child's general level of functioning" and "*language* is used throughout the day to give the child a strong *language input tied to his experience*" (italics in original, p. 43) and "the teacher's style of *questioning* must always take into account the child's level of operation" (p.46). The Cognitively Oriented Curriculum therefore is consistent with Vygotsky's theories although he is not cited.

Having learned that "for a preschool program to be really effective, home teaching and parents meetings are essential" (Weikart, Rogers, et al., 1970, p. 74), the Cognitively Oriented Curriculum teachers had regular one-and-a-half-hour fortnightly home visits and started parent support groups to "influence and modify the child-rearing practices" (p. 72). When it was found that these low SES mothers actually spend a surprisingly large amount of money buying toys, the teachers took them shopping and taught them to judge which toys had educational value and were also matched to the materials used in the preschool, making the home conceptually and functionally an extension of the children's preschool experience. In light of current understanding of the most helpful experiences that introduce children to literacy (Dickinson, Watson, et al., 2008; Melhuish et al., 2008; Mol & Bus, 2011; Raban et al., 2010; Snow & Beals, 2006), it could be convincingly argued now that the most potent ingredient of the Cognitively Oriented Curriculum program was not the preschool in isolation, but the unification of the home-school collaboration with the introduction of educational materials into the home with explanations and training for mothers as to their purpose and use. When this training was supported by ongoing parent groups, in which teachers were trained to make the experience interesting, interactive and participatory for every parent, the likelihood of making these new parental habits permanent would have increased dramatically, and from a Vygotskian analytical viewpoint it could be said that the Cognitively Oriented Curriculum program changed the home culture and linked it to the wider culture of other homes (community) and in a way that perpetuated and extended this culture into the future far beyond any association with the preschool.

Home visits by themselves, even when associated with a high quality preschool program, without parenting support groups, has been shown to *not* change the family environment (Burchinal et al., 1997), with these authors concluding that these interventions were likely to not have been "intensive" enough (p. 950) to be effective, which is supported by a review of many home-visit programs (Olds & Kitzman, 1993) where it was concluded that many had few or no effects. A review of research of home interventions for low SES mothers (Snow et al., 1976, p. 18) found that the most successful programs were those in which the mother was "trained to provide special cognitive experiences for her child" (p. 18). It was found by Snow (1991) and Porche (2001) that when both home and school support the same effective positive early experiences for children, risk factors are reduced, language and literacy are improved and the chances of later success are enhanced.

Program type or process differences?

Although it was becoming a goal in preschools to enhance thinking, problem solving and concept development (R. K. Parker, 1972; Robison, 1977), the literature up to then had mainly described preschool *programs* rather than specific *practices* (Rashid, 1969), with a comprehensive review of the literature finding "few attempts to observe and describe in quantifiable fashion both teacher and pupil behavior" (Gordon & Jester, 1973, p. 184). Even less information existed about what *should* occur in these exchanges, with research of conversations being limited to coding of general categories rather than that which could enable a detailed analysis to afford an in-depth understanding of what was occurring (Blank, Rose, & Berlin, 1978, pp. 1-3).

The opening up of perspectives from theoretical work of Bernstein (1960) and Bruner (1960) sparked a wider interest among some researchers in the critical need for

particular kinds of dialogue between adults and young children with a slowly growing number then adding perspectives from the first major translation of Vygotsky (1934/1962) to help them understand their own observations and research (Bowerman, 1978) which countered Piaget's denial that language had any important influence on cognitive development (Sinha & Walkerdine, 1978, p. 358) and threw doubt on the concept of "an underlying universal a-contextual structural 'level' in the child's mind" (p. 374) which Chomsky had put forward (Chomsky, 1957, 1965).

The results from one of the first studies on preschool aged children (four-year-olds), based on Bernstein's educational theories (R. D. Hess & Shipman, 1965), suggested that significant differences in children's task solution behaviours were related to a lack of cognitive meaning in the mother-child communication system associated with social class. A summary of the research after 15 years of this opening of theoretical understandings (Snow & Waterson, 1978) made clear that language acquisition and cognitive development were linked and occurred within the social context. Evidence was beginning to emerge that the rate of acquisition could be influenced by certain patterns of response to the child by the mother (Newport, 1977; Snow et al., 1976) which was confirmed and summed up by Cross (1978, p. 214) as "substantially matched to the child's own communicative intentions" and also described as: "the provision of language structures just one step ahead of the child's productive abilities" (Snow et al., 1976, p. 3), both of which could be descriptions of the most helpful adult actions related to the Zone of Proximal Development (ZPD) (Vygotsky, 1978).

In a laboratory observation using trained tutors to work with, four- and five-year-olds (n= 30) (Wood, Bruner, & Ross, 1976), it was shown that within an

adult assisted learning process, using physical intervention, verbal instructions, questions and encouragement, children could accomplish with increasing independence a task beyond their current ability and where the mode of adult-child interaction became predominantly verbal for the children over three years old. This formulation was based on the idea that a child learns best, not alone and unassisted, but within a social context. This whole process was summed up with the coining of the term "scaffolding" (p. 90) and with one important adult task described as "keeping the child 'in the field'" (p. 98) in pursuit of a particular learning objective.

Evidence from studies directed at teacher-child interactions in educational settings mainly focused on school age rather than early childhood (Amidon & Hough, 1967; Barnes, Britton, & Rosen, 1971; Bellack, Kliebard, Hyman, & Smith, 1969; Bennett & Jordan, 1975; Cazden, John, & Hymes, 1972; Coulthard, 1974; Flanders, 1970; G. L. Miller, 1966; Perkins, 1965; Rosen & Rosen, 1973; Simon & Boyer, 1970). A review of this research (Beller, 1973) found that not only was teacher verbal elaboration helpful in improving cognitive performance, but particular types of elaboration such as restating, explanations and analysing the child's response were more effective.

A longitudinal study in the UK based on Bernstein's social class and language understandings and using categories of functions of language-use derived from the writings of Piaget, Vygotsky and Luria (Tough, 1969) started by comparing three-year-old children on variables of: (a) *favoured* and *unfavoured* homes, based on measured differences in attitudes to language, education and literacy and the availability of books in the home; and (b) nursery and non-nursery participation. In the initial stages, this study found the *favoured* home group used language five times

as often as the *unfavoured* home group for extending or promoting action and securing collaboration with others, three times as often to convey information not apparent in a concrete situation, two times as often to promote imaginative play, and five times as often to project beyond the concrete play context to create imagined situations. Tough (1969) found that the *unfavoured* home group used language three times as often as the *favoured* group to secure attention for their own needs and maintain their own status by defending or asserting themselves in the face of needs and actions of others. The *favoured* home group demonstrated significantly superior development on a variety of language measures, including complexity, mean length of utterance and use of pronouns and verbs, than the *unfavoured* home group. When dividing the data along the nursery to non-nursery variable, the data showed some superiority in the nursery group, but this was not consistent. These differences had increased when the same children were measured at ages five and seven, with the main differences due to social class (Tough, 1974, p. 178).

This led to Tough (1977) heading a project to improve teacher-child dialogue in nursery schools which produced a very practical guide for teachers, providing them with concrete examples of different kinds of helpful teacher talk that functioned variously to 1) orient the child to the dialogue, 2) sustain the conversation, 3) enable the child's thinking and ability to use language in the dialogue, and 4) provide children with a concluding strategy to orient the child's future engagement or thinking about the topic (pp. 37-45). This advice would not be out of place today, more than three decades on, and demonstrates the degree to which some research far outstripped common practice.

Bronfenbrenner's (1974) wide-ranging review of longitudinal research in the United States on effective preschool programs and early interventions allowed him to recommend a) that parents engage their children in "sustained patterns of verbal interaction around tasks which gradually increase in cognitive complexity as a function of the child's development" (p. 56), b) that this continue in conjunction with preschool programs with cognitively oriented curricula, and c) that "the child himself had no way of internalizing the processes which foster his growth, whereas the parent-child system does possess this capacity" (p. 54). It is likely that some of his confidence in these recommendations came from Luria and Vygotsky because Bronfenbrenner was Russian, spoke Russian and had been a frequent visiting scientist in Moscow in the 1960s (Panken, 2005) at the Institute of Psychology where he had conversations with Leont'ev about theory and experimental methods of Russian developmental psychologists. When Bronfenbrenner (1977, p. 528) states that "Russian developmental psychologists have indeed been ingenious in devising clever experiments that evoke new patterns of response", he cites Cole and Maltzman's (1969) book which contains a chapter titled *Speech Development and the Formation of Mental Processes* wherein Luria presents his and Vygotsky's work and theories. It is therefore not surprising that Bronfenbrenner made many attempts to integrate these Russian theories with his developing ecological theory and "decried" their delayed publication by 40 years in the West (Bronfenbrenner, 1979, p. 261).

It was to be more than two decades before a theoretical and empirical basis for the integration of education, psychology, neuroscience, language, culture, dialogue and the classroom was possible, with the works of Vygotsky (1978) and Luria (1965) becoming available and better understood (Cole, 2002) and then being shown to be

consistent with the ideas of Bakhtin (Akhutina, 2003b; Emerson, 1983; Holquist, 2002), Bruner (1982, 1985), Bernstein and Halliday (H. Byrnes, 2006b; Christie, 2005; Hasan, 2002; Wells, 1994, 1999). Another important addition was Grice's work on the inherent logical rules contained in ordinary conversations (Grice, 2002/1967) which explained the operational link between ordinary conversations and logical thought processes (H. H. Clark & Clark, 1977; Hilton, 2008; Levinson, 1983, 2000; Schwarz, 1996; Strack & Schwarz, 1992). This will be discussed in more detail later.

Wells (1980), in an evaluation of child language drawn from data collected during the Bristol longitudinal study "Language at Home and at School" which started in 1973, was able to conclude that academic attainment appeared to be due to a) oral language development related to the quality of linguistic interactions both at home and at preschool, and b) "familiarity with more abstract and less context-dependent use of language" associated with the value placed on written text by parents in everyday home life (p.12). "Probably the most striking finding" (Wells, 1987, p. 147) from this study was a strong relationship between literacy knowledge at five years old and subsequent school achievement, with literacy knowledge measured in terms of how much the child knew about how to cope with print and how many concepts the child understood about the written language.

Later, Wells (1993) was able to integrate theoretical understandings from Bruner, Dewey, Halliday, Vygotsky and Luria to explain in detail why he "accorded a special place to language" (p. 23) in a child's "apprenticeship" as a user of cultural tools in semiotic meaning-making opportunities at home and in educational settings where adult and children verbally share their thinking in cultural practices that are

"first encountered intermentally in purposeful joint activity" (p. 2) and are eventually internalized as an "intramental" resource for thinking.

Hart and Risley (1968) in the US had been measuring differences in the language of preschool children and attempted to teach vocabulary to children who had started preschool with less vocabulary with some success (1978), only to see the children return to low levels in later school years. Then they undertook a detailed examination of home language experiences over several years starting at an age of 7-9 months. The total number of words a child heard and the positive feedback they received were correlated with language and cognitive test scores at 10 years old (Hart & Risley, 1995), and this was without regard to race and only associated with socio-economic status. This supported the view that a child's abilities could be influenced by exposure to rich vocabulary and positive feedback, which is subject to modification.

The ability to adjust one's speech to engage another in sustained conversation has been found to exist at a young age. Shatz and Gelman (1973) found that four-year-olds, when talking to two-year-olds (but not when talking to same age children or adults), consistently made efforts to attract and sustain the two-year-old's attention, adjusted their speech toward shorter, simpler utterances, and did so more for younger two-year-olds. However, they did not reduce their complexity of speech entirely to the two-year-old level, showing that they were shaping their language to a position just a bit more complex than their listener and creating a linguistic environment conducive for the two-year-old's language acquisition. This suggested that they had learned, not only how to communicate from the adults in their environment, but had concepts and sufficient understanding of Theory of Mind (ToM)

with which to assess the capability of others. Further, they must have been aware of their own speech production and its likely effects on someone less capable, as evidenced by the fact that they consistently adjusted their speech during socially and culturally appropriate moments to cooperate with their younger listener. In this study, all four-year-olds showed these capabilities whether they had younger siblings or not, and therefore it is claimed that it was unlikely that they were simply copying (or imitating) the way they had heard their mother talk to a series of younger children, but rather had become competent, insightful communicators long before Piaget's stages predicted and by means unexplained by either Piaget or Chomsky (Sachs & Devin, 1976), with even Vygotsky having underestimated the conceptual capacity of four-year-olds (Gelman & Brenneman, 2004). In this example, children appear able to recruit their mothers' skills in adjustment of language in support of their own language development as described by Cross (1977). Further work on peer-to-peer communications development of this age group (Hartup, 1983) and communicative development in children with handicaps in preschool (Guralnick, 1990; Guralnick & Paul-Brown, 1989) helped to lay the groundwork for Hischler's (1994, p. 234) claim that preschool children who were first language learners could be recruited to assist "in the development of nascent language and social skills of second language learners" with changes to classroom social interaction arrangements.

SECTION TWO: Recent developments

More recent research based on social interaction has examined underlying child capabilities that would explain their ability to benefit from the adult engagement in conversations. Some of these are the ability to track others' experiences (Saylor, Baird, & Gallerani, 2006), the abilities that contribute to taking roles in pretend play

(P. L. Harris, 2005), "cognitive flexibility" in four-year-olds developed by manipulating labels when using language (Jacques & Zelazo, 2005, p. 157), "flexibility in early verb use" (Naigles et al., 2009), the "smoothness" of communications in three- to four-year-olds (J. Dunn & Brophy, 2005, p. 61) where speakers are "tuned into what the other is talking about" (p. 59), "the pragmatic ability to produce connected talk that relies on an understanding and sharing or meeting of minds" in 22-month-olds (O'Neil, 2005, pp. 99-100) based on Grice's "cooperative principle" (Grice, 2002/1967), and the "sophisticated discourse interactions with real give-and-take of perspectives" that two-year-olds begin to use (Lohmann, Tomasello, & Meyer, 2005, p. 262). The internalizing cognitive process that makes use of these abilities and conversations can be understood as conceptual blending (Fauconnier, 1985, 1997) where children do not create each utterance or extend understanding of concepts by building from all the constituent parts, but rather by integrating "different kinds of already constructed constructions, each with an associated communicative function" (Tomasello, 2003, p. 305).

Because the focus of this study is pedagogical practice, theory is not reviewed in detail in regard to a main divide between *functionalists* (Vygotsky, Bruner, Halliday) and *formalists* (Chomsky and proponents of an underlying genetically endowed Universal Grammar) despite the proposition that they "have very different implications for instruction" and "it clearly matters who is 'right' in this regard" (J. P. Byrnes & Wasik, 2009, p. 43). Not discussing this divide in detail does not mean that the literature about the question has not been examined in detail. From that investigation, the following conclusion was made. The simple reason for following the *functionalists* is that if one believes there is little connection between language

function (meaning) and form (structure), as the formalists do, then pedagogy should mostly be about having children practise mapping their local language onto a biologically endowed Universal Grammar with an emphasis on direct phonics instruction. Unlike any other sort of learning, the teacher would not need to "constrain the learning space" (Gee, 2001, p. 650) because a genetically endowed Universal Grammar would do that, making it unnecessary to immerse children in functionally rich, meaningful, and natural communicative settings. The research cited provides overwhelming evidence that the functionalist account is a more coherent account. Why then is the *formalist* approach dominant? According to Newmeyer (1986) most psychologists, as a result of the linguistic wars of the 1970s, learned "to steer clear from too close an association with any specific linguistic theory" partly from a lack of communication between theorists but also from UG arguments being "forbiddingly opaque to outsiders, bristling with arcane phonetic symbols and esoteric terminologies", and therefore they relied on articulate universal grammar "envoys" who claimed "to represent the consensus view within linguistics" (Evans & Levinson, 2009, p. 430).

Theory is also not discussed in detail within the functionalist approaches between the socio-linguistic theories, particularly Systemic Functional Linguistics (SFL) (Halliday) and the socio-cultural theories (SCT) (Bruner and Vygotsky) because the focus of this study is mainly about how teachers orchestrate the dialogue with a number of children in a group and negotiate meanings without close attention to a linguistic and grammatical analysis of the spoken texts. This clearly favours Brunerian-Vygotskian sociocultural theory, as it is now understood, with its "core construct" as "that of mediation" (H. Byrnes, 2006a) being important in understanding

how teachers effectively motivate children's "participation" or "engagement" (Louden et al., 2005, p. 79) where the teacher uses questions, prompts, encouragement and feedback in a "careful structuring of the learning environment" or "scaffolding" (p. 84)within a Zone of Proximal Development (ZPD) (Vygotsky, 1978).

An eclectic selection from a variety of theoretically-compatible approaches to understand how discourse is produced and understood will be used. This has been legitimized by Runge (2011) with specific reference for the SFL research community and follows the logic used by Dooley and Levinsohn (2001) in their manual for analysing discourse where a functional and cognitive approach within a coherent framework is used as a good approximation of how discourse is actually produced and understood. Systemic Functional Linguistics (SFL) will be used to underpin the microethnographic qualitative analysis of some text to understand the interplay of meanings and the teacher's mediation (P. Harris & Trezise, 1997). In contrast to this part of my study, the teachers' choices of where to focus their attention, in terms of pragmatic rules of engagement, will be quantitatively measured using the Gricean maxims (Grice, 2002/1967) as a "better account of how such choices are made in language than Halliday could offer" (Runge, 2011, p. 1). Both of these analyses will be accomplished within teacher orchestrated Zones of Proximal Development, thus foregrounding the sociocultural (SCT) approach.

The principal theoretical framework for this study will be based on Mercer's (2000) intermental development zone (IDZ) as a furthering of the ideas of Vygotsky, who Bruner (1987, p. 16) considered one of the century's "great theory makers", and who Luria (1979) said was a "genius" with clarity of mind, understanding of complex structure, breadth of knowledge, and foresight into future developments (p. 38).

According to Gardner (1991), Vygotsky did more than any other theorist to draw the attention of other scholars to understanding the importance of social context and culture in learning and development.

Vygotsky

Vygotsky's contributions to understanding development during childhood (1934/1962, 1978) was much broader than Piaget's (Wertsch, 1985), with human activity considered as purposeful and culturally meaningful (Kozulin, 1986). Vygotsky in the 1920s, and Bruner much later, independently arrived at the view that an individual's mind develops as an outcome of sharing minds, where subjectivity is a consequence of intersubjectivity, and not the other way round as the Cartesian philosophies would postulate (Sinha, 2000), with Bruner acknowledging Vygotsky's earlier contributions. Understanding Vygotsky's work required close analysis of the context of his time and language, with such essentials as the title of his book *Thought and Language* being translated and understood as *Thinking and Talking* (Wertsch, 1979/2008) showing that Vygotsky was more interested in the dynamics of human activity rather than "static representational systems" (footnote, p. 68). Luria (1935, pp. 238-239) credited Vygotsky with originating the idea that the "complex mechanism of the psyche" was determined in the social development of the child where "speech plays the most important part" in the "integration of human consciousness" and said that modern psychology was particularly indebted to him for this. Luria himself then added decades of research that supported this notion.

Vygotsky importantly developed a cultural psychology (Mercer & Littleton, 2007) which included understanding how adults assist children's learning in what he called the Zone of Proximal Development (ZPD), where strategies to self-regulate

complex activities are learned between the lower and upper limits of the learner's competency and particularly for preschool-aged children spontaneously in everyday activities (Hedegaard, 2007, 2009). The ZPD is the space between what learners can do independently and what they can accomplish only with the assistance of a more competent adult or peer.

Vygotsky also proposed that this process was a cultural-historical account of acculturation occurring during the early development of the child's brain and mind by a process of internalizing the language system that reflects the social history of the culture (Akhutina, 2003a). Both of these levels of learning led Vygotsky to claim that speech is the source of social behaviour and consciousness through using language as a culture tool, first as an *interpsychological* category during interactions with others, which then changes its structure and function as it is internalized to allow for *intrapsychological* reflection and logical reasoning (Vygotsky, 1981, p. 163). This is echoed by Taylor's (1985) exposition that language functions in the "creation of public space" (p. 282) between participants, thus creating "explicit awareness which we call consciousness" (p. 270).

Bakhtin

Bakhtin's influential work was rediscovered in the 1970s and 80s (Lyle, 2008) and his theoretical work on Dialogism (Bakhtin, 1986a) bolstered Vygotsky and Luria's formulation for the educational world (Holquist, 1990) by extending the understanding of two ways children assimilate the words of others in classrooms (Emerson, 1983, p. 255), either reciting by heart or retelling in their own words, with the latter argued as an internally persuasive discourse allowing the mind to be able to originate ideas verbally (Bakhtin, 1981). Bakhtin may have influenced Vygotsky

indirectly (Rieber & Robinson, 2004) and in particular through Vygotsky's cousin David who belonged to the same Leningrad intellectual circle of linguists in the 1920s (Kozulin, 1990). Both shared many of the same linguistic theoretical sources.

Bakhtin's dialogism views the distance between adult and child consciousness as a gap to be traversed in a dialogic "space" through "pedagogical activity of the parts in a dialogic simultaneity relating to each other in time" (Holquist, 1990, p. 83). Education occurs as adults challenge a child's restricted experience of actions and words by exposing them to a wider set of possible roles and where "the ordering ability of language" overcomes "the chaos of events" (Holquist, 1990, p. 84). The child is being helped to translate real or imagined experiences into patterns of words, sentences and narratives by adults making a "loan of consciousness" from the their monopoly of "foresight" (Bruner, 1986, p. 77). Bakhtin's original work that outlined this (1920/1990) states that:

> "[t]he child receives all initial determinations of himself and of his body from his mother's lips [words] and from the lips of those who are close to him" and "they come to meet his indistinct inner sensation of himself, giving it a form and a name in which, for the first time, he finds himself and becomes aware of himself" (p.49) and "as a result, they give plastic form, as it were, to this boundless, 'darkly stirring chaos' of needs and dissatisfactions, wherein the future dyad of the child's personality and the outside world confronting it is still submerged and dissolved" (p.50).

A further understanding of Bakhtin's dialogism as an open-ended interplay of texts in social or signifying spaces called *intertextuality* by Kristeva (1966/1986) is a

perspective that will be recruited as integral to a qualitative discourse analysis examining talk interactions in this study. How this intertextuality in the context of social spaces creates input mental spaces which are connected and "*compressed* into *blended structures* in the *mental blend*" (Turner, 2006, p. 18), will be examined later using *Blending Theory* (Fauconnier & Turner, 1996).

Social psychology of communication

Social psychologists came to many of the same conclusions as Vygotsky from different sources and a separate line of theoretical development where it was not only seen that culture is transmitted by language as a symbol system constituting social action (Fiedler, 2007), but also that the psychology of interpersonal communication creates and shapes human culture (Conway & Schaller, 2007). This approach also included a systems approach to understanding the complexity of symbolic transactions between a communicator making meaning and a recipient achieving mutual understanding in groups using language. Language socialisation in this view is a reciprocal process where children acquire sociocultural knowledge while acquiring and using language during social activity (Ochs, 1988). Traditional linguistic notions had previously focused on children acquiring structures and rules of discourse toward increasing grammatical competencies, whereas the sociocultural view centred around communicative competence (Cazden et al., 1972). More recently, Nelson (2005) delineated a preschool-age pathway by which children participate in and enter the "community of minds" with a "communally shared belief system" (p.45).

Sociolinguistics is a theoretical approach which started out as an atheoretical examination of language purely through its function (Firth, 1957) and where "the

account does not presuppose any one particular psychological model of language acquisition or theory of learning" (Halliday, 1970/2004, pp. 34-35). It came to propose a detailed understanding of how culture is transmitted to the child through language while learning language (Eggins & Martin, 1997; Halliday, 1961 / 2002; Halliday & Webster, 2005). The unit of analysis in this view is not the word, but the transaction between meanings that the child attempts through communication and the response from the adults. Halliday (1976/2004, p. 72) calls this the "interactional function" or the "'me and you' function of language". Dewey (1938, 1996) and Vygotsky (1978) both tackled the same idea of meaning making as the central issue rather than genes, neurons, parts of speech or concepts at a time when "virtually all psychologists and philosophers considered *concept* to be the basic unit of meaning" (Prawat, 2002, p. 18).

Dewey and Vygotsky

Dewey and Vygotsky both became very interested in the role of language in the process of concept development, and although they used different terminology, they came to the conclusion that meanings were the central organizing principle in concept formation and that concept labels mediated between the meaning created by children in their own minds and the meanings adults share in a culture (Prawat, 2000, 2002).

Dewey and Vygotsky may have met face-to-face in 1928, explaining a subsequent shift in both their writings (Prawat, 2000). Later Dewey allowed that he might better have used the word "culture" in place of "experience" (Glassman, 2004, p. 333) with his transactive/pragmatic theory strongly linked to sociocultural theory in its claim that specific activities are understandable only within specific contexts (p.

334) and in terms of thinking (p. 337). They both came to believe that action was the mediator between the individual and the environment with a transactional approach that viewed meaning making as something that goes on in the world and not just in the head (Prawat, 2002). This is where the interacting parties are not conceptually isolated from one another, are not independent things, and the interaction is not an intervening third "thing". What for Vygotsky had been an organism-action-environment model became an organism/environment co-action model or a unity (Minick, 1986).

The last two decades have seen increasing and strong evidence that language does structure and restructure cognition in a variety of ways independently of any genetic endowment (Boroditsky, 2001; Gumperz & Levinson, 1996; Lucy, 2004; Vygotsky, Whorf, Wittgenstein, & Fromm, 1990; Wolff & Holmes, 2011) and is therefore a further challenge to the universal grammar view or genetically programmed set stages of development.

This theory, its implications and new revelations has been compared in the past with Vygotsky (Lucy & Wertsch, 1987; Vygotsky et al., 1990), with their connections and understandings now being revisited (Lucy, 2010) in light of increasing evidence showing that subtle language differences influence the development of children's thought and culture beyond their genetic endowment. The synthesis of Vygotsky's and the Saphir-Whorfian hypotheses, it has been argued, shows that "language use in thought makes possible the development of higher order thinking, that is, thinking in (true) concepts" (Lucy, 2010, p. 275). It is within the dialogue of the ZPD that the child's developing thought structure is mapped from the local language structure. This lends weight and urgency to efforts to examine

precisely how adults engage young children in conversation if their higher order thinking depends on the success of mapping from those adults' particular discourse.

From these various accounts, it would appear that there is a continuity of effective communicative phenomena that start very early, build on each other, and have great influence on children's developing social and cognitive abilities. An important concept in all of these understandings is the functional match between the adults' communication and the children's expressed-meaning through either behaviour or talk. Parents' ability to correctly understand the internal meanings of their children's communicative bids (mind-mindedness) (Ensor & Hughes, 2008; Sharp, Fonagy, & Goodyer, 2006), has been shown to predict positive social outcomes and better attachment (Wood, 1988); whereas deficits in this ability predict future psychological problems in children (Fonagy, 2001).

Child and caregivers communicate with each other through what has been termed a protolanguage (Halliday, 1976) from about the child's age of nine months. This influences the child's developing capacities by means of the mother/child mutually responsive orientation (Kochanska, Forman, Aksan, & Dunbar, 2005). Experiments have shown that mutually responsive orientation has both a direct, unmediated effect on these capacities and also has two mediated pathways of (a) increasing the child's enjoyment while interacting with the mother, and (b) increasing committed compliance.

In somewhat older children, where conversations start taking place, Dunn and Brophy (2005, pp. 59-60) define "connectedness" in child-mother talk, as the "extent to which each speaker is tuned into what the other is talking about – the semantic

relatedness of one speaker's turn to that of the other speaker". This skill depends to a large extent on Theory of Mind ability, which is concerned with understanding another person's thinking, and there is growing evidence that its development depends on language ability (Astington & Jenkins, 1999; J. Dunn & Brown, 1993). A more recent claim is that "children without language or with impoverished language do not achieve Theory of Mind" (Nelson, 2005, p. 28).

A fine-grained deciphering of parent-child interactions has shown that even in low SES homes certain types of interaction, without regard to sheer amount of language used or variety of vocabulary, are associated with better outcomes for children (Ensor & Hughes, 2008). This research showed that the two-year-old children of mothers who had more connected conversations with them and used mental state words more often within these extended turn-taking exchanges developed better social understandings by four years old. In a study of three-, four- and five-year-old children and their mothers engaging in a joint challenge of building a tower (Elbers, Maier, Hoekstra, & Hoogsteder, 1992), an "emergent structure of goal-directed acting" (p.192) was observed in which the participants influenced one another and shaped their cooperation and where children did not have a subordinate position, but negotiated with the adult about how to proceed in a pattern of behaviour that was jointly regulated by adult and child.

Another approach to this age group, and a similar concept called "motherese" (Newport, 1977), constitutes more than just a device to teach language (Snow & Ferguson, 1977) and includes a whole range of actions that keep conversations going (Brand, Baldwin, & Ashburn, 2002). Essential to the development of children's comprehension is the mother's motivation "to keep the conversation going for as long

as possible, at a level which is nontrivial yet rewarding to both partners" (Bridges, Sinha, & Walkerdine, 1981, p. 125) and where the linguistic message matches the child's needs "and puts into practice Grice's Cooperative Principle" (p.117). Grice's cooperative principle is about *pragmatics*, the importance of which Dunn and Brophy (2005) emphasize when they state that even the *amount* of "causal" talk, which is thought to increase Theory of Mind understanding, is not as important as what was being done *pragmatically* in mother-child conversations during this causal talk.

Most research on adult-child interactions in educational settings has been done with regard to school age from primary through secondary (Alexander, 2008), which has provided a growing body of training material and advice to schools and teachers (Dawes, 2008; Dawes, Mercer, & Wegerif, 2006; Dawes & Sams, 2004; Hattie, 2011; Mercer, 2011; North Yorkshire County Council & Alexander, 2006; P. Palmer, Perkins, Ritchhart, & Tishman, 2011). Hill and Rowe (1996) showed that evidence from school effectiveness research suggested that variability between classrooms is more significant than variability between schools, with Rowe (2003) further demonstrating that quality education, although a problematic term and concept, is not about the school, teacher education or professional development or even teaching methods, but about talk interactions.

A much smaller base of research provides evidence for enhancing the quality of preschool conversations based on research on interactions (Dickinson, 2001; Dickinson, Watson, et al., 2008; Hamre, LoCasale-Crouch, & Pianta, 2008; Hancock, Kaiser, & Delaney, 2002; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Roskos et al., 2008; Snow, Tabors, & Dickinson, 2001), with the most recent summaries of research providing substantial evidence that pre- and primary-school

children gain the most academically and socially from higher-quality interactions and closer relationships with teachers, not from child or program characteristics (Hamre et al., 2013; Pianta, Mashburn, et al., 2008; Williford, Maier, Downer, Pianta, & Howes, 2013).

The *Report on Government Services* (2008, p. 3.55) stated the Australian government was planning to base children's needs in the area of learning and development on a broad set of measures using data from the Longitudinal Study of Australian Children (LSAC) (Brinkman, Sayers, Goldfeld, & Kline, 2009) and/or the Australian Early Development Index (AEDI) (Centre for Community Child Health and Telethon Institute for Child Health Research, 2009). Unfortunately neither effort contains independent validated objective measures except for the use of an abbreviated form of the Peabody Picture Vocabulary Test (PPVT-III Form IIA, 1997), a measure of receptive language only (Sanson et al., 2005). Otherwise these studies relied solely on teacher and parent reports to assess language and literacy and thus have come under criticism from researchers (Li, D'Angiulli, & Kendall, 2007). The AEDI development team themselves (Brinkman et al., 2007, p. 427) admit that "with no criterion measure with which to assess the AEDI, findings are inconclusive prior to predictive validity assessment" which will depend on future investigations.

Learning how to "think"

To this point, little has been said in this review about *how* Vygotsky, Bruner and Bakhtin's "loan of consciousness" occurs within the ZPD. Conners and Eisenberg (1966) in a study of preschool teachers during episodes of teacher-child interactions found intellectual growth from extended and stimulating teacher-child talk interactions but could not connect specific teacher behaviours to this growth.

After surveying many of these kinds of studies, Rogoff (1990) expressed the concern that not knowing how the loan of consciousness within the ZPD occurs remained a "deep problem" (p. 195) for these approaches. This loan of consciousness in the ZDP has been reconceptualised by some as thinking for speaking (Slobin, 1996), visible thinking and cultures of thinking (Ritchhart & Perkins, 2005), thinking together or "interthinking" (Mercer, 2000), and sustained shared thinking (Siraj-Blatchford, Sylva, Muttock, Gilden, & Bell, 2002). Splitter (2014, p. 215), bringing together understandings from the philosophies of Dewey, Bakhtin, Taylor, Habermas and Davidson, and the theoretical and applied research of Vygotsky and Bruner, suggests that "powerful thinking" is created by self-awareness and "awareness of others as thinkers" and actualized when people think together through dialogue, where people assess others' assertions, beliefs and perspectives and work out which ones meet their standards of reason, evidence, and justification. Although Splitter does not use the terminology, these assessments are clearly Gricean maxims as part of Grice's Cooperative Principle (Grice, 2002/1967). Splitter calls this a cooperative community of thinkers, a community of dialogue, a community of inquiry, comprising people engaged in working toward a common purpose or quest, and who relate to each other with care, respect, trust and empathy. In the same edited book titled: *People without borders: Becoming members of global communities* (Wang & Bernas, 2014), Patton (2014) showed how growing up with multiple dialects of English, with access to multiple respectful but different thinking communities, enabled a cognitive openness and flexibility of conceptual integration. This enabled later entry into and understanding of multiple cultural/linguistic communities. A chapter in the same book considered similar integration challenges of parenting children who moved from one culture and language to another (Assegedetch, 2014), while another chapter

(Wang, 2014) discussed raising a family where children learned three languages simultaneously. Somewhat surprising to Wang was the prejudice her multilingual children expressed toward other dialects or accents of Mandarin Chinese or French. Research corroborates this phenomenon as common. To counter this, the parents deliberately engaged their children in frank and truthful extended conversations modeling respect after or while viewing other accented French. Although this author, who was one of the parents involved, did not explicitly use the terminology of this study, their conversations were understandably "interthinking" or Sustained Shared Thinking episodes with parental insistence on the Gricean maxim of: "Do not say that for which you lack adequate evidence" (Grice, 2002/1967, p. 722) and specifically in contexts when dialects of one of the family languages were being spoken. This maxim is particularly related to preschool science teaching, which will be discussed later, and shows how parental conversations can support and prepare children for preschool thinking.

Cognitive neuroscience data indicates there is no unitary system for logical reasoning (Holyoak & Morrison, 2005) but rather a "fractionated system that is dynamically configured in response to specific task and environmental cues" (Goel, 2007, p. 439). The field of research on thinking is wide, contentious and "far too complex to declare a winner" (Ritchhart & Perkins, 2005, p. 784). By 1990, almost all research into the development of creative thinking in children had been done with year five students, adolescents and adults (Morrison, 1990).

When interventions are narrowed to only approaches based on a theory of action which guides teachers and program developers, and which have been tested for the preschool age group, a few guiding studies remain such as reciprocal teaching (A.

L. Brown & Palincsar, 1989; Palincsar, 1998) and the Preschool Pathways to Science (PrePS) (Gelman, Brenneman, Macdonald, & Moisés, 2010) which "allows children to practice thinking, talking, and working with a concept over time" to build "deeper understanding" (p. 18).

One study has tried to adapt Harvard-based Project Zero's *visible thinking* routines for school-age children (Ritchhart & Perkins, 2005, 2008) to preschool-age children in two Regio inspired schools with some success (Salmon & Lucas, 2011). Another study measured thinking interactions and tested three different approaches for effectiveness "in providing for the children a 'meta' vocabulary with which to discuss their own thinking and learning" (Whitebread, Damaskinou, Humphreys, Linklater, & Proudman, 2007, p. 4). These approaches were Mind Mapping (Buzan, 1991), TASC (Thinking Actively in a Social Context) program (Wallace, Adams, Maltby, & Mathfield, 1993) and Philosophy for Children (Lipman, 1973, 1976). Otherwise, very few preschools have been reported to teach thinking explicitly.

Interaction systems where thinking is shaped

A more detailed understanding of *how* thinking is shaped by teachers in preschools may benefit from three theoretical constructs of interactional systems. The first is about the overall structure of a thinking dialogue, called Sustained Shared Thinking (Siraj-Blatchford et al., 2002). The second is about children creating new conceptual blends (Fauconnier, 1997) as a "structural-mapping" crucial to understanding emergent abstractions (Gentner, 2003, p. 199), and the third is about acquiring a set of conversational "rules" (Grice, 2002/1967) which are perhaps the simplest forms of "thinking dispositions" (Ritchhart & Perkins, 2000). This

discussion will now continue to narrow itself to areas that will directly inform a selection of testable concepts and measures.

Sustained Shared Thinking (SST)

The importance of a particular kind of conversation in preschool has been robustly supported by recent research in the Researching Effective Pedagogy in the Early Years (REPEY) study (Siraj-Blatchford et al., 2003), using data from the larger Effective Provision of Pre-School Education (EPPE) study of 3,000 children in preschools in the UK (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). This showed that children who advanced the most from preschool experience on measures of cognitive, social and educational outcomes had attended preschools where clear discipline and behaviour policies promoted talking through conflicts with other children, usually mediated by teachers, and where there was more Sustained Shared Thinking (SST), defined as: "[a]n episode in which two or more individuals 'work together' in an intellectual way to solve a problem, clarify a concept, evaluate activities, extend a narrative" (p. 8) and where both parties contribute to the thinking. The ideal pattern in an SST is one of sharing, where the teacher's language reflects attempts to understand rather than judge and "replies to" rather than "assesses" what the child produced. This then becomes either open and sustained, or closed and ended, based on a linguistic style of questions, statements and replies by the teacher. In this sense, the SST appears to be a developmental continuation of the above-mentioned mother/child mutually responsive orientation and connected conversations. The SST may also be a more precise definition of Conners and Eisenberg's (1966, p. 4) "groups of episodes" of teacher-child-environment interactions "which constituted a coherent and unified activity".

Because children's higher cognitive outcomes were associated with SST episodes in the REPEY study and there were many fewer such episodes in centres where children achieved less than excellent outcomes, the SST has been linked to more effective preschool experience and can therefore be considered an "effective pedagogic interaction" (Sammons et al., 2005, p. 220). REPEY provided evidence for Paley's (1981, p. 213) understanding that "logical thinking and precise speech can be taught in the classroom" by keeping "the inquiry open long enough for the consequences of their [children's] ideas to become apparent to them", where the thinking skills involved in "rational discourse" in preschool are "the important precursors to formal schooling and the main business of the kindergarten teacher".

The conceptualisation of the SST can also be understood from Pettito's (1988, p. 548) insight that the most helpful longer interactions of "semantic sequences" occur when mothers combine semantic contingencies of "expansions and extensions". For teaching English as a second language to young children, Gibbons (2001, p. 267) argues that the "long conversation" is particularly important so that learning by doing relates the immediate situational contexts to the discourse to "build through time a joint frame of reference" (Edwards & Mercer, 1987, p. 65), or "continuity" necessary "for understanding 'given' and 'new' information" in the social-cognitive process (p. 63). Also in regard to ESL situations in early childhood, Clarke (2009, p. 25) explains that "many children who are in the early stages of learning English as a second language are not able to engage in sustained shared thinking which requires metacognition, that is the ability to undertake higher level thinking and problem solving". These understandings are linked to Vygotsky by Clarke (p. 8) using this citation: "Language is the most powerful tool in the development of any human being.

It is undeniably the greatest asset we possess. A good grasp of language is synonymous with a sound ability to think. In other words language and thought are inseparable" (Vygotsky, 1986, p. 120). Clarke also claims that "[t]here is now widespread recognition of the social, personal and cognitive benefits of bilingualism" (p. 10). This has been shown to be true for Theory of Mind development (Goetz, 2003; Meristo et al., 2007; Pelletier, 2006) which is foundational to empathy development and social interaction. In one study of 163 children 3 – 6 years old (Siegal, Iozzi, & Surian, 2009), the children with both Italian and Slovenian were found to be have enhanced communicative abilities in terms of Gricean maxim use, over monolingual children in either language, despite their L2 (Italian) being comparatively delayed. Like the ability to judge distance from binocular vision, thinking in multiple dialects of English (Patton, 2014) or seeing alternative viewpoints from two or more cultures and languages (Assegedetch, 2014; Wang, 2014) provides an analytical distance or perspective that helps navigate an increasing number multicultural landscapes children encounter and grow into (Sankey, 2014). Thus it likely that having sustained shared thinking experiences in multiple dialects, languages or cultures, enhances cognitive abilities beyond monolingual and more homogenous experiences, given the extraordinary plasticity of the human brain and the extensive variability of human languages at every level of complexity (Evans & Levinson, 2009). Although Vygotsky did not directly speak to multiculturalism in the terminology now used (Ageyev, 2003), his contribution to culturally diverse learners in terms of special education, whether physical or mental disabilities, was that he assumed a child was not *less* developed but had developed *differently* (Gindis, 1995). The problem of any impairment, as he saw it, was how it altered the child's interactional relationship and therefore more specifically, the implications for learning

potential within the ZPD. Vygotsky did pioneer studies of cognition in cross-cultural settings, but only recently has this been related to modern multicultural education (Kozulin, Gindis, Ageyev, & Miller, 2003a, p. 10) with the conclusion that "Vygotsky's approach does contain, potentially, one of the best theoretical frameworks for educating culturally and socially diverse learners". Part IV of this edited book (Kozulin, Gindis, Ageyev, & Miller, 2003b) is devoted completely to exploring of these possibilities. Kozulin (2003, p. 15) says that "the majority of educators were oblivious of this cultural element until confronted with it in the reality of the multicultural classroom," and Vygotsky's answer to this challenge was the reorientation of learning theory from an individualistic to a sociocultural perspective with the key concept being the use of psychological tools. Kozulin goes onto argue that what happens in the multicultural classroom can be operationalized as a "co-presence of different systems of psychological tools" (p. 16). He calls this "distributed literacy" where participants "contribute to different aspects of one literacy action". This is perhaps an aspect of what one might call a *diverse* SST. Nowhere has it been found that the literature discusses or examines varieties of SSTs in terms of cultural diversity of those involved and it is beyond the scope of this review to extract what might be SSTs by other names from the literature in this regard.

The definition of an SST at the preschool level, with its inclusion of the idea of extending a narrative, differs slightly from Alexander's (2008, p. 110) definition of *dialogue* at the school level: "achieving common understanding through structured, cumulative questioning and discussion that guide and prompt, reduce choices, minimize risk and error, and expedite the 'handover' of concepts and principles". The

SST definition includes discussion, which Alexander (2008, p. 110) makes a separate category defined as “the exchange of ideas with a view to sharing information and solving problems”. In addition, the SST's “working together in an intellectual way” does not necessarily go as far as Alexander’s *dialogue* criteria of “achieving common understanding”. It may be that the SST definition necessarily describes a broader set of circumstances at the preschool level that provides a canalizing developmental precursor to what will later become *dialogue* at the school level, reflecting the development of higher order thinking spaces.

It would appear however, that preschool children may be able to achieve some of the higher category of *dialogue* (Gelman & Brenneman, 2004) now being encouraged for the primary school science classrooms (Mercer, Dawes, & Staarman, 2009) and do so when the teacher talk is systematically focused on higher concepts in a carefully constructed approach based on children’s natural curiosity called the Preschool Pathways to Science (PrepPS) program (Gelman et al., 2010). One PrepPS program goal is to allow “children to practice thinking, talking, and working with a concept over time” to build “deeper understanding” (p. 18) through dialogue with classmates and teachers in “hands-on, minds-on experiences” (p. 22). One example was to have children interview each other about their families by asking questions, counting categories of family members, and graphing or tabulating the results. Examples of actual dialogue (pp. 40-41) show that children can engage in episodes of Sustained Shared Thinking with very little input from the teacher.

Theoretical underpinnings for the SST

An important contribution that the study of dialogue in older children can contribute to understanding the SST in preschool was a further refinement of

Vygotsky's ZPD, called an Intermental Developmental Zone (IDZ) (Mercer, 2000) as an "emerging theory" (Mercer & Littleton, 2007, p. 23) able to help analysis of teacher-child dialogue and the educational function of talk between children, especially the IDZ's ability to account for strategies a teacher may use to encourage groups of children to develop ways of thinking about specific contexts such as literacy (Warwick & Maloch, 2003).

The need for a new conceptualization arose from confusion over what Vygotsky meant in many of his formulations (DeVries, 2000) and from neo-Vygotskyan research that often construed the ZPD as a static concept of the learner's mental state in a passive transfer of skills and knowledge without regard to the learner's participation in the shared communicative space where talk and joint activity are created and negotiated by a sustained interchange (Mercer & Littleton, 2007, pp. 21-23), where learners are seen as active agents in socially shared cognition in a community of practice (Lave, 1991; Lave & Wenger, 1991, 2005), where there is "mutual orientation of participants to a shared task" (Fernández, Wegerif, Mercer, & Rojas-Drummond, 2001, p. 42), and where participants constantly evaluate each other's contribution (Hoogsteder, Maier, & Elbers, 1996, 1998) in an interactive "dance of the classroom" (Bloome, Carter, Christian, Otto, & Shuart-Faris, 2005, p. ix).

The IDZ takes account of the "special role that language has in the educational process" (Mercer & Littleton, 2007, p. 20) and includes the importance of both the talk and the joint activity. An additional requirement of any emerging sociocultural theory, according to Mercer and Littleton (2007, p. 23), is that it accounts for how language functions specifically as a cultural and social tool in the role of a child's

development, something which they say has not been considered in any great detail, and which echoes earlier statements that little is known about the transition and transformation from the intermental to the intramental in Vygotsky's theory (Wertsch & Bivens, 1993).

Mercer's theoretical approach includes importantly: 1) a temporal framework for understanding how learning in dialogue unfolds, particularly the *"dynamic aspect"* (Mercer, 2008a, p. 44) of the unplanned spontaneous emergence of shared understanding; 2) the incorporation of Gee's (1999) dynamic concept of *reflexivity;* and 3) Grice's (2002/1967) arguments for the explicitness in language as detailed in his maxims.

Mercer's theory meets two challenges in justifying the approaches taken in this study – "talk that mediates joint intellectual activity poses a considerable methodological challenge for a discourse analyst", and "a profound problem for researchers" is "understanding how conversational communication works at all" (Mercer, 2008a, p. 44). The first concern will be addressed in the methods chapter while the second justifies the inclusions of Fauconnier and Turner's (1996) blending and Grice's (2002/1967) cooperative principle in this study, to be discussed shortly.

Another perspective that helps to understand the role of language in an SST and in particular why the Gricean maxims have a role in this is Tomasello's (2000) social-pragmatic theory of word learning. In this perspective, word learning is "a process of establishing joint attention" and "relies on intention reading" and is simply a "unique form of social (cultural) learning" (p. 405) where, when learning a new word's meaning, "the child must understand something of the adult's overall

communicative intention as expressed in the utterance as a whole" (p. 410). This is further developed in Tomasello's (2003) "usage-based theory of language acquisition" which adds that "this learning process ensures that the child understands that she has acquired a symbol that is socially 'shared'" (p. 28) which "sets up all kinds of pragmatic 'implicatures' of the type investigated by Grice (2002/1967) concerning expectations that other persons will use the conventional means of expression" (p. 28).

What is important in these theories for this study is an understanding of how the flow of pedagogical moments are "reconstituted constantly as the dialogue continues" and the two engage in "dynamic, reflective maintenance of a purposeful, shared consciousness" (Mercer, 2008a, p. 38). These moments have been conceptualized broadly by Buber (1958) as *dialogic moments*, where meaning "emerges in the context of relationship" (Cissna & Anderson, 2002, p. 186), "first transforming the interlocutors' understanding of the action in question…and second, altering the relations among the interlocutors themselves" (McNamee & Gergen, 1999, p. 35). "Critical moments" according to Siraj-Blatchford and Sylva (2004, p. 723) occur when the teacher lifts the thinking in the interaction by initiating an episode of Sustained Shared Thinking (SST) or by extending a child-initiated SST episode, and within this series of dialogic turns the "teacher both selects examples and focuses attention at the moment of encounter" (Cazden, 1992, p. 306). In these challenging moments the teacher actively focuses the child's mind on the most significant features of what needs to be learned. Most preschool teachers would call these dialogic moments *teachable moments* (TM), about which Hyun (2002) says there is a lack of discussion in the professional literature regarding how they are

constructed pedagogically and whether a teacher's TM is relevant to the learner's learning moment. From the REPEY study the question as to why only a 20% increase in SST frequency in a classroom should have such a large effect in child outcomes (Siraj-Blatchford & Sylva, 2004) may relate to children reaching a critical number of practice opportunities, or a "tipping point" in habits of thinking encoded in conceptual blends.

This is similar to the discovery that four encounters with a concept with less than 48 hours between encounters is most likely produce permanent learning for young children, where it is unlikely that three encounters will achieve this result (Nuthall & Alton-Lee, 1993). This 25% increase in encountering the concept is not dissimilar to the 20% increase in SST frequency and both these insights support Mercer's conclusion that a temporal analysis is required for a more complete understanding of the efficacy of classroom dialogue (Mercer, 2008a).

Activity type matters

Sylva, Roy and Painter (1980) found that some preschool activities, such as a) music, when not led by an adult; b) art, where the child chooses the medium and construction assembly activities; and c) games or activities, where the child builds something tangible with an objective in mind are situations where the child is able to assess progress to an implied standard producing a sense of achievement. These activities out of all types of preschool activities, provided more challenge, dramatic force, real-world feedback and possessed a definite goal structure. Sylva, Roy and Painter (1980) found that this produced more cognitively complex engagement, as scored by the children's actions and talk with self or others and evidenced by children showing "sequential elaboration" or transformation (p. 61), which helped to create the

ideal learning situation of “sustained conversations” (p.225). More recently, preschool activities have been divided into three domains of effective “supportive” practice (Hamre et al., 2013), all of which depend primarily on teacher-child interactions and relationships, but which, measured independently, show variation in the details of what support is required. For instructional support, it is thought that "quality feedback" in sustained and frequent "feedback loops" is a key to getting the most out of "instructional opportunities" (Hamre & Pianta, 2007, p. 68), which is perhaps another way of talking about teachable moments that are responded to with episodes of Sustained Shared Thinking. It will be important in this study, therefore, that different activities are examined separately and only amalgamated if differences are negligible.

Blending Theory

Blending (Fauconnier, 1997) is a theory and a model of some characteristics of *the way we think* and as *a process* as it unfolds in interactional situations (Hougaard, 2005; Sinha, 2005). Tomasello (2003, pp. 293, 305) briefly references *Blending Theory* as a basis for explanation of the internalization process. Others in the socio-cultural cognitive development field (Bache, 2005; Coulson & Oakley, 2005; Gibbs, 2000; Langacker, 2008) also refer to *blending* as explanatory of learning in general with some specifically discussing concept formation (Dancygier, 2006), language production (Freeman, 2006) and comprehension of metaphors (Ritchie, 2003). When a new concept is encountered in the environment, this internalization process operates from existing or input mental spaces (already existing concepts) to yield a third space – the blend. Partial structures from the input spaces, or current concepts, are projected into the blended space, which has emergent structure of its

own. This occurs while engaged in talk and/or activities where new or creatively rearranged representations or material objects are engaged. Hutchins (2005) argues that this process requires the use of *material anchors* (objects and real life experiences) during conversations. This combination acts as cultural "integration networks" where "the manipulation of the blended space can be learned" (Fauconnier, 2001, p. 6).

Sinha's (2005) discourse analysis of five- to six-year-old play, based on an extension of Blending Theory, is a good example of the socio-cultural collaborative and materially grounded nature of the human mind encountering the social roles, relationships and identities negotiated by participants in communicative interactions. These phenomena will be examined here in teacher-led activities rather than in play by tracking the dialogue that provides the input for a new concept being visibly established in a child's thinking. When a blend can be seen to have occurred, it is evidence of learning made visible in the flow of talk interactions, and "knowledge is made more publically accountable and reasoning is more visible" (Wegerif & Mercer, 1996, p. 51). Gathering evidence of visible learning has been encouraged as a goal for schools and teachers (Hattie, 2011) but this is not usually accomplished while a concept is in the process of being formed in the flow of talk interactions.

Grice's Cooperative Principle

"The language children hear ... displays the conventions of that language...[a]nd these are the conventions children must adopt to communicate effectively" (E. V. Clark, 2010, p. 260). They must untangle indirect meanings of others and compose utterances that stay within the "bounds that speakers adhere to" (H. H. Clark & Clark, 1977, p. 122) with "[p]erhaps the most insightful analysis of

these bounds" having "come from Grice (1967) in his discussion of what he called the cooperative principle".

Grice (2002/1967, 2008/1978) has shown how a cooperative logic in conversation forms a "rational communicative system" (Hilton, 2008, pp. 776-778) and if these rational rules are violated, it has been found that "conversations break down" (H. H. Clark & Haviland, 1977, p. 5). Grice's cooperative principle and the maxims that define it, have formed an important element for many researchers studying social cognition (Bless, Fiedler, & Strack, 2004; McCann & Higgins, 1992; Strack & Schwarz, 1992), how children develop thinking while learning language (Katsos & Smith, 2010; Levinson, 2000, pp. 12-21; Matthews, Lieven, & Tomasello, 2010, p. 749; Mercer, 2008a; Schwarz, 1996, pp. 7-16; Tomasello, 2003, p. 28), how first-graders comprehend referentially ambiguous messages (Jackson & Jacobs, 1982; Surian & Job, 1987), how children learn scientific concepts (Gelman, 2002; Gelman & Lucariello, 2002), how five-year-olds are sensitive to both the first and second Gricean maxims of Quantity (Davies & Katsos, 2010, pp. 1958, 1968), and how deaf children aged 6 to 11 years, who were native signers receiving bimodal/bilingual instruction, were as sensitive to violations of Grice's cooperative principle as were hearing children (Siegal et al., 2009).

In an early analysis of the sequential structure of mother-child discourse, Wells (1981, pp. 30-36) showed how adults sustain and extend a conversation by making "explicit cohesive ties", to link turns through repetition, reframing, contrasting or acknowledging comments to aid the child to both stay engaged in conversation and learn how to converse by the way the adult speaker matched the child's needs in "constructing a linguistic message" and put "into practice Grice's Cooperative Principle" (p. 117). It has been argued further that parents use this

cooperative principle when speaking "motherese" to their children (Bridges et al., 1981). Adults continue to "recast" what less competent speakers say as a form of "corrective feedback" (Baker & Nelson, 1984; Camarata & Nelson, 2006; Tomlinson, 2007), providing "effective models" of language output.

It was found by Sonnenschein (1984), in a study of 84 kindergarten children, that their speaking and listening skills only improved with feedback that provided details of production ambiguities. Schwarz (1996, p. 90) went further and more broadly by arguing in a review of research into social judgement that "thinking is for doing", and provided compelling evidence that supports Grice's original position that the cooperative principle operates more broadly than just the conversation and constitutes "rational rules that apply to all situations that require cooperation".

The Gricean maxims

Grice (2002/1967) defines his Cooperative Principle concisely as: "Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged" (p. 722 in the 2002 republished William James Lecture). More precisely, the cooperative principle is further defined by a set of maxims in terms of:

Quantity. Quantity of information in two specific maxims:

1. Make your contribution as informative as required.
2. Do not make your contribution more informative than is required.

Quality. Super-maxim: "try to make your contribution one that is true".

3. Specific maxim: Do not say what you believe to be false.
4. Specific maxim: Do not say that for which you lack adequate evidence.

Relation. A single maxim: "Be relevant."

5. Although this maxim “be relevant” is “terse”, there are complex questions: what different kinds and focuses of relevance operate, how this shifts and how subjects of conversation are legitimately changed.

Manner. *How* it is said as one super-maxim: “be perspicuous”, divided into:

6. Avoid obscurity of expression.
7. Avoid ambiguity.
8. Be brief (avoid unnecessary prolixity).
9. Be orderly.

Antecedent. Or “referent”:

10. For each bit of information, have one clear antecedent known to the listener, or one referent in the current environment. This maxim was added by Clark and Haviland (1977), being the core of their “given-new contract”. It could be construed as part of the Relation maxim of “be relevant”, but perhaps expanding in a specific area of relevance.

Grice’s cooperative principle has been used to understand interactions in preschools in a few studies (Gelman & Brenneman, 2004; Shwe, 1999; Wells, 1981) and in year one elementary school in relation to reading instruction (Elster, 1990), where Gricean maxims operated according to constraints only present in the classroom setting. Although children at four years old have been shown to be able to learn the first three Gricean maxims (Eskritt, Whale, & Lee, 2008), little research has measured children’s acquisition of these maxims, “making it unclear as to how children come to grips with these maxims in the course of development” (p. 436). Gee (1999, p. 68) states that “the mind is a pattern recognizer,” and “[i]f the patterns a mind recognizes or assembles stray too far from those used by others in a given

Discourse, the social practices of the Discourse will seek to 'discipline' and 'renorm' that mind" (p. 68).

Mistakes using the maxims at four years old may be misapplications rather than lack of understanding (Jackson & Jacobs, 1982, p. 211), with the implication that teachers who demonstrate, challenge and extend children's abilities with the maxims may be equipping them for better engagement later in school by strengthening their general conversational ability. It is likely that this occurs within episodes of SST, and also likely do so following Gee's disciplining and renorming in the discourse, if SST is in fact helping children to learn to think as has been suggested. The examination of the use of Gricean maxims within SST dialogue will be examined in this study.

Forman and Larreanmendy-Joerns (1998) relied on Grice's Cooperative Principle to argue that everyday discourse and academic discourse only differ in the degree of accountability. Mercer (2000) has included Grice's Cooperative Principle in a revision and expansion of Vygotsky's theories about how schools assist the socialization of children into scientific and academic concepts. Scientific argument, therefore, may simply be an elaborated extension of the Gricean maxim: "Do not say that for which you lack adequate evidence" and the operationalized framework for John Dewey's (1929) claim that scientific knowledge is an extension of everyday knowledge, an idea supported later by Lave (1988). Dewey also suggested (1913) that the way for children to learn scientific thinking was to have them start in everyday occupations with the teacher explicitly linking academic ideas with everyday experience through the teacher taking a number of conversational moves with the child before the link is established.

These conversational moves may now be understood as a series of "double moves" (Adger, Snow, & Christian, 2003; Daniels, 2005; Hedegaard, 2005;

Khomskaya, 1996; Zunshine, 2003). These double moves appear to be underpinned by "the idea that linguistic exchanges are instances of shared rational purposive activity" (Fogelin, 1991), or what Splitter (2014, p. 213) called " a community of thinkers" where people assess others' assertions, beliefs and perspectives and work out which ones meet standards of reason, evidence, and justification.

Neurologically, it may be that these everyday experiences represent "material anchors" for concept development, as understood in Blending Theory (Hutchins, 2005). These understandings go some way in answering the question posed by Vygotsky in *Thought and Language* (1934/1962) as to how children reconcile their everyday understandings of the world with scientific knowledge learned through formal schooling.

Extended discourse or decontextualized language is now often called "academic language" according to Snow, Porche, Tabors and Harris (2007, p. 10), who also say that their previous work had "suggested that good readers were distinguished by better control over certain kinds of oral discourse...such as telling coherent stories, making convincing arguments, or providing succinct and communicatively effective definitions of words" and these skills correlated with literacy success in the middle grades, with the argument that: "[o]ne reason to focus so heavily on literacy development is that literacy is the gatekeeper skill for academic success".

Question use in orchestrating the conversation

Challenging statements or questions, recasts and restatements by a teacher in reaction to children's input can all be considered as cases where an "utterance by a first speaker is contested by a second speaker via pinpointing of problematic

inferences" (Hougaard, 2005, p. 1667). It has already been seen how feedback in the form of directly correcting a child in terms of the Gricean maxims might help train their ability to cooperate in conversations, and now the role of questions providing a similar function will be examined.

Teacher questioning behaviour, examined in an extensive review of observational studies in the USA from 1893 to 1963 (Hoetker & Ahlbrand, 1968), was found to have a remarkable stability of the rapid-fire question-answer pattern of instruction, despite successive generations of educationalists condemning its use (p.19). This pattern was then further understood as an Initiation, Response, Evaluation or Follow-up (IRE, IRF) dialogue (Mehan, 1979; Sinclair & Coulthard, 1975) which Cazden (1988, p. 29) said was "the most common pattern of classroom discourse at all grade levels" and then went on to show how questions can make or break a conversation.

Moderate use of questions (Soar, 1966; Solomon, Bezdek, & Rosenberg, 1963) has been shown to be more effective in some kinds of learning. Some researchers distinguished between "drill" and "inquiry" activities (Soar, 1966) and showed the most effective teachers had a higher ratio of inquiry to drill activities and that moderate amounts of inquiry activities and questions and low use of drill produced better learning. This was thought likely to constitute cognitive structuring. A similar conclusion was made by Conners and Eisenberg (1966, pp. 10,11) in a study on the effect of 38 teachers' behaviour on 379 preschool children's changes in the Peabody Picture Vocabulary Test (PPVT) (L. M. Dunn, 1965) from the "highly significant ($p < .001$)" finding that "teachers who placed a high value on intellectual activity" had children who advanced more than teachers that did not do this.

However, they could find no pattern in various measures of language, questions and "convergent reasoning, and divergent reasoning" and concluded that it might be the "total pattern of intellectual stimulation, rather than any specific adherence to language training per se, or to different patterns of questions" (p.10) that was required to induce intellectual growth. Convergent reasoning or convergent thinking (White, 2005) is now understood by some as cognition that analyses a relatively few representations to converge upon a single solution, while divergent creative thinking, on the other hand, involves generating multiple ideas or solutions to a problem.

An important pedagogical distinction has often been made between a) *open questions*, where answers are not necessarily predetermined, and b) *closed questions*, where they are predetermined or if not, then possible answers are very limited, with open questions thought to better stimulate higher-order thinking (Alexander, 2000; Galton, Hargreaves, Comber, Wall, & Pell, 1999). However, in an early review of research from preschool to college on teacher behaviours and child outcomes, Rosenshine (1971) said that although "frequent questioning" did significantly correlate with measures of achievement, the "frequency of use of specific types of questions" did not (p. 92).

Structure of questioning toward a goal

What did improve student responses seemed to be a "moderate amount of structuring" prior to a train of questions (Rosenshine, 1971, p. 90), with research on "cognitive interchanges" (p. 93), showing that "the over-all pattern of behaviors is more important". It was suggested that types of questions only mattered when the teacher saw them as a means to a cognitive goal, and not an end in itself.

This goal orientation has been seen in the course of orchestrating thinking in group discussions where teachers often revoice or challenge students (O'Conner & Michaels, 1996) by "posing questions that encourage students to make connections" (Palincsar, 1998, p. 363), and where teachers mediate discussion "by seeding the conversation with new ideas or alternatives that push the students' thinking and discussion and prepare them for conversation" (p.365).

The importance of the overall pattern in judging the openness of questions has been more closely detailed in a random sample of 28 staff in 12 preschool classrooms in over 400 hours of dialogue which has shown that an "ambiguity of open-ended questions became apparent during the process of coding" (Siraj-Blatchford & Manni, 2008, p. 11). The solution to coding required considering the whole context of the extended exchange, such that: only if teachers accepted more than one possible answer, were questions judged truly *open.* Only 5.5% of questions out of more than 5800 qualified as *open* in this study, and although some of these provided increased encouragement and opportunities for sustained shared thinking, this did not always eventuate (p. 14).

One important step in finding out more about the most effective pattern of questioning has been to distinguish a somewhat more detailed variation of question types in preschool settings (Raban et al., 2010) and compare these with the child response to determine which kinds prompted children's use of extended language, or helped "sustain" the conversation. Some *closed yes/no, closed not known,* and *statement-acknowledgement* questions elicited extended responses, while on other occasions they were used in the third conversational move, apparently to encourage

the child to think further about their responses, as in the following use of a *closed yes/no* question (p. 32):

Teacher: I think it's a special something.
Child: I know! It's a wand.
Teacher: It could be a wand. It could be a thing that the king holds to show that he is king. Do you reckon that?
Child: Yeah.

In this study, the *open questions* provided the most substantial opportunities for extending conversations, while *closed not known* questions were also often used. The study was about talk during storybook reading and found that *open* questions were used 16% of the time, substantially more than the random study mentioned earlier, indicating that different activities are likely to have different characteristic patterns of response. This more detailed coding of questions was adopted for this study.

Recent officially sanctioned guidance (Education Services Australia, 2014) on how to use questions in schools (Godinho & Wilson, 2004), equated *open questions* with "divergent questions", "higher-order cognitive questions" and "higher-order thinking", while *closed questions* are equated with "convergent questions", "lower-order cognitive questions" and "lower-order thinking" and stated that while "there are subtle differences, these terms are often used interchangeably" (p.18). This is perhaps too simple a proposition considering Rosenshine's (1971) statements that while frequent questioning did significantly correlate with measures of achievement, the "frequency of use of specific types of questions" (p. 92) did not and that "the over-all pattern of behaviors is more important" (p. 93). The criterion is not what kind of question, but rather what it does according to Palincsar's (1998, p. 363)

conclusions that “posing questions that encourage students to make connections” mediates discussions “by seeding the conversation with new ideas or alternatives that push the students’ thinking” (p.365).

Acknowledgements

A further marker of quality conversations is when a teacher provides positive supportive feedback by repeating what a child has said, responds with ‘yes’, reframes or otherwise validates what a child has just contributed in a discourse. These affirmations can all be termed *acknowledgements*. These are forms of feedback, but not the only kind (G. T. Brown, Harris, & Harnett, 2012; Hattie & Timperley, 2007).

Rosenshine (1971) said that the most powerful types of acknowledgements were “praise coupled with a reason for its being given” (p.91) or when the teacher repeated, summarized or modified the child’s ideas and even integrated child ideas into the lesson. Dweck’s (2002, 2009) extensive research into praise makes it clear that acknowledging effort and specific strategies a child has used is a motivator for children to choose more challenging tasks. Even subtle linguistic cues can influence four-year-olds to make more effort (Cimpian, Arce, Markman, & Dweck, 2007). Hattie and Jaeger (1998) provide a model for the relationship between assessment, learning and feedback that postulates and provides evidence that student achievement is enhanced both “as a function of feedback” (p. 111) and to the “degree that teachers use reinforcement to help verify rather than enhance students' sense of efficacy” (p. 112). This study will use the term *acknowledgement* as substantially equivalent to Rosenshine's and Dweck's definitions with the addition of being timely feedback verifications (Hattie and Jaeger) when given by the teacher during dialogue.

Hattie and Jaeger (1998) also pointed out that effective teachers give feedback during child engagement in tasks that relate to challenging goals and that if children "share commitment" (p. 113) to the goal or task, then it is more likely that the goal will be attained. They argue that the degree that students are trained to be receptive of this kind of verification also enhances achievement. The efficacy of training children's receptivity to verification feedback, particularly during a goal set task with shared commitment, may be a reason that small group inclusive episodes of Sustained Shared Thinking are very important at the preschool level as a preparation to effective engagement in schooling.

Engagement and participation in dialogue

Defining *engagement* and *participation* in terms of the talk interactions in small group activities that are to be examined has not been explicitly addressed. Much of the literature reviewed here uses these terms without clear definition and this has been shown to be problematic (Hickey, 2003). For this study, it will be necessary to decide what visible signs to use to know whether a child has engaged in the shared thinking. According to Fenstermacher and Richardson (2005, p. 194), certain kinds of behaviours and actions are indicative of children's "substantive engagement" such as: "engaged, motivated, following, excited, connected, and the many other words used in describing the ways children participate in lessons". Unfortunately even children's eye gaze at the lesson texts is not indicative of substantive engagement according a study done of 72 five-year-olds of mixed gender and race (Lorch, Anderson, & Levin, 1979). Half the children watched an episode of *Sesame Street* with toy distractors on the floor with attention to the screen at 44% of the time, while a no-toy condition group attended to the screen 87% of the time with no significant difference in tests of

their comprehension. Later research showed that children monitor the verbal texts and attend to the visual presentation when it is understandable and disengage when it is garbled, backward, foreign language edited or simply not as clearly stated (Anderson, Hyewon Park, & Lorch, 1987; Anderson, Lorch, Field, & Sanders, 1981). Researchers and producers of *Sesame Street* used this signifier of comprehensibility to edit and change programming by installing a "distractor" slide show screen next to the episode screen (E. L. Palmer, 1972) so that they knew exactly when they "lost" the children's attention and understanding (and therefore likelihood of learning) (Truglio, Lovelace, Segui, & Scheiner, 2001). In the current study, it will therefore be assumed that the preschool room is sufficiently endowed with "distractors" that the children paying attention to the activity is indicative of engagement. "Participation", on the other hand, will be considered to be when they verbally participate in the dialogue using a visible (or verbal) sign such as a gesture or word. Even chorus responding will be counted as participation for each child that responds visibly or verbally. These will be called "turns" and counted, whether the child uses one word, or many. It has been shown that a single word can be very meaningful in dialogue (P. Harris & Trezise, 1999). The kind of intertextual analysis that can be accomplished in this case or that of as little as six words (P. Harris, Fitzsimmons, & McKenzie, 2004), is beyond the scope of this study where insufficient information about other texts is known. The qualitative analysis of some texts in this study, particularly unravelling the meanings in a few examples of blending, will be attempted but staying within the known texts of the three preschool activities recorded on video.

The importance of improving early childhood relationships in schools

A framework of quality factors as guidance for teachers in Australia (Louden et al., 2005, p. 25), on what constitutes effective practice to create supportive classroom literacy learning climates, has been described as: “positive, safe and warm…structured, safe and orderly”, inclusive, pleasurable and respectful toward establishing rapport, all of which underpin a general principle of “social collaboration” toward learning as “meaning making” (p. 29). However, also in Australia, 22% of “children enrolled in their first year of formal fulltime school are developmentally vulnerable” (Australian Government, 2012, p. 26). In these reports “vulnerable” is the most challenged category in the bottom 0 - 10 percentile, while those “at risk” are children in the 10 - 25 percentile. A relationship outside the family with at least one caring adult, often a teacher, can be “the single most important element in protecting young people who have multiple risks in their lives” (Sabol & Pianta, 2012, p. 213). They go on to say that “teacher-child relationships have begun to emerge as a central agent of change for improving the quality of education…and…can improve children’s functioning and adjustment. More specifically, evidence suggests that focusing on providing coherent and cohesive professional development may significantly improve the quality of teacher–child relationships” (p. 225). Johnston (2004, p. 2) summed up the importance that this study addresses as: "If we have learned anything from Vygotsky, it is that ‘children grow into the intellectual life around them’ (Vygotsky, p.88). That intellectual life is fundamentally social, and language has a special place in it. Because the intellectual life is social, it is also relational and emotional. To me, the most humbling part of observing accomplished teachers is seeing the subtle ways in which they build emotionally and relationally healthy learning communities - intellectual environments

that produce not mere technical competence, but caring, secure, actively literate human beings. Observing these teachers accomplish both goals convinced me that the two achievements are not completely at odds". This capability has been described in detail (Louden et al., 2005, p. 183) in terms of effective early literacy learning where "more effective" teachers create high levels of child participation and mutual respect while simultaneously "orchestrating" a variety of activities, "support and scaffold learners at word and text levels" while targeting and differentiating their instruction. This was measured using the Classroom Literacy Observation Schedule (CLOS) (Louden & Rohl, 2003) which has a specific dimension of orchestration practices.

Orchestration, as a complex of teacher abilities, was measured using the Classroom Assessment Scoring System (CLASS) (Pianta, 2007) by research confined specifically to preschools (Curby et al., 2009) which showed that some teachers were perfectly capable of orchestrating organisational, emotional and instructional support all at the same time. How this knowledge can be used in effective teacher professional development has also been demonstrated (Hamre et al., 2012). These authors argue that the ability to measure the detailed aspects of quality with finer grained accuracy is the beginning of being able to improve these important young experiences. This ability to measure more details of "quality" allowed early childhood education researchers (Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009) to be able to show that a subcategory of classroom quality called classroom management, was uniquely linked to an increase in children's behavioural and cognitive self-control, higher behavioural engagement, with less off-task time in the classroom. In addition, this was equally true for all children even after controlling for entry levels of self-regulation, socio-demographic characteristics, and other facets

of classroom quality. Despite these advances Rimm-Kaufman and Ponitz (2009, p. 201) say that "much remains to be learned about how early educational settings relate to children's learning and development".

Rowe's (2003) analysis of the data shows that "quality" education, although a problematic term and concept, is less about the school, teacher education or professional development or even teaching methods, and more about talk interactions, and that "measures of quality should focus on the quality of opportunities for learning that teachers are providing for their students" (p.16). For Hamre and Pianta (2007, p. 68) children or groups of children get the most out of learning opportunities when the teacher provides "high quality feedback" and the children are engaged in frequent "feedback loops" in a "sustained effort to reach deeper understanding". Gaining a better understanding of Sustained Shared Thinking, therefore, would be a productive direction to explore in search of additional information about how teachers both orchestrate the interactions and also provide high quality feedback.

Summary and what remains unanswered

The literature reviewed suggests that early experiences are critically important and that improving the quality of verbal interaction in early childhood education would have long lasting consequences for the child. This inquiry will be guided by what remains to be explored as articulated from some key research questions. Mercer and Littleton's (2007) claim that little is known about how language functions specifically as a cultural tool in children's transformation from intermental to the intramental thinking, an outstanding question for Vygotsky as well, voiced in *Thought and Language* (1934/1962), will be examined by looking for specific actions representative of using language as a cultural tool, such as questions and

acknowledgements. Conners and Eisenberg's (1966) failure to find any patterns in teachers' "emphasis on language, convergent reasoning, and divergent reasoning" or in the "different patterns of questioning" that was required to induce intellectual growth in children will be examined by looking for patterns in the use of these "tools" in terms of Sustained Shared Thinking and blending episodes. This is informed by Rogoff's (1990, p. 195) concern that there is a "deep problem" of how the external lessons cross the barrier into the child's mind from an "apprenticeship in thinking" (p. 7) within "shared thinking and guided participation" (pp. 8, 189), which will be examined by tracking "blends" (Fauconnier & Turner, 1996). These analyses will also extend a purpose of the Effective Provision of Preschool Education (EPPE) project (Sammons et al., 2005, p. 210) which was "[d]iscovering the individual characteristics (structural and process) of pre-school education in more effective centres". All these examinations will then be examined together for correlations and patterns to test any relationships. Little is known about possible relationships, so this is the exploratory nature of this study.

This study's methodology and approach could add to Dickinson's (2006, pp. 184-185) expressed need for "tools that describe selected features of classrooms in greater detail" and provide "criterion measures" that were lacking, for example, in assessing The Australian Early Development Index (AEDI) which rendered its findings "inconclusive prior to predictive validity assessment" (Brinkman et al., 2007, p. 427). This will also add to "discussions that focus on the constituent elements of *teacher quality* in terms of what teachers should *know* and be able to *do*" (Ingvarson & Rowe, 2008, pp. 6-7) and will provide new research on: "the measurement of teaching quality" which "should focus on the quality of the opportunities for learning

that teachers are providing for their students" (p.16). This study will finally provide added clarity about "how children come to grips with these [Gricean] maxims in the course of development" (Eskritt et al., 2008, p. 436).

Summary narrowing the methodology and research design

Dickinson (2006, p. 184) provided a research methodological path to answering his own statement that "we need tools that describe the content of teacher-child and child-child interactions" by capturing "what teachers and children talk about" and by "examining classrooms with a microscope" (p. 186) and says that although researchers have examined the specific features of mother-child talk, they "have rarely sought to use detailed descriptions of children's language experiences as measures of quality for predicting children's subsequent development" (p. 186). The current study will confine this injunction to looking within the most likely preschool teacher orchestrated activities, at the most likely type of orchestrated dialogue, by measuring some of the most likely indicators contributing to quality talk, and by measuring markers of quality language use. In summary, it will look for differences in the rates and patterns of quality indicators and markers of quality language within the dialogue of teacher-led activities with a particular focus on Sustained Shared Thinking episodes.

The current study

This study will show *how* quantitative measurement of important indicators of quality talk interactions can lead an unfolding mixed methods analysis of dialogue useful for answering outstanding questions of import to children's futures. This will be confined to within this particular population of teachers and not necessarily be applicable in general. In addition, it will describe the Sustained Shared Thinking

episodes in a fine-grained detailed analysis to find out exactly *how* these early childhood teachers orchestrated learning opportunities productive of higher order thinking in children and will do so by examining some indicators of quality that have never been assessed in this context (Gricean maxims and blends) and will look for patterns of these and more commonly researched indicators (questions and acknowledgements). Tentative conclusions are expected to emerge pointing to productive directions and possibilities for further research.

Research Questions

Overarching question

How did 23 Australian preschool teachers create quality talk interactions in dialogue during three teacher-led activities? This will be divided into specific research questions:

Specific research questions.

1. Is there evidence of Sustained Shared Thinking (SST) in the 23 classrooms?
2. Is SST activity associated with four quality indicators of teacher use of:
    a. questions,
    b. acknowledgements,
    c. blends, and
    d. Gricean maxims?
3. What are the differences between non-SST dialogue and SST dialogue in terms of:

a. the identified quality factors,

b. and children/teacher talk ratios?

4. Are there differences between non-SST and SST dialogue in the quality of children and teacher's language in terms of:

    a. Mean Length of Utterance (MLU), and

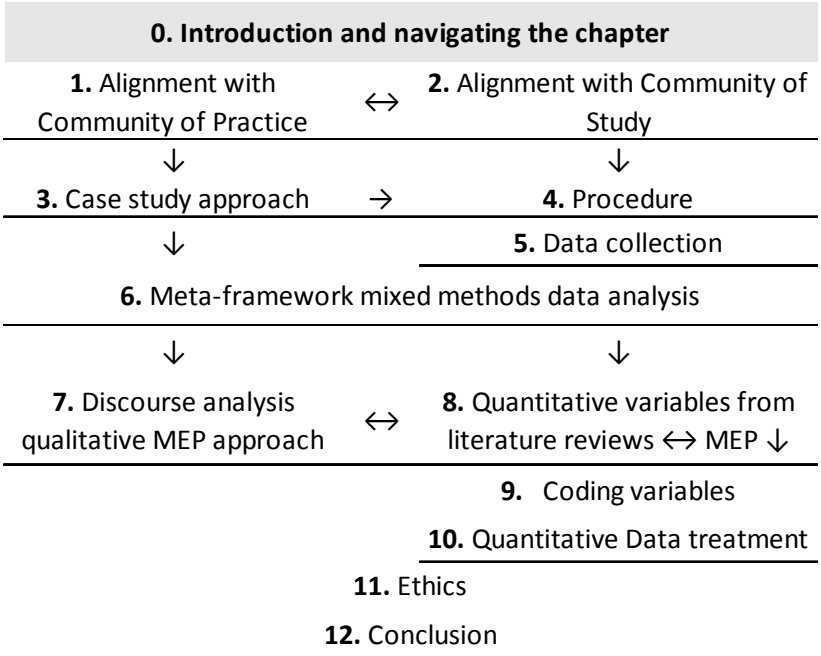
    b. Type Token Ratio (TTR)?

The primary addition to research

This study is a demonstration of a methodological approach to discourse analysis using quantitative and qualitative methods to accomplish a fine-grained analysis of teacher-child talk within preschool settings in terms of "factors" or indicators of quality that have been shown to be likely to produce long- term learning outcomes through helping children develop their thinking ability. This both demonstrates a methodology not used before in this context for this purpose and adds to the knowledge of how such conversations are orchestrated. It is a comprehensive microanalysis of these indicators within episodes of Sustained Shared Thinking in preschool dialogue.

CHAPTER 3: STUDY DESIGN AND METHODS

The purpose of this chapter is to outline and justify the study design and methodology. This chapter also contains a limited methodological literature review woven into the justification argument. The literature reviewed is limited by being selected for its applicability to the specific local research context. Because of the interaction between past research practice and the local challenge of this study, the chapter is somewhat complex as every methodological choice is justified. Therefore, a *Methods Navigation Guide* is included. The numbering is the order of discussion while the arrows show the alignment of research knowledge and practice on the current study. The left side of the diagram topics align with the community of practice, while the right side topics are shaped by the local context or community of study. The double arrows represent reciprocal interactions between the two topics that must be considered to inform choices.



The focus of the study is restated to foreground this discussion and then situated in the research approach first within a community of practice and then within the community of study (the participants of this study). A community of practice is defined here as a group of people who share interests, concerns, knowledge and approaches to effectively changing a set of circumstances of importance to them (Gee, 2005; Lave & Wenger, 2005). This study is also part of an *apprenticeship* as a "process of becoming a member of a sustained community of practice" (Lave, 1991, p. 65). Gee (1999, p. 6) says: "new researchers in an area are normed" by the examples of advanced researchers' use of tools and strategies, but in addition, have to "adapt, convert and translate 'standard' methods to solve their practical problems" (Mishler, 1990, p. 426). The interaction between the community of practice's tools and strategies with the community of study will inform the methodological decisions taken in detailing the steps needed to fulfil the study aim and answer the research questions. The discussion starts broadly to examine possibilities and then narrows as each decision is made.

1. Alignment with Community of Practice	↔	**2.** Alignment with Community of Study

Alignment with community of practice

The aim of the study was to identify effective teacher-child talk interactions that enhance early thinking in children engaged in the four-year-old preschool program in the state of Victoria, Australia. The particular focus was: How did 23 Australian preschool teachers use dialogue to construct episodes of Sustained Shared Thinking (SST) during three teacher-led activities? This question drives the choice of methods within a theoretical approach and within a community of research. The closest community of research is necessarily very small for the reason that:

"[e]xamination of the details of teacher-child discourse has rarely been attempted, possibly because of the daunting nature of the task. It takes an enormous amount of time to transcribe, verify, and code transcripts of classroom interaction" (Dickinson, 2006, p. 189). For this reason and to explore the methods chosen for this study, this chapter is partly a literature review of methodological approaches that will inform the choices made. The trustworthiness, validity and reliability that are derived from these choices as applied to this study will be addressed throughout the chapter and will include detailed descriptions of the data collection, transcription, coding and framework for analysis of the data following an established set of steps (Bakeman & Gottman, 1997).

Whatever the combination of methods and choices of focus, there is still a need for coherence. The important point about different sources and types of data is that they need to be theoretically coherent in answering the questions and providing a higher level of trustworthiness to the evidence by their triangulating the phenomena being examined. How this coherence is maintained and the evidence organized is both the method and design of the study including the data treatment methods. Coherence will be argued and justified at each point in this chapter and the results chapters where the story shifts from one type of examination to another. Because of the unfolding nature of this exploration, it is not possible to detail the arguments for coherence in one place.

To identify effective personalised teaching strategies that construct a preschool classroom culture for learning to think through verbal interaction, it was necessary to obtain data of naturally occurring conversations in the available preschools. The

choice of methods derives from the above research questions but also matches the possible data set available in the proximal context.

The choices follow a long tradition from the beginnings of social research into instructional practice where insights come from "illuminative" rather than "evaluative" research (Trow, 1967, p. 25), through direct observation of the "pedagogical forces" associated with the "genuinely effective aspects of education practice" that engage or bore students, and which, according to Parlett and Hamilton (1972, p. 31) concentrates on processes "within the learning milieu, rather than on 'outcomes' derived from a specification of the instructional system" with the primary concern of description and interpretation rather than measurement and prediction. Context in qualitative research is made explicit in explanations rather than being controlled for or edited out as in experimental approaches (Creswell, Shope, Clark, & Green, 2006).

As demonstrated in the literature review, much can be added to the details of how preschool teachers talk to children in terms of the identified indicators of quality conversations. As there was no outcome data at the end or after the collection of the video data, this study is exploratory. But it uses a particular methodological approach that has never been applied to episodes of Sustained Shared Thinking and will analyse indicators of quality that have rarely been studied in early childhood settings, such as blends and Gricean maxims. The approach uses both quantitative data as part of the exploration, and qualitative analysis approaches (Mason, 2002, 2006) that are concerned with explanation in a wider sense than causation. A traditional quantitative definition of "explanatory" study is too narrow to capture the rich complexity involved in how a teacher weaves together diverse elements and orchestrates

interactions. Instead, Mason's (2006, p. 20) argument is adopted, whereby a "multi-nodal" examination of different axes and dimensions of the social experience can create "dialogic explanations" that are "diverse" but nevertheless meaningful and related (p. 22). This approach also goes beyond a simple description of the complexity involved and moves toward an explanation of the mechanics and processes at work within cases, such that analytical comparisons can be drawn between these cases, which can then point the way for future research in other contexts and other populations.

The design of, and making inferences from, mixed method research is one of this area's least developed and most controversial issues (Onwuegbuzie et al., 2011; Teddlie & Tashakkori, 2003). The legitimacy of taking a mixed method approach operates not as a procedure, but as an iterative process which includes "evolving interpretations" and "a variety of intermediate representations for discovering, evaluating, and representing the video data" (Derry et al., 2010, p. 15), and relies on a "multiple validities legitimation" (Onwuegbuzie & Johnson, 2006, p. p.59). The strength of the validity of the research depends on achieving multiple relevant "validities" with coherent arguments at each step and when integrating results from quantitative and qualitative steps. This then allows strong meta-inferences, such that the whole is greater than the sum of its parts, or an "Holistic and Synergistic Legitimation Research Process" (Collins, Onwuegbuzie, & Johnson, 2012) where holistic refers to adopting legitimation criteria from the community of practice and synergistically refers to the coherence of the mix of methods supporting each other throughout, not just the existence of the two.

Converting the video of preschool activity by transcription is a *conversion* of qualitative data into quantities of words in the structure of utterances with some capture of other quantities such as a smile, frown, eye gaze or body language where such factors influenced the meaning of what happened as deduced by the transcriber. After this step, this study uses what Chi (1997, p. 280) calls the "most conservative way" to combine methods wherein the predominant quantitative treatment of data uses further qualitative analysis only as an aid to interpretation and understanding. In the current case, the problem of legitimation of the integration is greatly lessened by using the same data source, obtained at the same time for both quantitative and qualitative analyses.

The study uses quantitative data firstly with the unit of analysis as the "room" (one teacher and a group of children) to distinguish the frequency and variety with regard to SSTs, questions, acknowledgements, variety of vocabulary and Gricean maxims used. The analysis then focuses in closely on SSTs to examine precisely how they were initiated and sustained, using both the quantitative data of preselected factors as well as a discourse analysis as a qualitative approach. Thus, the approach is a quantitative dominant mixed study (Johnson et al., 2007), taking firstly and primarily an outsider's view of the phenomena, the researcher-observer or "etic" view (Onwuegbuzie et al., 2011) with the mixing of the "emic" or insider viewpoint coming not from interviews of the participants as is often the case in qualitative research, but from their actual dialogic interaction as transcribed. This makes the legitimation of this step primarily dependent on the interpretive arguments as the results unfold. The *Methods Navigation Guide* shows location of the discussion now

moving to the bolded and shaded area.

1. Alignment with Community of Practice	↔	**2. Alignment with Community of Study**

Alignment with community of study

Context of study

The four-year-old preschool program is the predominant form of formalized education leading to school entry in the Australian state of Victoria. This program was chosen as the study focus as it is distinguished from other childcare or preschool programs by two factors.

Firstly, the state government funds all four-year-old children for 12 hours per week of preschool education in the year prior to their entry into primary school. To be eligible, children must be four years of age by April in the year of school enrolment, and not have been previously enrolled in such a program. Children enrol in their chosen preschool (kindergarten) which is then directly funded. The Blueprint for Education and Early Childhood Development (State of Victoria, 2008) states: "All children should have access to high-quality early childhood services. We will increase participation so that a higher proportion of children benefit from a four-year-old kindergarten program in the year before they start school" (p. 25).

Secondly, the Blueprint states that all teachers in these programs must be qualified early childhood teachers with a minimum of a two-year tertiary degree. This is to increase the likelihood of finding effective personalized teaching strategies in these settings (Barnett, 2003; Barnett & Frede, 2010; OECD, 2006; SCRGSP Steering

Committee or the Review of Government Service Provision, 2008), although others would contest this proposition (Early et al., 2006; Howes et al., 2008).

Selection criteria

Because one aim of the study was to identify effective personalized teaching strategies, preschools were not selected randomly, but rather through nominating preschools considered to be implementing best practice by researchers and other qualified early childhood educators according to their own understanding and beliefs. Other researchers in this same field (Whitebread et al., 2009) avoid random selection of teachers and make a deliberate selection "based on evidence of a high level of skill as early years educators" (p. 69). Because the effect of these teacher practices on thinking development could be confounded by examining preschools of children only from high socio-economic and therefore highly literate homes, schools were sought that drew from lower socio-economic status (SES) areas, so that these effective practices would have the best chance of influencing differences in child response to teacher interaction strategies. Thus, there were two criteria for adding additional schools to the study: quality program, and low or medium SES population served.

Recruitment of schools

Preschools in the Melbourne metropolitan area and in a rural area within 100 kilometres of Melbourne and meeting the aforementioned criteria were then approached using a package of material explaining the project. Those drawing from the lowest socio-economic status (SES) neighbourhoods were approached first, but most refused to participate as they were already overloaded with intervention programs. The non-inclusion of program-loaded low SES schools was seen as acceptable, as these programs might confound the usual practice of teachers. The next

higher SES tier of schools was then invited to participate with the result that over the three years of the study, 14 preschools that drew on high to medium SES neighbourhoods and the destination primary school were identified and agreed to participate. In the third year cohort, two preschools that drew on low SES neighbourhoods, but did not have confounding other intervention programs were added, increasing the total preschools that agreed to participate to 16.

At meetings with teachers, the study was explained and they were given a letter outlining the scope and aims of the research and a consent form. When consent was obtained, a formal data collection timetable was negotiated. Where both preschools and destination schools agreed to participate, parents of the four-year-old preschool entrants were given the same letter as the teacher received and a consent form. Within the selected 16 schools, 25 teachers were initially enrolled in the preschool study with two subsequently dropped for shortness of video recordings. The remaining 23 teachers engaged 136 children in the selected activities.

Participant demographic characteristics

School and room SES

The research schools drew children from one or more neighbourhoods whose SES status was calculated based on where specific children lived according to their postcode, referred to as Socio-economic Indexes for Areas (SEIFA) (Australian Bureau of Statistics, 2008). The SEIFA has measures of disadvantage, economic resources and a scale of education and occupation. The scale chosen for this study, the "Index of Relative Socio-economic Advantage and Disadvantage", hereinafter simply referred to as SES, balances both challenge and opportunity and is recommended in the SEIFA explanation as the most appropriate for measuring the

total influence of the neighbourhood on people's opportunity. Because the SEIFA calculation method was changed between the 2006 and 2011 census (Pink, 2013), only the 2006 census was used to rate neighbourhoods even though schools were recruited over three years from 2008 to 2010. Because some schools had more than one teacher, each "room's" children's neighbourhoods were calculated separately. Two schools had rooms that differed on SES, but by one rank only, which were nine and ten in one school and eight and nine in another. On the SEIFA decile scale from one to ten where ten was the highest SES, there were rooms with intake from SES neighbourhoods as follows: there was one room only at levels one, two and six; three rooms at level seven; nine rooms at level nine; and four rooms at level ten. This information was used in the results chapters to check for any systematic SES influences on children's measures of language quality.

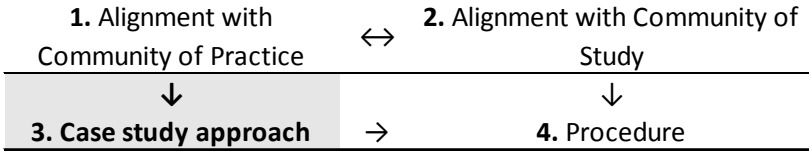
Teachers

The study rooms were taught by twenty-two female and one male qualified early childhood teachers with between two and seven years of tertiary education and with experience levels ranging from one year to 41 years. All had had at least two in-service professional development experiences in the two years before the study and all had either used professional journals or another source of information about language and literacy development.

Children

There were 136 children (57 male and 79 female) in the study with 117 of known age (86%). The range of ages for these children was 3.5 years to 6.4 years, with an average age of 5.1 years; 100, or 85%, were between 4.6 and 5.7 years. The average age of the children in a room ranged from 4.3 to 5.5 years. A correlation

analysis between children's participation rates, turn rates, MLU level or TTR level showed a low and statistically non-significant correlation with the following characteristics: average age, oldest age in a room, and the average of the two oldest aged children in a room. The *Methods Navigation Guide* shows the discussion now moving to point 3.



Case studies

The data set of videos of 23 teachers engaged in preschool activities with a small group of children constituted a complex series of naturally occurring dialogic events. They were observations of contemporary events linked directly to the children experiencing these complex cultural practices. Because the questions in this study contained significant theoretically driven propositions guiding the choice of cases and choices of data within cases, this was not a traditional ethnographic or purely qualitative study.

Interpretive case study "approach"

This study is broadly an interpretive case study (Stake, 1995) based on an interpretivist philosophy which assumes that knowledge about the meaning of social interaction is contextual, dynamic, and pluralistic. An interpretive case study aim of

contribution to knowledge is through understanding what is meaningful to people within specific contexts rather than trying to generalize causal explanations.

Multiple case study

Keeping each teacher as a separate case allowed comparisons between them and provided the possibility of tracking a particular teacher's communicative behaviours in relation to the group of children in that classroom. Keeping each room as a distinct case also allowed importantly a "within" examination of that room, in particular comparing Sustained Shared Thinking episodes to non-Sustained Shared Thinking dialogue in the same room with the same teacher and children in the same activities, thus controlling for unwanted variables and providing a high degree of confidence in the changes. Then comparing these "within" results across all cases allowed a degree of generalizability within this population of rooms. Any coherence found would add to the meta-legitimation by using these two approaches in analysis of the multiple cases.

Stake (2006) argued that a researcher's interest in a single case derives from its inclusion in a collection of cases which share enough commonalities to constitute a distinct "phenomenon". This group he calls a "quintain" (p. 5), playing on the name's derivation from the medieval military exercise of tilting at a quintain which was both the name of the target and event. The researcher's quest is to understand the target quintain by noting what is similar and different about the cases, or learning from repeated attacks on multiple targets (cases), which is the logic of the within and between examinations of these cases.

Claims of generalizable phenomena were not possible in this study with its low number of cases and non-random selection at levels of school choice, teacher agreement to participate, parents' permission and choice of activity for study. There may, however, be sufficient meta-legitimation in numbers, coherence and *within* cases results, to suggest that discoveries here, may exist more widely. The *Methods Navigation Guide* shows the discussion now at point 4.

1. Alignment with Community of Practice	↔	**2.** Alignment with Community of Study
↓		↓
3. Case study approach	→	**4. Procedure**

Procedure

Given the context of the study and the multiple case design of the research, the outline of the procedure was as follows:

1. Find schools, teachers and children willing to provide demographic data and have their conversations in preschool activities recorded by video.

2. Collect the data.

3. Transcribe the videos and check the accuracy by a second transcriber.

4. Code the transcripts according to the factors derived from the review of the literature that were considered markers of quality (see following section "Quantitative variable selection" p. 104) , and check for inter-coder agreement of a minimum of 20% of the transcript data.

5. Enter the coded transcripts for analysing and comparing data between speakers and transcripts into the Systematic Analysis of Language

Transcripts (SALT), Research Version 2012 SALT software (J. Miller & Aquiles, 2012), and then:

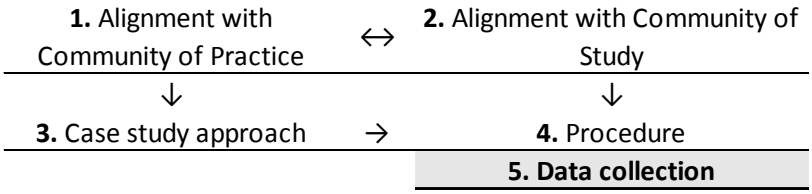
6. Export the data to Microsoft Excel (2010) for quantitative analysis.

7. Analyse the data at increasingly complex levels to see if critical factors group or follow in a consistent or typical pattern within conversations and might be related to teacher or children's quality of language.

8. Complete qualitative analyses to explore, explain or illuminate the quantitative data.

9. Look for and examine any patterns or systematic differences among the cases.

The *Methods Navigation Guide* shows the discussion now at point 5.



Data collection

Demographic data was obtained by questionnaire and government publications regarding the social and economic status of communities. Teacher-child interaction data was obtained by video recordings.

Video is commonly used by researchers when great detail and accuracy in analysing communicative interaction is required (Ratcliff, 2003) and where "sustained views of an event may permit more detailed analysis later" (p. 115) and it allows detailed analysis of micro-level features (Duranti, 1997). This "powerful microscope"

greatly increases the "interactional detail" that can be stored for "comprehensive analysis" (Derry et al., 2010, p. 6). Observations using video can collect details missed by live observation and avoids teacher self-report biases and inaccuracies. What teachers report as the type of activities they do in preschool has been found to be minimally related to how they actually behave (M. W. Smith, 2001, p. 167). Dickinson (2006) promotes the use of fine-grained measures where researchers "need tools that describe selected features of classrooms in greater detail… we need to capture what teachers and children talk about" (pp. 184-185), while Schieffelin and Ochs (1986) argued that understanding language socialization builds on a "rich understanding of children's discourse at the microanalytic level" which needs to be linked with cultural practices of communities "into which children are socialized" (p.168). Cazden (1992) refined this approach further as "socialisation of attention" (p.167) where the teacher provides the child assistance to focus attention on the most significant features of context "at the moment of encounter" (p. 306). This perspective is particularly pertinent for a socio-cultural conceptualization of children being socialized into a culture of thinking by teachers engaging them in dialogue with the particular structure of an SST, while also examining the functions of the identified indicators of quality discourse within that structured dialogue. Choosing to code quality indicators from videoed dialogue follows an established procedure (Graesser, Person, & Magliano, 1995) for investigating components of interactions to "quantify the quality" for analysis to "identify patterns of tutorial dialogue at a fine-grained level" (p. 500).

For consistency between rooms and to focus on activities where interactions productive of thinking were likely to occur, it was decided to specify two commonly

employed teaching activities, a group story reading and a writing/drawing activity. To add an opportunity for teachers to demonstrate unique or individualized classroom cultural input based on their individual preferences, teachers were asked to select an additional activity of their choice that they might regularly do which they considered contributed to literacy learning for their children. To be able to check for differences between these three activities, they were recorded, transcribed and coded as distinct sets of data, thus providing three transcripts from each room.

Some researchers consider that story reading is not open enough for interactive conversations and therefore they choose to observe other activities when looking for typical characteristics of interactions (Dickinson, Darrow, & Tinubu, 2008). Others suggest that there are many different things going on in story reading (Snow et al., 2001, p. 34) and these may be representative of types of interactions occurring in other settings (DeTemple, 2001, p. 43). A quick viewing of the current data set of book reading sessions revealed a substantial number of teachers seemingly happy to stop reading and follow a child-initiated lead or their own lead, off into extended conversations about everyday activities from the child's world. This appears to be *situated dialogue* within their cultural contexts (Bakhtin, 1986b; Gee, 1992; Vygotsky, 1934/1962, 1978) and thus *authentic literacy activities* (Purcell-Gates, 2007) which are thought to be the most productive sort of conversations at this age for language learning for literacy and thinking.

That some of the teachers do this and others do not in the reading activity is a difference between classrooms of great interest for this study. It was decided therefore that all three activities be included in the data set to get a wide sample of classroom interaction and maximize the time for each case. Rather than equalize the

amount of time across classrooms by cutting longer sessions, which then would raise the question of which part to cut, it was decided to analyse the data according to what the teacher considered a “complete” activity.

The quantitative data was then made equivalent across different activity lengths by calculating the rate per minute of all coded action. This was particularly an important approach for some teacher reading activities because they left all the exploratory talk until after the book reading was done, while others used the introduction to story reading to situate the story within the children’s worlds by exploratory talk.

The literature review indicated that 20 to 30 minutes of teacher interaction in conversations with children has been considered representative of typical behaviour (Dickinson, Darrow, et al., 2008; Girolametto, Hoaken, Weitzman, & van Lieshout, 2000; Justice, Mashburn, Hamre, & Pianta, 2008; Pianta, La Paro, et al., 2008), with one study analysing transcripts of two activities with a total time of 24 minutes (Turnbull, Anthony, Justice, & Bowles, 2009).

The science of “thin slicing” data in other areas of human communicative interaction research indicates that even video samples of a few minutes, when rated for particular patterns of interactive critical factors, can correlate very highly with much longer samples (Gladwell, 2005; Kraus & Keltner, 2009; Tom, Tong, & Hesse, 2010). What is necessary in these thin sliced cases is to have determined the critical factors for this study identified in the literature review.

Combining the three activities of story reading, writing and a teacher selected activity for each teacher of the 25 teachers who agreed to participate provided a case

of 9 minutes, a case of 12 minutes, two cases of a little less than 18 minutes, five cases at around 25 minutes and the remainder over 28 minutes. The two shortest cases were eliminated, as the teachers both seemed rushed and asked if they had done enough to satisfy the research team in the videos, they asked the children only a few closed questions, and they had little or no sustained two-way interaction. On the other hand, both cases of around 18 minutes appeared to be relaxed and naturally constructed activities, with teachers having sustained verbal exchanges inclusive of all children present.

Thus, the number of possible cases that matched the research questions and methodological approach regarding length of time and appeared to be authentically representative of the teachers' typical classroom culture was 23. With three activities recorded for each room, the final number of transcripts was 69. An analysis was made to find out if there were systematic differences between the three activities and also to check as to whether the logic of including all three was useful in finding instances of Sustained Shared Thinking.

Collecting video data at the preschool occurred at a time arranged with the teacher. Video equipment was set up at the place chosen for the activity in as unobtrusive a position as possible. Recording started when the teacher indicated she was ready. The camera was attended to at all times to be able to change direction and focus as well as turn the camera off if an ethical issue arose precluding videoing, such as when a child without image approval strayed into interaction or other issues arose.

The camera used was a Sony DVCAM-3CCD mega pixel digital video camera recorder model DSR- PDX10P equipped with a Sony Electret directional polar pattern

microphone model ECM-NV1 to minimize off-axis noise and enhance a focused pick-up of conversation. The microphone remained attached to the camera during all recording and no lapel microphones were used.

Habituation by the children to the presence of the camera appeared to have occurred by the time recording started almost universally as there was only one case where a child obviously interacted with the camera in a display of gestures and this occurred by this student only a few times for a total of less than one minute. There were infrequent incidents of participants obviously looking at the camera, and these were occasional glances (less than four instances in any activity) of short duration (one second or less).

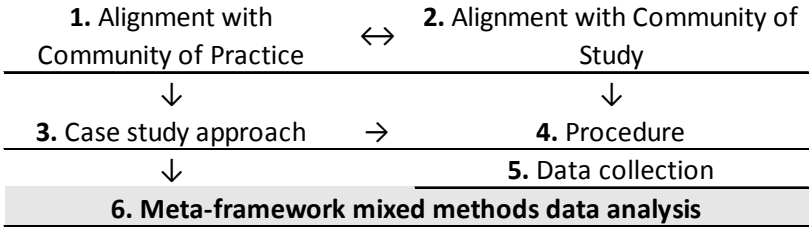
The two main alternative methods of dealing with video data are to code directly from viewing or to take the time-consuming alternative of transcription. Transcription of the complex interactions in these teacher-led activities is a mixed method typology of data conversion or transformation of qualitative data into quantitative data (Teddlie & Tashakkori, 2006). This has been termed "quantitizing" (Miles & Huberman, 1994) which converts the qualitative data into numerical "code" for statistical analysis. Not to be confused with later "coding" of research variables, these "codes" were in terms of specific words, utterances, turns and non-verbal indicators of meaning. Transcripts are not an object reality, but are based on choices that are "ultimately theoretical judgements" such that transcription is part of the analysis based on the "purposes of the analyst" (Gee, 1999, p. 106). These choices have been refined from the literature review and now will be further elucidated based on methodological considerations.

All changes and queries from the professional transcriber were checked by the researcher and where there were substantial differences that could influence meaning, videos were reviewed and checked again. Where no agreement could be reached as to what words were said or by whom, those words were marked unintelligible. Transcription followed SALT 2012 protocols (J. Miller & Aquiles, 2012).

Once the qualitative data was converted to transcripts, it was necessary to code them for analysis. Developing a detailed list of codes was derived in the light of two main criteria: what has been done in the past by the community of researchers investigating these phenomena, and based on this information, what is measureable and lends itself to analysis, typically addressed with quantitative methods (Yin, 2006, p. 43). Other researchers in the field have taken this approach (Siraj-Blatchford et al., 2003) and the selection of factors in this study therefore closely followed what have been found previously as significant key markers of quality conversations that enhance thinking as well as patterns of thinking. As this study is primarily an examination of Sustained Shared Thinking, these factors will be examined for their association with SST episodes.

In attempting "to explain quantitative patterns" including teachers' behaviour and "interaction patterns in the classroom" (Foster, 1996, pp. 72-73), it is important to make both quantitative and qualitative comparisons and find links between data sets. This approach also applies to collaboratively constructed dialogue (Graesser et al., 1995) and preschool teacher-child dialogue (Dickinson, Darrow, et al., 2008). Pattern matching is a common technique in case studies because internal validity is strengthened if patterns are found (Yin, 2003). The *Methods Navigation Guide* shows the discussion now at another major alignment between the community of practice

and the community of study in the decisions to be made for data analysis now that the procedure and collection of data have been evaluated.



Meta-framework for mixed methods analysis techniques

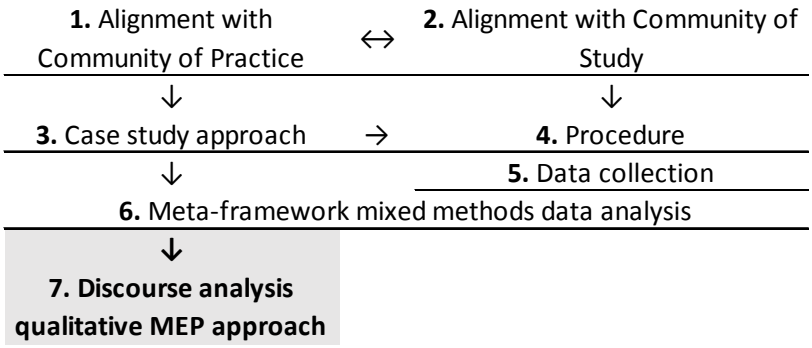
This study purpose aligns primarily with what Greene, Caracelli, and Graham (1989, p. 267) term a *development* design, characterized by "a sequential timing" where "one method is implemented first" and the results are then used to help select samples to "inform the analysis for the other method", with the different methods assessing the same phenomena "conceptualized within the same paradigm". The purpose was also to use the two types of methods to expand or explain more clearly what the results of the other method had found. This is called a *complementary* purpose, where one method helps elaborate, enhance, illustrate and clarify the results of the other method. In this case, both methods analyse the same data, not, as is often the case in mixed methods, where there is a time delay between collecting different kinds of data. A further distinction to other sorts of mixed methodological studies was the intention here of "emphasizing an in-depth understanding of the particular context and people studied" (Greene, Kreider, & Mayer, 2005, p. 274).

Chi's (1997) eight steps summarizing the points where researchers commonly integrate different methods is used to justify the decision to integrate as the process of discovery unfolded along a pre-planned framework that allowed flexibility for excursions of inquiry based on each iteration. The framework is discussed shortly

while the integrations will be seen as the results chapters unfold. All of this was based upon one main unit of analysis.

The main unit of analysis throughout was the room or teacher, as the *context* in which the socio-cultural-historic activity system is meaningful and functional (Cazden, 1988) and where the child is guided to focus on the particular patterns and sub-patterns "in the Discourse models of the person's sociocultural groups" (Gee, 1999, p. 68). Identifying each child in the transcripts served the purpose of connecting what happened within this unit of analysis to possible influences on the children that test the effectiveness of that unit in terms of child participation. In addition to the ultimate analysis aims, attributing actual words in use and participation in conversations to a particular child allowed these important factors to be available to measure participation rates by turns. Knowing how many children a teacher conversed with in any activity or within a particular episode of Sustained Shared Thinking and how many turns each child had within these dialogues is a cultural variable in a room which might be called *inclusiveness*. As the question was specifically about constructing SSTs with a group of children, examining inclusiveness could be important, if for no other reason than to test for alternative explanations in terms of one or a few loquacious children having a main effect in factors related to construction of SSTs. The *Methods Navigation Guide* shows the discussion now moving to a discussion of the rationale for discourse analysis which

informs both the qualitative and quantitative data analyses.



Discourse analysis selection justification and implications for choices

This study depended on making sense of teacher-child talk including but beyond the quantitative data, and therefore a discourse analysis framework was needed that provided a coherent treatment of both quantitative and qualitative data. For a discourse analysis system based on a sociocultural approach that accomplishes this, the Microethnographic Perspective (MEP) (Bloome et al., 2005) which was specifically developed for the study of classroom language and literacy events was followed. Specifically, it provides perspectives, understandings, and tools for the analysis of transcripts with moment-by-moment classroom events, as well as the theoretical and methodological insights to support a logic that each new research endeavour will need to adapt these tools. Unlike much ethnographic research, MEP speaks of "methodological warrants" (p. xviii) obtained from theories guiding the research and which allow for choosing significant categories of interest prior to the collection of data. The analysis of how MEP fits within this study is part of the methodological literature review undertaken in this chapter and is therefore more complex than simply adopting some of its tools for the qualitative discourse analysis.

MEP makes clear that counting turns, vocabulary and utterance types is only useful and interpretable in terms of "participation structures" (Bloome et al., 2005, pp.

27-28) and that researchers need to make an argument about the function and meaningfulness of that structure. This is consistent with using quantitative data in terms of SST episodes and how the teacher's discourse functioned in terms of making meaningful the children's worlds of experience that they shared within the SSTs. All utterances by children and teachers recorded were considered "public utterances" defined as "those audible to the teacher and the class" (Alton-Lee, Nuthall, & Patrick, 1993, p. 53). This means that, even if directed at one particular other, words that were picked up by the microphone connected to the video camera constituted part of the participation structure for all.

MEP considers language practices as social events with multiple levels of structure and meaning. The five theoretical tools for the analysis of classroom language events and how they relate to this study are:

1. **contextualization cues**, which include verbal, nonverbal and prosodic signals and the manipulation of artefacts, which informed transcriber decisions on "what counted" as a meaningful turn, comment or question contributing to participation in a blend or SST episode;

2. **boundary-making**, which involves making a decision on where a text ends and another begins, particularly useful for the theoretical logic of practical decision making regarding the beginning and ending of SST episodes, Gricean maxim events and blending events, as well as when an interchange does not qualify as a meaningfully coherent pattern;

3. **turn-taking** as important to successful and meaningful interaction, especially in terms of a meaningful SST, Gricean maxim and concept formation using blended space;

4. **negotiating thematic coherence**, which concerns the organization of meanings obtainable throughout particular events, where the meanings may be ideational, interpersonal, textual or metafunctions (Halliday, 1993, 2004), which is useful in understanding Gricean maxims and concept development; and

5. **intertextuality**, that is, the juxtaposition of texts where one text refers to another or shares a common referent. Bakhtin (1986b) insisted this was the case for all texts as "situated action" (Wertsch, 1991, p. 50). This understanding of intertextuality is also at the heart of implicatures in Gricean maxims and justifies the logic of tracking blends throughout the dialogue and beyond an SST episode. The blend here is only the visibly related intertextuality, limited to within the transcribed preschool activities and does not take into account texts from prior school or home experiences as do other analyses (P. Harris et al., 2004; P. Harris & Trezise, 1999).

In simple terms, this approach asks "who is doing what, to whom, where, and how through the use of language in classrooms" (Bloome et al., 2005, p. 49).

These tools have also been used to reveal structures or patterns in discourse that act like a chain of associations where teachers and children build on what each brings to the communication (Bloome et al., 2005, p. 36) rather than following cultural scripts of sticking to a "topic", and also to identify points in the conversation

where this shift occurs (p 34). These are the kinds of descriptive tools useful in identifying patterns of which an SST is a special case and finding where and how an SST starts. MEP also emphasizes that the "researcher must make an argument about the function (meaning) in the participation structure using evidence from *within* the conversation itself" (p. 33). This matches the logic for an analysis of an SST in terms of quality indicators used within them. The MEP perspective on classroom cultural practices is that they must be understood in terms of both continuity and change and that this is a key question for researchers (p. 99). If one considers the cultural practice of children listening while a teacher reads a book as "continuity", then departing from this into exploring children's lives or thinking outside this activity constitutes "change". Understanding this shift to SST from non-SST dialogue as change from continuity, requires the fine-grained examination herein proposed and an analysis of SST starts as the point at which anything related to changing the conversation is most likely to present itself.

The methods Fauconnier and Turner (1998) have developed for the analysis of discourse that leads to learning in terms of new concept development are related to MEP's (Bloome et al., 2005) understanding of intellectual "locations" as social spaces rather than a space inside a single person's head (p. 235). Sinha (2005) demonstrates the usefulness of this kind of analysis using Fauconnier and Turner's methodology and shows how, from a developmental perspective, conceptual blending acts as a microgenetic process where cognitive strategies, social roles, relationships and identities are collaboratively negotiated by preschool children through communicative interactions during play. Also in children's play, Sustained Shared Thinking has been used to understand these social interaction contributions to concept development

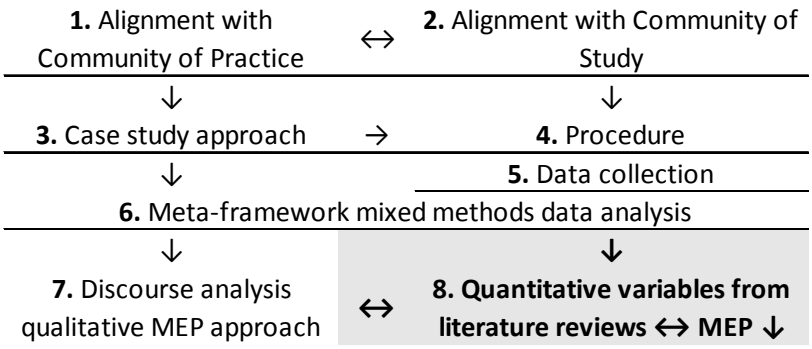
(Siraj-Blatchford, 2009). This is similar to Hutchins' (1995) demonstration that the "cognition" of knowing something is often shared among a number of people in a particular space or place. Children and teachers may not share the same intellectual locations although they share the same physical location. MEP has the goal of naming and acknowledging intellectual locations so that they can be made visible, which, in this study, are the episodes of Sustained Shared Thinking. Furthermore, MEP argues that a teacher's use of questions "opens a space where students can bring to bear their experiences" (p. 56). This equates with Hutchins' (2005) concept of *material anchors* where children manipulate objects and real life experiences in conversations as one of the cultural "integration networks" where "the manipulation of the blended space can be learned" (Fauconnier, 2001, p. 6). Thus an SST acts as a dialogic space, a material and intellectual space and a neurologically blended space all at once with the analysis of what is going on undertaken in this study as a snapshot of a dynamic process and not a complete analysis of what the child brings to the blend from prior intertextualities.

It was important in this study to understand the interplay of *structure* and *substance* (Bloome et al., 2005, p. 99) within what are called *participation structures* defined as a common understanding by participants of the pattern of turn-taking within a shared activity. These structures provide coherence and connection pathways for the *substance* which is "the system of claims, warrants, reasons, groundings, and backings of what is said" (p.92).

The *substance* then of the details of what is said takes on additional meaning because of the *structure* of patterns within which it is uttered. One cannot assume meaning is inherently in the structure because participants' reactions to each other

must be accounted for, and this is beyond the pattern itself and beyond any one utterance, but a combination of a number of factors. Different teachers have different "rules" and expectations about what children can do during book reading for example, and this is another way of describing the "culture" of the classroom.

An argument, therefore, must be made about the function and meaningfulness of a participation structure using evidence from the conversation itself, from how people act and react to each other. Therefore, the logic of this design requires looking at a variety of levels at the same time, as any one level cannot be "understood" standing alone. Fenstermacher and Richardson (2005) suggested that further research into quality teaching use a greater variety of variables, subdivision of variables, of both high and low inference "in the same investigation" (p. 197). The *Methods Navigation Guide* shows the discussion now moving through a major intertextuality between the main literature review, the selective review in this chapter and MEP discourse analysis logic toward the decisions of quantitative variable selection.



Quantitative variable selection and organisation

The decisions on variables selection and how these will be organised follows, starting with an overarching structure within the participation structure of the dialogue.

A hierarchy of increasingly complex levels of the quantitatively measurable variables for coding and analysis was created as a means of organising the range of indicators related to enhancing language and learning to think. The levels start with the simplest and most easily agreed forms of data and then proceed to more complex and contentious constructs that require increasingly more insight, argument and discernment to achieve intercoder agreement and legitimation for the research community. The first five variables are what Fenstermacher and Richardson (2005) call low inference measures (LIM) that are easily observed and do not require judgement of effect or meaning. High inference measures (HIM), on the other hand, require interpretation of the flow and context. The first five levels are also measures that relate to both what is happening in terms of how the dialogue is constructed on fine-grained levels, and at the same time are a consequence of the more complex structures, such as a teacher question. An example would be the teacher asking a closed question versus an open question, a high inference decision, and the effect on the children's answers in terms of the low inference measures of the number of total words (NTW), type-token ratio (TTR), and mean length of utterance (MLU).

For example: Teacher: "Are you happy?" Child: "Yes", compared to the teacher asking: "Why are you happy?" which would have a longer and more complex answer. In this sense, the first five levels can be considered outcome data, or dependent variables, operating in the immediacy of the dialogue and as outcomes of

the operation of independent variables such as question types. Variables by levels of increasing complexity and inference follow.

1. *Number of Total Words (NTW)* to measure children/teacher talk ratio in dialogue and as a constituent of TTR. This was measured in non-sustained shared thinking dialogue, SST dialogue and in the first four turns of SST episodes, to compare differences. The SALT program counts only root words, not iterations. Level of confidence depends on transcription agreement (two transcribers) and the accuracy of transcription in terms of SALT program protocols (details discussed below).
2. *Type Token Ratio (TTR),* that is, the number of different words used as a ratio of total words, as a measure of complexity of vocabulary, and measured for all children combined (as though one speaker) (Heisler, Goffman, & Younger, 2010) and the teacher (Dickinson, Watson, et al., 2008). Level of confidence relies on accuracy of transcription and logic of SALT program TTR which counts only root words (not versions of the same word), discounts repeated words and incomplete words.
3. *Utterances* as complete communicative units (Carter & McCarthy, 2006), usually bounded by silence as breaths or pauses (Aronoff & Rees-Miller, 2001), or identified "by attending to phrase-final intonation" (Dickinson & Porche, 2011, p. 873), which could consist of single words, phrases, clauses and clause combinations spoken in context, and as Bakhtin's unit of analysis because "it focuses on situated action" (Wertsch, 1991, p. 50). The level of confidence depends on transcriber accuracy and agreement on this.

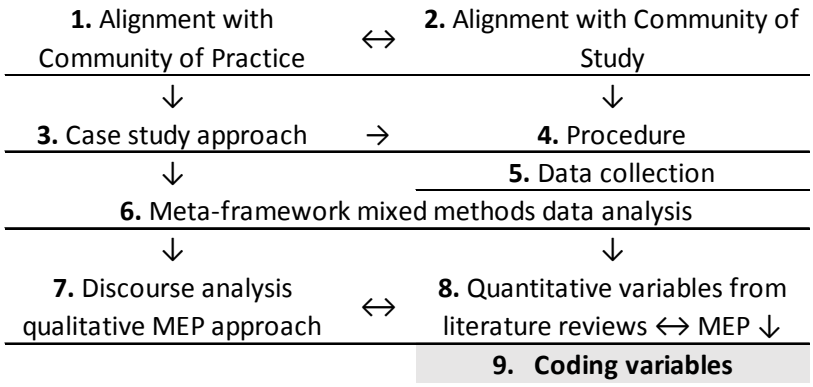
4. *Mean Length of Utterance (MLU)* in terms of the number of *words* in an utterance (as opposed to counting morphemes). MLU measures a higher level of structure (the utterance) and is often used to measure language development in preschool children (Huttenlocher et al., 2002) sometimes with SALT software (Dickinson & Porche, 2011; Dickinson & Smith, 1994; Paulson et al., 2004). The level of confidence includes items one and three above, as well the SALT program logic of calculation (explained later).
5. A *Turn* consisting of one or a series of uninterrupted utterances by a single speaker, or a meaningful gesture. Each child turn was counted separately, even multiple children answering a single teacher question, if not said simultaneously (chorus response). The level of confidence is based on the two transcribers' accuracy of identifying speakers. Turns were counted as:
    a. *Total turns* in an SST consisting of all children and teacher turns and used to measure the "length" of an SST.
    b. *Total turns per minute* as a rate of the amount of SST activity taking place, making comparable the different length activities in different rooms.
    c. *Turns per child* were counted for each child in an activity so that participation balance could be calculated as a measure of teacher constructed culture.
6. *Teacher prompts or feedback* as a *question* (13 categories) from (Siraj-Blatchford & Manni, 2008) or an *acknowledgement* (four categories), measured over the whole dialogue and within SSTs. Ultimately, the categories were collapsed into *open questions* (from seven open categories), *closed* questions (from three closed categories) and *total questions* (closed, open and

two categories of statement questions), and *acknowledgements* as a single category collapsing all positive acknowledgements. The level of confidence depends on intercoder agreement, reported later. Within this category, acknowledgements would be considered a lower inference level than determining what kind of question was asked.

7. *Teacher requirements in terms of Gricean maxims* (ten categories) from (Grice, 2002/1967) could be a simple reformulation of the child's offering to model compliance to the cooperative principles and could be with or without a question directed to the child to confirm if that was what they meant. Also the teacher might use a question to ask the child to clarify a deficiency in upholding the maxims. In either case, the teacher modelled or otherwise required compliance with Grice's maxims of the cooperative principle. The level of confidence depended on intercoder agreement.
8. *Blends* (Fauconnier, 1997) were counted as single episodes and could be as few as three turns or, more often, many turns. Often a blend was interspersed across other dialogue where the teacher repeatedly returned to the theme or concept to add information, prompt or otherwise help the child construct or expand their understanding. The level of confidence depended on intercoder agreement.
9. *Sustained shared thinking episodes* (SSTs) from (Siraj-Blatchford et al., 2002) were counted as single episodes with six categories based on whether the teacher or a child started and who led the episode. "Leading" an SST was defined as who provided at least two-thirds of the challenging questions or statements that extended the dialogue. The level of confidence depended on intercoder agreement.

10. *Overall complexity of helpful quality indicators,* measured by adding the teacher's rates per minute of SST turns, open questions, closed questions, acknowledgements, and Gricean maxims and the total number of blends. This was accomplished by adding the z-scores of the various measures so they were comparable. The "logic" of this is justified and argued in the analysis as the results unfolded, but suffice it to say here that each of the indicators included had large differences between teachers and between each indicator, indicating that each measure appeared to operate independently of the others over the 23 teachers. The level of confidence in this complexity depended on the previous levels as well as the logic of argument and analysis.
11. *Functional differences* of the SST episodes was qualitatively explored. The level of confidence for these insights is within the argument in each case.
12. *Patterns* of all or any of the previous factors combined is the highest and most difficult level to have confidence about in consideration of the limited number of cases (23). In this study, only the potential of this kind of approach is demonstrated as a way to uncover possible patterns, rather than a claim of definitively established patterns. As the study is "prospective", the low numbers are acceptable in terms of statistical power in the "between" comparison, whereas the "within" comparison is much stronger and may also produce patterns. The *Methods Navigation Guide* shows the discussion now

moving into the details of coding the quantitative variables selected.



Coding of variables

The codes that were derived from these levels and written as they appear in the transcripts for analysis by the SALT software are shown in Table 1, which was also used as the first document for training the intercoders.

Table 1

Independent variables as transcript codes, definitions and examples

Variable code & short description	Variable full definition	Examples
[t1] = **Turn** number of a Shared Sustained Thinking (**SST**) episode	**Turn**: A unit of communication, either verbal or not, made by one participant toward the group or a person. A series of uninterrupted utterances constitutes one turn. Switching from addressing one person to a different person is counted as another turn for the same participant, usually the teacher between 2 children and/or topics. **SST**: A series of **turns** where child thinking is *valued, visible,* and *actively promoted* by the teacher while: a) scaffolding or extending ideas or concepts; b) discussing or exploring events or experiences; c) modelling language or behaviour; d) using language or ideas playfully or creatively. Teacher is usually challenging or expanding children's thinking through questions, hints, or examples.	T what's growing (scribing with her finger path of a growing root) [itt] [t1]? M the root [t2]. T the root. T now, do roots grow up (T pointing up) [t3] ? C No, down [t4]. T Down, down deep into the soil. T (so they) why do they grow down into the soil as roots [t5]? D So they can grow [t6]. T so they can grow [t7]? G what's that [t8]? T That's a root, they suck up all the water and nutrients [t9]. M Look at the fairy wand, what's the fairy wand for [t10]. T Do you think it looks like a fairy wand [t11]? U No.
[ict] = initiated SST episode by a child but then led by teacher	A child question or statement initiates an SST episode, while the teacher then leads the dialogue, with at least 2/3rds of challenging utterances.	P this time I'm going to do pink [ict] [t1]. T (nodding) you can [t2]. P change [t3]. T it's changed from the big purple kite to big pink kite, has it [t4]? P yeah [t5]. (more turns follow)
[icc] = initiated SST by a child and led by the child or children	A child question or statement initiates an SST episode, and the child or children lead with at least 2/3rds of challenging utterances. In the following example, although short, the SST is significant because the child initiated it through challenging the truthfulness of T's assertion, gains T's agreement that the concepts of hat and crown are overlapping, with T adding a thought about what kind of hat a crown is, e.g. special. In this case there is only one challenge so child gets the lead category.	T (hmm) it's a little bit like a crown. T You can make a crown instead of a hat. J A crown *is* a type of a hat [icc] [t1]. T It is [t2]. T It's a special hat. T Would you like to make it into a crown, Jocelyn ? J No thank you [t3].

Variable code & short description	Variable full definition	Examples
[ice] = initiated SST by child and equal or shared lead	A child question or statement initiates an SST episode, and neither children nor teacher contributes 2/3rds of challenging utterances. In this example the teacher's only challenging question is "why are they easy", with the other questions simply confirmatory. Whereas, the child is supplying the storyline and continues to impress the teacher with her thinking.	P Trees are easy for me [ice] [t1]. P they're easy. T are they? T why are they easy [t2]? P cause, I did one for my > P for Father's Day [t3]. T did you [t4]? P (nods yes, slightly) [t5]. T (gives P a surprised look pointedly, like 'unbelievable') [t6]. P that's how I <know how> [t7]. T <on a card> ? T did you [t8]? P yes [t9]. T oh [t10].
[itt] = initiated SST conversation by teacher and led by teacher	A teacher question or statement initiates an SST episode, and the teacher leads with at least 2/3rds of challenging utterances.	T How does he look there [itt] [t1]? X Sad [t2]. T Sad, do you think it is [t3]? T is it just sad? T Why is he sad? X I don't know [t4]. J Because he doesn't like egg/s and ham [t5]. T And what's *Sam_I_am* doing, (is he) does he stop bothering him [t6]? J No [t7]. T Do you remember that big long word that we used [t8]? T it starts with a FR, FR. J No [t9]. T That word that sometimes we feel we can't do something <when someone> [t10] ^ E Frustrate/d [t11]. T Frustrate/d [t12].
[itc] = initiated SST by teacher but led by child	A teacher question or statement initiates an SST episode, and a child or children lead with at least 2/3rds of challenging utterances.	This is so rare I can't find one, but need code to show that we looked and came up with very few or none.

Variable code & short description	Variable full definition	Examples
[ite] = initiated SST by teacher and equal or shared lead	A teacher question or statement initiates an SST episode, and neither children nor teacher contributes 2/3rds of challenging utterances. In this example, the teacher has more challenging statements, but in this count it is only 5 to 3 in favour of the teacher with the children having challenged twice.	T do you need wings to fly [t1] [ite]? C no [t2]. T you don't [t3]? E (shakes head no) [t4]. T we'll have a think about that one [t5]. X super_dogs can turn into a spaceship, so they can fly [t6]. T (ah but ooh) but you just put your hands out. T do super_dogs have wings [t7]? U no [t8]. T yeah [t10].
[ck] = Closed Question with Known Answer	A question to which the answer is known by the teacher and there is only one, or very limited number of acceptable responses.	What's he doing? Is he flying or running?
[cn] = Closed Question with NOT Known Answer	A question to which the child holds the answer. A narrow framework is offered which limits possible responses to a small selection.	What is your favourite story? What do you do at home with books?
[cy] = Closed Question requiring Yes / No answer	A question which requires a yes or no response. Often this is made clear by child response.	Can bears fly? Were there clowns there? Was he happy about that?
[oe] = Open Question asking child to Expand thinking	A question to which the child is encouraged to reveal or expand their thinking.	What made you say that? How do you know? Why are you doing that?
[op] = Open Question asking child to Predict future or next event	A question to which the child is encouraged to predict what may be about to happen, real or fiction.	What do you think is next? What is going to happen if you do that?
[oi] = Open Question asking child to Infer from text/illustration	A question encouraging child to make an inference. Examples are during storybook reading. The same questions with no explicit clue in the text would be asking an opinion of the world or experience (next code).	Why do you think she wouldn't wear it? Why does he not like her to frighten the fish? What's going to happen now?

Variable code & short description	Variable full definition	Examples
[ow] = Open Question asking child for World knowledge/experience	A question to which the child is encouraged to answer using their greater knowledge of the world or from their own experience outside school, where teacher is unsure of their knowledge or experience and how they think about it.	What are you really good at doing ? Did they have glass in those times, back a long, long time ago? Octopus, where do you think it might live?
[oo] = Open Question asking child for Opinion	A question to which the child is encouraged to give his/her own opinion.	Which part did you like? What colour do you like to draw with? Where to you like to go?
[oc] = Open Question asking child for Clarification regarding a response	A question to clarify the child's initial response. This is technical clarification rather than asking child to reveal thinking.	It doesn't look like a boat, this one? Which one do you mean? Which part does that?
[sa] = Statement question acknowledges child's response	A question that acknowledges the child's response, often in the form of a restatement with an added question, which doesn't require a response.	It looks a bit the same, doesn't it? People do like to ..., don't they?
[si] = Statement Question providing further Information	A question which provides further information, often a combination of a restatement with new information followed by *isn't it? doesn't it?*	It seems very hard to make them happy, doesn't it? She **was** helpful, wasn't she?
[ri] = Question seeking child Recall of info / prior experience	A question which seeks to recall information previously learned or experienced. Teachers often use an "oral cloze", marked ~ to prompt recall during book reading. These are coded as questions because the teacher expects an answer to fill in the gap left at the end of her statement.	What have we been exploring for the last week? T He did/n't need the blackberry/s in the end, cuz he liked [ri] ~ B marmalade. T marmalade is what he liked.
[pr] = Pseudo choice Request Question actually statement / demand	A question which is usually a statement or demand and does not add information and could be answered yes/no, but child knows they aren't really being asked.	Are you ready to listen to me? Do you want to come a little bit closer and sit down here? Are we each taking our turn in order?

Variable code & short description	Variable full definition	Examples
[ap] = acknowledge child product by T	The teacher simply acknowledges child's contribution as correct or acceptable without labelling it good or special by her words or tone. Often done by restating what the child has just said with a falling tone. This is by far the most common type of acknowledgment.	T Right (flat tone), yes, OK, uh huh, T The boy did jump into the water. T marmalade is what he liked.
[at] = acknowledge talent or fixed attribute by T "good" "clever"	The teacher acknowledgement is in the form of a fixed attribute such as a talent or intelligence, usually a form of the verb *to be.*	That was smart. You are a good artist. You are so clever.
[as] = acknowledge strategies of thinking	The acknowledgement is in the form of specifying a thinking strategy or thinking word that also implies effort: asking curious questions, guessing at explanations, observing things, noticing connections or differences by comparing, imagining things, concentration.	That used a lot of **imagination**. You **remembered** how we... You **compared** how they were different, good job You saw a **connection** between... Thank you for your hard **concentration** just then.
[ae] = acknowledge effort by T as opposed to products or talent	The teacher makes a statement or question which acknowledges or praises the effort a child has just made rather than stating the child has a fixed inborn talent, or intelligence.	T you worked really hard. T that's a good try. T Thank you very much for all your effort.
[av] = acknowledge child using a virtue by T	The teacher acknowledges a virtue the child has used in action or talk. In the last example, the virtues are implied, but only because the word ***how*** is used instead of "you **are** a good listener" which would imply a fixed attribute.	T you were very patient waiting a turn. T good on you for helping Oscar. T I like how Eli was listening. (implied: cooperation toward group activity or self-discipline)
[gqi] = Gricean maxim Quantity, contribution of Information as required	A person either asks for more information so the original statement becomes meaningful to them, or a teacher will simply add the missing information, as in the 2nd example, where story reading at night isn't wrong, but could use more information to make it a better communication.	How do you know that? A (um) when it/'s night_time. T night_time, just before you/'re go/ing to go to bed [gqi] ? A yes.

Variable code & short description	Variable full definition	Examples
[gqv] = Gricean maxim Quantity, not too much info, Verbose	Sometimes too much information is also irrelevant to the moment, so double coding is often called for as in this first example when a child is telling the story before the teacher gets to it in the book reading, framed in a pseudo question.	N (telling everyone what is next). T we haven't come to that part yet, have we Nathan [grr] [gqv] [pr]?
[gtf] = Gricean maxim Quality, Truthfulness not False	Often in the form of a challenge to a claim which doesn't appear true, natural or likely. Especially during play or pretence in storybook reading, children will start claiming things and the teacher challenges this. If it goes on and the children don't back down, the teacher may then start asking for evidence to support the claim, as in the next code.	T (reading) Peter Pan flew out the window. D I can fly. T can you [gtf]? F my brother is big too. T when did you get a brother [gtf] ?
[gte] = Gricean maxim Quality, Truthfulness Evidence for	One participant asks another a question or challenges them and requires further evidence for a statement or claim. The example is from book reading *Can Bears Fly?* where the bear in the book is running with its arms out. The teacher challenges the child first, then provides her own evidence from the book by the picture of him running as well as the text, and then reiterates by again asking a challenge question that depends on evidence from the book.	T can : you : fly [itt] [t1]? X **he** can, see (pointing to picture in book, e.g. child claims bear is flying as its arms are out) [t2]. T you think he's flying [cy] **[gte]** [t3]? T this said though (pointing to book). T (reading: he RAN as fast as he could to see the bird/s). T is he flying there or is he running [ck] **[gte]** [t4]? A running [t5]. T he's running [ap] [t6].
[grr] = Gricean maxim be Relevant	One participant reformulates what another has said to make it relevant, OR asks a question trying to clarify how what was just said is relevant to the conversation or current context. In this example, first coded is the challenge for [grr] and also not enough information [gqi]. Then teacher models how to give enough information [gqi] in an orderly fashion [gmo] and what is relevant [grr] to this, e.g. the exit sign.	T what does exit mean again [ck]? T what do we use those doors for [ck]? H walk/ing. T walk/ing where [ck] [gqi] [grr]? H outside. T outside [ap]. T so, those signs tell us that we can get outside, [gqi] [gmo] if we look for an exit sign [grr].

Variable code & short description	Variable full definition	Examples
[gmx] = Gricean maxim Manner, avoid obscurity of eXpression	One participant reformulates an obscure use of expression into something acceptable, challenges or asks a question to clarify such use.	L we have a butterfly. T I didn't see them when I went out. T where were they [cn]? L they were flighting away. T they all fluttered away [gmx].
[gma] = Gricean maxim Manner, avoid Ambiguity	This maxim often accompanies [gmi] or [gqi] since lack of a single antecedent or lack of sufficient information can be the source of ambiguity. In the 2nd example, the teacher first challenges a statement lacking the proper form, and then models what should be said. Both are coded because the first teaches what is not acceptable and the other teaches what does follow the rules.	T what are the fish going to do [oi]? C run. T swim away, aren't they [si] [gma]? E I'm really good at making a set-up. T making what [oc] [gma] [gqi] ? E making block/s. T you are very good at making blocks [gma] [gqi].
[gmb] = Gricean maxim Manner, be Brief	One participant reformulates the statement into an acceptable length or challenges length of statement.	T How can you say that in a few words [gmb]? T Do you mean the cat was uncomfortable [gmb]?
[gmo] = Gricean maxim Manner, use Orderliness in language	One participant reformulates the statement into acceptable order or points this out. Example includes avoiding an obscure expression [gmx] as well as the order of expressions [gmo].	T what makes you think the cat looks scared [oo]? H he got all up his hair. T all his fur is standing up [gmx] [gmo].
[gmi] = Clark/Haviland Manner, make clear only one Intended antecedent	One participant will usually ask specifically for clarification as to what is being referred to, or take a guess, reformulating statement or asking if that was what was intended. Example shows teacher guessing among many kinds of dragons. This also avoids ambiguity [gma] and gives enough information [gqi].	T what's something that you are really good at Xander [ow] ? X (ah) : being a dragon. T you are a very good spyro_dragon, I have to say [at] [gqi] [gma] [gmi].

Variable code & short description	Variable full definition	Examples
[bso] = blended space opened, start of new concept work (visibly)	The teacher challenge that eventually can be shown to have started concept change work visibly. This can only be determined after assessing that portion of the dialogue. Because it involves shared thinking, then by definition it will also always be within an SST, all or in part. The example is about a teacher suggesting they can become book illustrators or publishers by the activities they have recently accomplished in a book making activity.	T and one day you did the (T mimes drawing a circle) ~ B a house . T a house. T and then you were the illustrator of the book [bso]. T the next time you put the words in, and then you were ~ T what was that other word we learned about the other day? T was it called authors? F yeah. U yeah. T Hmm. (continues below)
[bsw] = blended space work, evidence of work happening	This code is for significant additional challenges by teacher, or others; or when the shift in child concept is seen, within the blended space episode.	T and then when you went with Victoria and she put the book together. T what did you become then [bsw]? (continues below)
[bsf] = blended space finished, as far as can be seen	The work is visibly and logically concluded when the child is behaving or talking in a way indicating change has been established. Sometimes the teacher is distracted with other children and then returns to engage the blend topic later.	T do you remember that word? T was it call/ed the publisher? F yes. T Hmm [bsf] . - 0:01:35 (reading) - 0:02:50 (conversation starts in a new direction)

Notes:
Questions coding, definitions and examples from actual data collected or published in: (Raban et al., 2010; Siraj-Blatchford & Manni, 2008).
SST definitions from: (Ritchhart, 2007; Siraj-Blatchford et al., 2002).

Coding of the transcripts followed using the independent variables in Table 1 above. A random procedure was then used to select five rooms, whose combined transcript time was 21% of the total time of all transcribed videos (727 minutes). These five rooms had their three activities transcripts combined. Two intercoders were located and engaged in a process of familiarization with the study and training.

Two intercoders, whose doctoral dissertations included coded child dialogue, were found through messages to the eXtended Mind, Culture, Activity (XMCA)

discussion forum (The Laboratory of Comparative Human Cognition, 2011) and the Friends of Positive Psychology list (American Psychological Association, 2010).

The training consisted of reading the instructions and examples, watching videos of SSTs from a CD available for public purchase to train teachers (Dowling, 2005), and then by attempting to code short practice transcripts created from extracts of actual transcripts other than those from the random sample. Questions were answered by the researcher as the training proceeded. Their practice transcripts were corrected by the researcher and returned with comments clarifying disagreement areas. The intercoders then proceeded to a longer and more difficult practice transcript and received further feedback. Both intercoders had low agreement with the master coded documents on SST identification, and therefore starts and turns, as well as the related concept of blends. They were then specifically asked to code only the other codes of questions, acknowledgements and Gricean maxims. They then proceeded to code the five selected transcripts from opposite ends of the set. Both improved accuracy over the first two transcripts such that the final intercoding agreement rates reported here consist of two rooms from each intercoder, with the third room choice of intercoder going to the one who finished that first, although the alternative would have produced little difference in the total intercoder agreement.

The two intercoders' questions about SSTs and blends indicated that their theoretical orientations interfered with being able to adopt this researcher's definition of an SST, mainly by their ascribing underlying motives and strategies to the teacher. Therefore, another intercoder was approached and the training followed the same procedure described above but focused just on these codes.

The third intercoder was the professional transcriber who had checked the transcripts for accuracy from the video recordings. She easily grasped the conceptual parameters defining an SST from the same practice documents and was able to rely on the surface evidence of engaging a child in thinking as instructed. As she proceeded through the five transcripts, only coding for SSTs and turns, she quickly achieved a high level of intercoding agreement of SST episodes and turns. Then blends were identified on another pass over the transcripts.

Because the methodology of this study allows legitimation at every step, the intercoder experience offers the first opportunity to justify the approach taken and to validate the main research construct of the SST episode in its usefulness to the wider community. The intercoder raw data counts included the entire coding scheme. Initial code counts indicated that there were too few instances of much of the fine-grained coding to be statistically significant for either intercoding or the analysis found in the results chapters. The data was therefore collapsed as follows. Acknowledgements were collapsed to one count for positive acknowledgements with the few instances of praise of fixed talent being left out. Questions were collapsed to the theoretically important divide between open and closed questions. Total questions was also kept as the sum of open and closed questions plus statement questions, but leaving out pseudo questions. Recall questions were counted as an open question. Gricean maxims were collapsed to one count. Blends like SSTs, were counts of entire episodes, so no collapsing was needed.

The intercoder agreement calculation procedure started by entering the intercoder transcripts of the five rooms into the SALT program along with the researcher's master coded documents. The output was exported to an Excel

spreadsheet where the codes were totalled into the collapsed categories for a comparison of intercoder and the master transcripts. The larger of the two collapsed counts was divided into the smaller of the two counts for percentage agreement. This traditional method ignored chance agreement. Only the codes for questions were "forced" when a question mark or prompt by teacher tone was indicated. The categorical choice of closed, open, statement or pseudo question, although small in number, was not particularly discrepant and along with other problems of using Cohen's kappa (J. Harris, Pryor, & Adams, 1997), it was decided to use the simple method for all coding agreement calculations.

It is noted that there was a low agreement on some rooms in the total number of SST occurrences, which was a question not of what was an SST, but where to break or not break longer SSTs into shorter episodes. This explains the low agreement on numbers of SSTs in a few rooms but high agreement on total SST turns. This had to do with deciding whether the topic was the same or changed enough to count two episodes or one. Because the main metric used in this study was turns per minute, the number of SST episodes and lengths was of some interest, but not critical to conclusions.

1. The number of SST occurrences achieved 85% agreement overall, with a range over the five transcripts from 50% to 100%.
2. SSTs started by teacher or child achieved 88% agreement, with a range over the five transcripts from 66% to 100%.
3. SST total turns (teacher and children) achieved 96% agreement with a range over the five transcripts from 90% to 100%.
4. Open questions achieved 93% agreement with a range over the five transcripts from 83% to 100%.
5. Closed questions achieved 91% agreement with a range over the five transcripts from 86% to 96%.
6. Total questions achieved 94% agreement (this included both open and closed as well as statement questions) with a range over the five transcripts from 89% to 100%.
7. Acknowledgements achieved 87% agreement with a range over the five transcripts from 82% to 95%.

Initially intercoder agreement was 84% on the total number of blends and 78% on Gricean maxims instances (subsuming all maxims into one count). Disagreements were discussed with the intercoders involved and consensus achieved on what to keep. The revised intercoders' transcripts then agreed with 91% of the researcher's original transcripts on blends and 89% on Gricean maxims. Based on this learning, the researcher checked and altered the coding on the remaining 18 transcripts. Of all the coded constructs, Gricean maxims seemed be the most difficult to code with a tight focus into the meaning of how a single utterance relates to another's production with many instances of the focus being on what is missing from the child's output, which, as a non-existent entity, is logically hard to spot. Blends, on the other hand,

were easier to spot initially as they usually either start as an SST or begin to start but are then interrupted. The coder has to take note of all these starts. Once noted, the difficulty then lies in tracking the blend across the whole dialogue with interspersing talk by other children, activity focus and time. The final difficulty is noticing when a visible sign of actual conceptual change is produced or in some cases a continuing deepening and broadening of the concept. Blends are best tracked as a single focused objective on a third or fourth reading of the transcript. An example of a long and intricate blend with analysis is included as Appendix A. The *Methods Navigation Guide* shows the discussion now at point 9.

1. Alignment with Community of Practice	↔	**2.** Alignment with Community of Study
↓		↓
3. Case study approach	→	**4.** Procedure
↓		**5.** Data collection
6. Meta-framework mixed methods data analysis		
↓		↓
7. Discourse analysis qualitative MEP approach	↔	**8.** Quantitative variables from literature reviews ↔ MEP ↓
		9. Coding variables
		10. Quantitative Data treatment

Quantitative data treatment

A few researchers have used specialized software – Systematic Analysis of Language Transcripts (SALT) (Language Analysis Lab, 2006) – to compare extended conversations between adults and preschool-age children and measure language with simple markers of quality (Girolametto, Sussman, & Weitzman, 2007; Turnbull et al., 2009). It has been used to both count vocabulary and count coded researcher-selected variables and compare them across multiple cases as was done by Dickinson, Watson and Farran (2008) and others (Dickinson & Caswell, 2007; Dickinson, Darrow, et al.,

2008; Dickinson & Porche, 2011; Dickinson & Smith, 1994; Griffin, 2009; Hancock et al., 2002; Murry, 2006; Paulson et al., 2004). A logic of counting vocabulary word differences used by Ritchhart (2002) also informed this selection of software.

Aligned very closely to the current study is one study (Dickinson, Darrow, et al., 2008) that measured "quality" of language in terms of: utterances and number of words per session and per minute, root words (vocabulary), Type Token Ratio (TTR), mean length of teacher and child turns by words, and who initiated topics, within "extended sequences of topically related talk" and in relation to the "shared ownership of conversations" (p. 404). It was claimed that these variables had not been previously studied in the preschool classroom. In a further refinement, the idea of extended talk was termed "sustained conversations", with teachers being advised to strive for "at least five or more back-and-forth exchanges" (Dickinson, Watson, et al., 2008, pp. 142-143). This is almost identical to the concept of Sustained Shared Thinking (SST) (Siraj-Blatchford et al., 2002). In another similar study (Dickinson & Porche, 2011) Mean Length of Utterance (MLU) was measured as a marker of quality.

Type Token Ratio (TTR) was created (Templin, 1957) as a simple way to measure children's language development. It has been used in natural samples where the variety of words used as a ratio of total words is indicative of developmental levels, normal or specific language deficits or complexity of language production in comparing contexts in young children (Phillips, 1973). Problems of sampling (C. W. Hess, Ritchie, & Landry, 1984) have led to development of software to calculate TTR by repeated sampling word by word for a moving average (Covington & McFall, 2010; McKee, Malvern, & Richards, 2000), while others have refined the traditional

method. More stability in TTR results has been achieved by using aggregated data instead of comparing individual children (Hess, Sefton, & Landry, 1986), by avoiding clinical diagnostic purposes (Watkins, Kelly, Harbers, & Hollis, 1995) and by using the same size samples of a uniform number of tokens (Richards, 1987) which more recently is recommended as between 100 and 200 tokens (Koizumi & In'nami, 2012). The Systematic Analysis of Language Transcripts (SALT) software (Language Analysis Lab, 2006) avoids some of the noted problems by counting only root words, in complete utterances only and in uniform samples. This can be done both by utterance numbers or word numbers using the SALT software.

One study (Heisler et al., 2010) calculated TTR of two groups of 13 children to compare normally developing children to those with specific language impairment (SLI). This approach of measuring the TTR of groups rather than individual children, justified in terms of the principle of "aggregation" of measures across subjects where "errors tend to average out" providing "a more accurate picture of relationships in the population" (Rushton, Brainerd, & Pressley, 1983, p. 19) with support from Spearman's (1910) arguments, will be used in this study to measure the average language quality of all the children in a room and compare SST dialogue to non-SST dialogue of that same group for both TTR and MLU measures. The SALT software can count all data and codes for the first speaker, in this case the teacher, and the second speaker being the combined children's output. Aggregation of children's individual rates of behaviours in group-work activities in learning interactions in similar multiple case study research has been done (Bryce & Whitebread, 2012; Grau & Whitebread, 2012).

Some researchers use an alternative method of comparing the sampled vocabulary to a list of rare words (Dickinson, Watson, et al., 2008) rather than the local vocabulary in the transcript. This list, based on American word use, would be problematical for use in Australia, and constructing a validated list is a vast project in itself. The TTR count by SALT software uses the actual number of total words from that dialogue and that particular speaker from the transcript, or in other words, the local language. Using this method makes this study more easily replicable, whereas using a specific list produces a barrier for further research.

Mean Length of Utterance (MLU) is a less contentious measure for developmental age than TTR provided it is used in children less than four years old for clinical evaluations (Huttenlocher et al., 2002). Above that age, it is still useful for showing differences for other purposes, including parent, teachers and clinicians' talk directed at children (Dethorne, Johnson, & Loeb, 2005), and has the advantage of being independent of the amount of talk. It has been measured with the SALT software (DeThorne & Channell, 2007; Paulson et al., 2004) where it was also found that a child's production of complex sentences was highly correlated with their comprehension of complex speech. Mercer (2008b) reported that primary school children used longer utterances as a consequence of an intervention which extended conversations using the *thinking together* lessons (Dawes et al., 2006). This shows the usefulness of measuring MLU to test what happens in different dialogic conditions, which in this study will be the non-SST versus SST conditions where the application of an SST can be seen as a "treatment".

Justification for this approach is found in a study of preschool children using a fine-grained analytical framework of situational variability (Cole, Dore, Hall, &

Dowley, 1978), where the three-year-olds' MLU and other features of complexity increased in response to Wh- questions as opposed to yes-or-no questions in classrooms. MLU also increased in an activity in a supermarket over that in the classroom, which was seen as a more meaningful activity in terms of real life experiences.

In regard to sampling, it has been found the MLU calculated by words (the traditional method) and MLU calculated by morphemes were highly correlated in 40 children from 3.0 to 3.10 years old (M. D. Parker & Brorson, 2005), and that MLU has good stability across sample sizes from 10 to 150 utterances (Casby, 2011).

Data counts were then exported from SALT software into Microsoft Excel (2010) which was used for table and graph creation. These were used for both visual analysis of patterns and also any quantitative analysis by either simple counts or comparisons using Excel's Pearson product-moment correlation.

Pearson correlations were used in the case of interval or ratio data sets that are both linear and are approximately normally distributed and also show homoscedasticity of the data (Cohen & Cohen, 1983). To test for normalcy using the Kolmogorov-Smirnov Goodness-of-Fit test and to make a visual plot to assess linearity and homoscedasticity, each data set where a correlation was tested was first run against a comparison to a normal curve using an Excel spreadsheet developed for this purpose (Guth, 2012).

Most of the analysis is a *between* rooms research design. However, the changes in dialogue within a room, between non-Sustained Shared Thinking (non-SST) dialogue and Sustained Shared Thinking (SST) episodes, with the same

teacher and children engaged in the same activities, is a *with-in* research design and can be considered a naturalistic experimental test of a "treatment" (SST dialogue) with the control condition of the non-treatment (non-SST dialogue). Because of the idiosyncratic nature of co-constructing dialogue with the vast number of possible variables involved, the with-in design is a good way to reduce the possibility of confounding variables because the teacher, children , and many other factors known and unknown are controlled by simply being the same. This design has been used where interactions are "heavily influenced by individual cognitive and affective differences" (Bernardini, 2001, p. 255). This design requires a different way of validity testing than the usual statistical analysis. One way suggested in the literature is to compare the same subjects doing the first part of a task and then the second part (Chi, 1997) which fits the idea of the two dialogic conditions. The teacher engaging children in SST dialogue compared to non-SST dialogue is a naturalistic, non-experimental "intervention" by the teacher, which in most cases was applied and then removed repeatedly (in some cases as will be seen, the teacher makes the entire activity a single long SST episode). This can also be considered a before and after "treatment" or phases of treatment where the children's combined dialogue in a single room (case) as coded for quality is the dependent variable, and treatment or not is the independent variable.

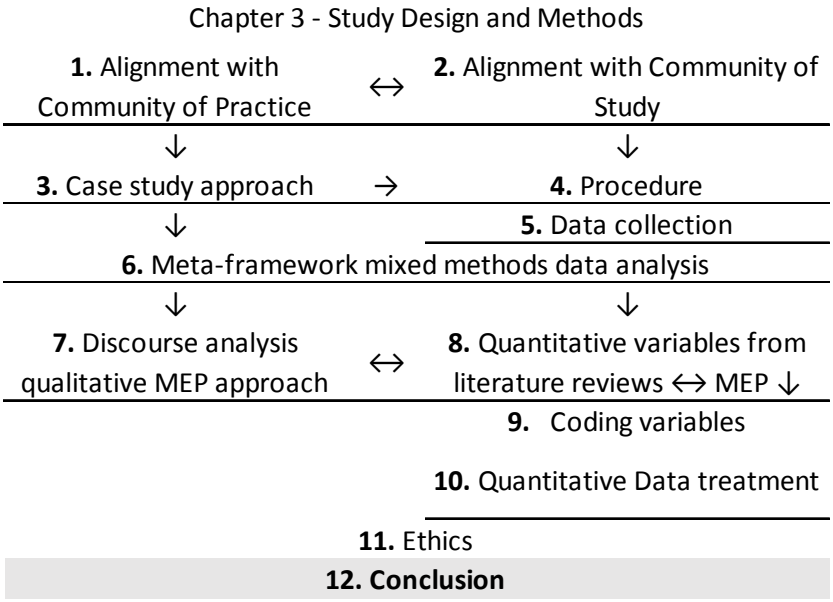
The analysis of change for with-in designs often uses percentage change from non-treatment to treatment as a measure of validity (Durlak, 2002, 2009; Vacha-Haase & Thompson, 2004) and specifically has been used in observation protocols measuring changes in interaction behaviour in preschools (McGoey & DuPaul, 2000). In addition, in this study, if some rooms are found to have quality indicators in the

SST sample (treatment phase) at levels that are outside the non-SST dialogue samples (non-treatment phase), this would be called non-overlapping data, and is one of the more powerful statistical validations that something important has changed the behaviour being measured (J. M. Campbell, 2004; Scotti, Evans, Meyer, & Walker, 1991). Non-overlapping data has also been used for documenting evidence of "clinical effectiveness" (R. I. Parker, Vannest, & Brown, 2009, p. 357). Comparing such single cases (rooms) where the with "treatment" phase shows non-overlapping data, and therefore likely to have high levels of effective practices, to the other cases which do not, then becomes a *between* design, and can distinguish the relative effectiveness between two or more conditions or treatments. In these 23 cases, the comparison is between each teacher's approach to constructing SST dialogue. Moving from analysing each individual case (with-in) towards across-case analysis (between) according to Yin (2009), is a commonly accepted tactic to check the pattern's validity (patterns of quality indicators) to locate the phenomena within the community of practice (the 23 rooms) and have a quantitative way to measure variations in the patterns (use of quality indicators in SST episodes). This kind of analysis will be done between non-SST and SST dialogue with-in rooms, and then between rooms in the search for what Conners and Eisenberg (1966) called the "total pattern of intellectual stimulation" required to induce growth of the intellect (p.10).

Ethics

The study complied with the ethical guidelines set by Melbourne Graduate School of Education Human Ethics Advisory Group (MGSE HEAG, 2009) and met all requirements of risk management as required by the University of Melbourne's Human Research Ethics Committee (HREC Approval Nos. 0717678.1, 0717678.2,

and 0721302). Approval for the study was also obtained from the Victorian state government Department of Education and Early Childhood Development (DEED) and the Catholic Education Office, Archdiocese of Melbourne, Knowledge Management Unit. The *Methods Navigation Guide* shows the discussion complete.



Conclusion to chapter

This chapter has articulated the methodological approach that drives the analysis of the data. The legitimacy of this approach operates as a "continuous iterative, interactive, and dynamic process" (Onwuegbuzie et al., 2011, p. 1253), and relies on coherent arguments at each step and when integrating results from quantitative and qualitative steps. The results chapters that follow are presented as the analysis proceeds through answering the research questions and will show how alternating between quantitative and qualitative examinations of the data unfolds through increasingly complex hierarchical levels where the discoveries and questions arising at each step inform and guide the next.

Guide to results chapters

Chapter 4 considers research question one which looked for evidence of SST dialogue within the three activities. For the **first line of enquiry**, and based on the criteria established for defining SST dialogue as outlined in Chapter 3, the total number of SST turns was counted for each room in all activities. To establish room comparisons, the total number of turns was divided by the total number of minutes across the three activities for each room. This allowed for a *rate* of SST turns per minute to be established for each room. Using this metric, the three activities were then compared to examine the frequency of SST dialogue in each activity. The **second line of enquiry** compared the 23 teachers by the *length* of SST episodes by turns. Examples of dialogue were examined to show differences in how the teachers orchestrated varying lengths of SST dialogue. Also examined were the three activities in which varieties of SST length occurred. This showed varying degrees of consistency and persistency of the teachers' orchestration of SST dialogue across the three activities. The **third line of enquiry** compared the three activities to identify the teachers' highest rates of SST activity. The dialogue of the two teachers with highest rates of SST turns per minute in one of their activities was described. This analysis of the discourse allowed for differences in the patterns of talk interactions to be observed. The analyses presented in this chapter revealed that measures of turns, turns per minute and the length of SST dialogue were insufficient to distinguish the challenge and complexity of talk interactions.

A *Results Navigation Guide* is shown below. This step-by-step graphic of the analysis process as described above is used throughout Chapter 4 as each line of enquiry commences and at the conclusion.

Chapter 4 Turns/ min in SSTs	1st line of enquiry by turns/ min	**1.** Table 2 - Turns/min combined 3 activities by room Ordered a-w	**2.** Figure 1 Turns/min across 3 activities Ordered a-w
	2nd line of enquiry by SST length	**3.** Table 3 - SSTs by length in total turns PLUS Discourse analysis	**4.** Table 4 - SSTs by length/trns in 3 activities Persistent and Consistency
	3rd line of enquiry	**5.** Table 5 - Ordered by turns/ min highest rate by activity	**6.** Discourse analysis of SST "Quality"
			7. Conclusion

Chapter 5 considered research question two which looked at the quality indicators identified in literature. This includes an analysis of questions, acknowledgements, blends and Gricean maxims. The **first line of enquiry** counted these four indicators and compared them to SST activity. The dialogue was described for closed and open questions. An analysis of the discourse allowed different patterns to be observed. The analyses presented revealed that both kinds of questions and the other three indicators were all related significantly to SST activity, but in very different patterns. The **second line of enquiry** took the *rate* per minute of these five indicators and also *rate* of turns per minute from the previous chapter, and combined them for a single *six quality indicator* score to rank the 23 rooms. The dialogue of an exceptional SST of the teacher whose rank changed the most from the original turns per minute ranking was described. This analysis of the discourse allowed for differences in SST construction to be observed. The **third line of enquiry** looked for

patterns and indicator differences in the changes in rank across the 23 rooms. The *Results Navigation Guide* that was used for Chapter 5 is shown below.

Chapter 5	Data logic	**1.** Data treament fig.2	
Quality Indicators	1st line of enquiry	**2.** Tables 6 - 9 Five quality indicators frequency	**3.** Table 10 - summary five indicators across 23 rooms
	2nd line of enquiry	**4.** Table 11 - Six indicators z-scores added - one score to rank 23 rooms quality	**5.** Discourse analysis of SST "Quality"
	3rd line of enquiry	**6.** Tables 12-13 - rank change analysis original a-w SST turns versus 6 indicator rank	**7.** Conclusion

Chapter 6 considered research question three which looked at the differences between non-SST dialogue and SST dialogue, first in terms of (a) the identified quality indicators and then (b) children/teacher talk ratios. The **first line of enquiry** looked at part (a) by comparing non-SST talk to SST talk in terms of changes in the rate of use of the five quality indicators. Then a pattern search of these results was completed to identify teacher differences. The **second line of enquiry** looked at part (b) by comparing non-SST talk to SST talk for changes in the children/teacher talk ratio using the Number of Total Words. The start of each SST was described by using the first four turns of dialogue. This analysis of the discourse allowed for differences in the patterns of talk interactions to be observed. The *Results Navigation Guide* for Chapter 6 is shown below.

Chapter 6	Data logic	**1.** Data treament Table 14	
Change from non-SST to SST dialogue	1st line Question 3a 5 indicators	**2.** Tables 15-17 Five indicator changes non-SST to SST dialogue	**3.** Table 18 - 20 pattern search using z-scores and correlations
	2nd line Question 3b talk ratio	**4.** Table 21 - T/C talk ratio Number Total Words changes nSST to SST	**5.** Table 22 - T/C talk ratio significant correlations
		6. Qualitative discourse analysis of SST starts	7. Conclusion Qs 3a & 3b

Chapter 7 considered research question four which looked at the differences between non-SST dialogue and SST dialogue in the quality of children and teachers' language in terms of Mean Length of Utterance (MLU) and Type Token Ratio (TTR). The **first line of enquiry** compared the two kinds of talk for differences in MLU and checked to see if differences were related to children's SES status. The **second line of enquiry** compared non-SST dialogue and SST dialogue for TTR differences using 150-word samples for both children and teachers. These results were analysed for relationships to the five quality indicators. The **third line of enquiry** compared children's SST levels of MLU and TTR with the teacher's use of the five quality indicators. The analyses revealed three "approaches" used by groups of teachers which were then analysed for their distinctness using z-score differences. The **fourth line of enquiry** re-examined previous data analyses based on these differences. New patterns in the correlations between the five indicators and the ranking of rooms for the six quality indicator score were examined. The **fifth line of enquiry** checked for confounds to the results from children's participation as measured by turns. A pattern search was completed comparing the three approach groups with the data of SST turns in the three activities.

The *Results Navigation Guide* for Chapter 7 is shown below.

Chapter 7 Change from non-SST to SST continued	Data logic	**1.** Measuring MLU & TTR	
	1st line of enquiry MLU	**2.** Tables 23 - 24 MLU differences and changes	**3.** Table 25 correlation check SES and MLU
	2nd line of enquiry TTR	**4.** Tables 26 - 29 TTR differences and changes	**5.** Table 30 child TTR correlation with Teacher Acknowledgements
	3rd line MLU and TTR patterns	**6.** Tables 31 - 32 Compare child MLU and TTR with Teacher use of 5 indicators	**7.** Fig 5 - Three approach groups distinguished by z-score range
	4th line - 3 approaches checks	**8.** Table 33 3 approach groups check against previous data analyses	**9.** Table 34 - new correlations of 5 indicators by approach group
	5th line - discounting confounds	**10.** Table 35 child participation by turns influence on data analysis	**11.** Table 36 - approach groups and SST turns in 3 activity - pattern checking
			12. Conclusions

CHAPTER 4: RESULTS – SST EVIDENCE

This chapter presents the results that addressed the first research question: Is there evidence of Sustained Shared Thinking (SST) in the 23 rooms? All statements regarding "conclusions" are tentative and should be taken as confined to results from the analysis of that item and only within this particular population of teachers and not generally applicable. The following *Results Navigation Guide* shows how this chapter is organised in terms of analyses lines of enquiry with the current location bolded and shaded:

Chapter 4 Turns/ min in SSTs	**1st line of enquiry by turns/ min**	**1.** Table 2 - Turns/min combined 3 activities by room Ordered a-w	**2.** Figure 1 Turns/min across 3 activities Ordered a-w
	2nd line of enquiry by SST length	**3.** Table 3 - SSTs by length in total turns PLUS Discourse analysis	**4.** Table 4 - SSTs by length/trns in 3 activities Persistent and Consistency
	3rd line of enquiry	**5.** Table 5 - Ordered by turns/ min highest rate by activity	**6.** Discourse analysis of SST "Quality"
			7. Conclusion

Organizing the data by turns

As described in the literature review, each "teacher turn" in a dialogue has the potential to challenge or invite a child into a thoughtful space and each child turn has the potential to be a learning opportunity and can guide a teacher's response into the child's Zone of Proximal Development. An SST episode is defined as a series of turns where participants share their thinking in an extended dialogue. The methods chapter outlined how the amount of SST activity was best counted as the total turns taken by all participants in the identified SST episodes and the logic of using turns per minute as the metric to make an equivalent comparison between rooms and activities.

Table 2 combines the SST data from all three activities and shows total turns taken in each room, the total time of those activities and the SST turns per minute. The rooms were designated as ‘a’ – ‘w’ and ordered by the highest SST turns per minute rate.

Table 2

SST turns per minute of three activities combined in 23 rooms.

Room	Combined three activities		
	Turns Total	Time Minutes	SST turns/ minute
a	315	26.0	12.1
b	202	16.8	12.0
c	361	39.0	9.3
d	237	25.8	9.2
e	248	29.7	8.4
f	204	24.8	8.2
g	178	22.5	7.9
h	231	30.9	7.5
i	268	37.5	7.1
j	235	36.0	6.5
k	133	22.0	6.1
l	118	20.6	5.7
m	107	19.4	5.5
n	159	29.4	5.4
o	61	11.5	5.3
p	161	33.8	4.8
q	121	25.9	4.7
r	83	23.0	3.6
s	96	31.8	3.0
t	88	30.4	2.9
u	99	34.8	2.8
v	83	33.7	2.5
w	16	29.7	0.5
Average			6.1
ST DEV			3.0

The turns per minute varied widely between rooms with an average rate of 6.1 turns per minute and a large standard deviation of 3.0. The top two rooms had twice the average rate and four times or more the rate of the lowest five rooms. Room ‘w’ had almost no SST activity. The total turns per minute and the distribution of SST turns per minute across the reading, writing and then selected literacy activities in a

room is shown in Figure 1.

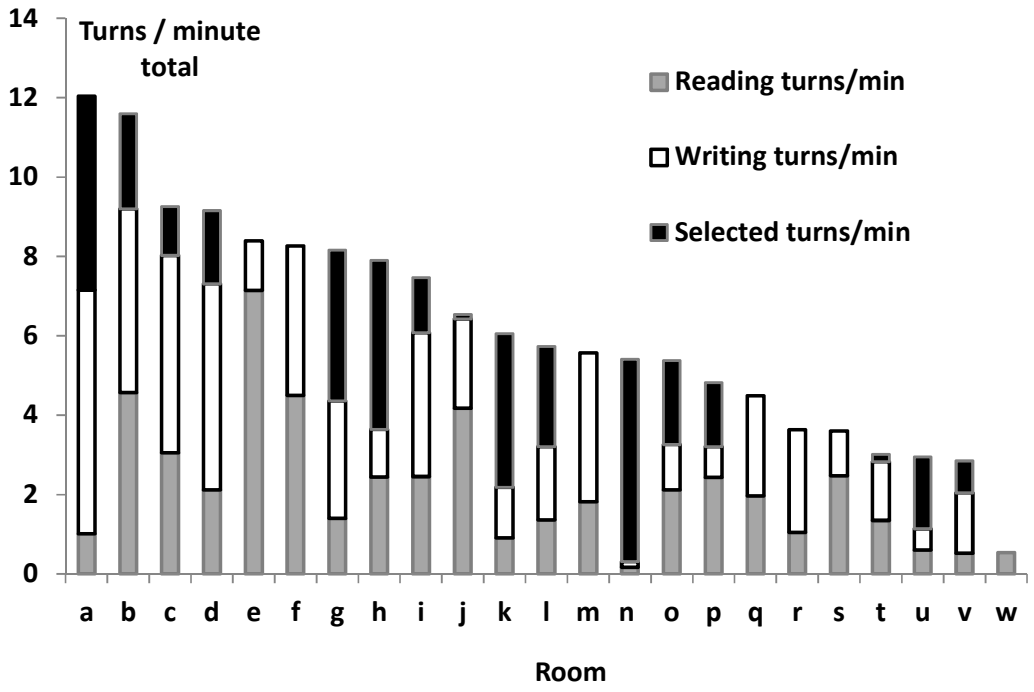


Figure 1 SST turns per minute across three activities in each of 23 rooms.

In Figure 1, the data shows that there is a great deal of variability in how the turns were distributed across the three activities with some rooms having a similar amount of SST turns in all three activities, while in other rooms, SST turns occurred mostly or entirely in 1 or 2 activities.

The *Results Navigation Guide* shows the analysis is now at the second main line of enquiry by SST length.

Chapter 4 Turns/ min in SSTs	1st line of enquiry by turns/ min	**1.** Table 2 - Turns/min combined 3 activities by room Ordered a-w	**2.** Figure 1 Turns/min across 3 activities Ordered a-w
	2nd line of enquiry by SST length	**3.** Table 3 - SSTs by length in total turns PLUS Discourse analysis	**4.** Table 4 - SSTs by length/trns in 3 activities Persistent and Consistency

The "length" of an SST episode is measured herein by the total number of turns by both teachers and children. The variability of SST episodes by length is shown in Table 3 below. This table has the 23 rooms ordered in rank by the longest SST episode and then by the second longest, with natural "breaks" in the data shown with solid horizontal lines creating apparent groupings of patterns designated as long, mixed and short.

Table 3

SST episodes across 23 rooms ordered by length in turns.

Room	SST lengths by turns	Longest 1st	SSTs 2nd	Pattern	SSTs Total
c	106,73, 48,45,37,21,18,14	106	73	Long	8
b	104,81, 10,7	104	81	Long	4
k	83, 30,17,3	83	30	Long	4
a	67,56, 44,20,19,19,18,18,14,10,9,8,5,5,3	67	56	Mixed	15
e	65, 38,33,26,17,17,16,8,6,6,5,4,4,3	65	38	Mixed	14
m	64, 32,8,3	64	32	Mixed	4
h	62,52, 16,13,11,10,10,9,8,8,7,6,6,5,5,3	62	52	Mixed	16
f	62, 34,19,12,11,9,8,8,7,7,7,6,6,4,4	62	34	Mixed	15
n	61, 38,32,19,5,4.	61	38	Mixed	6
d	60,58, 26,24,13,13,8,8,7,6,5,3,3,3	60	58	Mixed	14
l	44,15,14,11,10,7,5,5,3,3	44	15	Short	10
i	39,33,25,23,17,16,14,10,10,10,9,9,8,6,5,5,4,4,3 x7	39	33	Short	25
q	39,19,18,14,12,7,6,3,3	39	18	Short	9
t	39,11,10,8,7,7,6	39	11	Short	7
u	38,18,13,11,10,5,4	38	18	Short	7
r	36,27,17,3	36	27	Short	4
j	30,26,26,25,17,15,15,15,11,10,10,7,7,7,4,3,3	30	26	Short	17
g	27,26,25,15,14,11,9,9,7,7,6,5,5,3,3,3,3	27	26	Short	17
p	27,22,20,19,17,16,13,9,7,7,4	27	22	Short	11
s	25,22,12,10,10,7,6,4,3	25	22	Short	9
o	24,16,13,5,3	24	16	Short	5
v	21,17,15,13,7,6,5	21	17	Short	7
w	10,6	10	6	Short	2
				sum	230
				average	10
				ST DEV	5.7

The length of SST episodes measured in turns varied greatly. It can be seen in Table 3 that the ordering of rooms has changed from the previous ranking by SST turns per minute. However, the original top 6 rooms ‘a’ – ‘f’ remain in the top half for SST length as well, and the original bottom 9 rooms ‘o’ – ‘w’ remain in the bottom half for SST length. There were natural breaks in the data which were used to distinguish three categories as marked in the column “Pattern”. In the top category, rooms ‘b’ and ‘k’ had predominantly very long episodes from 81 to 104 turns, while room ‘c’ had more variety with two very long SSTs of 73 and 106 turns, two moderately long SSTs of 45 and 48 turns and 4 shorter SSTs. The bottom category

consisted of 13 rooms where the longest SSTs were of a moderate length from 30 to 44 turns with the majority of SSTs being less than 15 turns. The rooms between these two extremes had a mix of moderately long SSTs of 52 to 67 turns as well as SSTs of the shorter category.

Of the 69 child-initiated SSTs, none produced SSTs of 39 turns or more. This implies some teacher intentionality in SSTs over 39 turns, whereby deliberate extension of SSTs beyond 39 turns occurred for this group of teachers only when the teacher initiated the SST.

Qualitative comparative discourse analysis

Qualitative comparative analysis revealed that in most SSTs over 44 turns the teacher selected a topic and then systematically and persistently questioned all or most children on this topic. Example (a) demonstrates that when a selected topic was interrupted, the teacher persisted in efforts to return to a child's explanation of their drawing in a 65-turn SST that eventually included every child. Example (b) shows how a teacher typically pursues a very long SST, in this case one of 83 turns. Both these "long" patterns of questioning were characterized by the topic of focus taking priority over interjections from children that were "off-topic" and not contributing to the thinking. Sometimes the teacher just ignored the off-topic comment, at other times a single comment was made, and less often a short SST occurred that followed the child's initiated off-topic subject, and then returned to a pursuit of the main focus topic. An example of this is shown in Example (c) from room 'h' in a Writing activity SST of 62 turns.

Example (a) of a long SST comes from the room ‘m’ Writing activity and is a 65-turn SST where the teacher deals with an off-topic interruption by putting that child’s needs on hold. Then the teacher deals with another child interruption which is on-topic, before finally getting back to the first child who had been interrupted originally. The topic is for each child to explain their drawing of a path on a treasure map and what happens on the way to find the treasure. The teacher (always designated as ‘T’) was responding to child ‘L’ telling her story when interrupted by child ‘M’.

The transcription symbols are as follows: (comment by transcriber), ‘x’ is an unintelligible word, > is an incomplete utterance stopped by the speaker, ^ is an utterance ended by the interrupt of another speaker, a full stop (.) indicates the end of a complete utterance. New comments to explain the non-SST turns are bolded and coding, other than the SST start code and turn codes, has been removed for clarity.

Example (a): long SST

L But (if you, if) if the baddies go on there, the grass holds them [t33].
L hold by magic.
T Oh, the grass holds on to them, onto baddies [t34].
L (nodding) Before I, when I only step onto it [t35].
T As soon as they step on the grass it holds onto them [t36].
M (puts his picture in teacher’s face). **no turn credited as not part of SST**
T Thanks, Michael.
W Excuse me, (when they) when they walk in the grass it’s ^
^ = interrupted and ignored, so no turn in SST given
T (to Matthew who is getting up and walking away) Do you want to do another drawing while we’re waiting? **part of Teacher's previous turn**
W <Um, when they just strike on the grass, they just stick, and they just make a magic hole in the grass and just sink into it>. **over spoken by Michael and teacher**
M <No> (standing behind chair and pushing it in).

T <Okay, I might call you to do something later, okay> ?

N <What's the x x called>? **over spoken and ignored**

T <Oh, it/'s far too noise/y, sorry> (not clear who is being addressed).

L <And then it's my turn, and they sing> .

T <are you're gonna x x x>.

T I wasn't listening to you then (to W).

T you'll tell me that again.

T and then I will listen to you, Lynn.

T because I'm sorry, [looking at W] I wasn't listening to you when you were talking.

W So, when did they step on (the) the grass, (um) a magic hole comes and then they just fall into the sea [t37]. **W finally gets to continue**

T So, this one opens up (demonstrating with his hands) [t38] ?

W Yeah, because [t39]^

T So they just fall through [t40].

W <Yeah, cuz it's> magic [t41].

T <into the sea> [t42].

L when there's grass stick on them it does a magic hole and they fall in [t43].

L into the sea.

T so it doesn't hold onto them anymore [t44].

It can be seen in this example that the teacher persistently pursued obtaining an answer to the main topic question from a child with off-topic comments or interrupts dealt with or ignored and then there was a return to the main topic. These off-topic comments were not counted as turns within SSTs.

The following example (b) of a long SST sample is from an 83-turn SST in the room 'k' Selected activity and shows how the teacher pursued the children's understanding of friendship and rejected an attempt to interrupt. The SST occupies the entire 6½-minute activity and is started by the teacher with a clear outline of the two main topics and their order and what purpose this serves.

Example (b): Long SST dialogue start

T now, in a little bit.
T I'm going to get you to draw a picture of something that you like about yourself.
T but before we think about things that you like about yourself.
M I like <my x>. **ignored**
T <I'm gonna> get you to tell me something that you like about one of your friends.
T one of your Kinder friends. **Kinder (slang) = Kindergarten**
T so I want you to have a think of one of your Kinder friends.
T and then I'm going to ask you to tell me what you like about them.
T so have a little bit of a think.
T one of your friends that's a really good friend.
M (raises hand).
T Matthew can you think of one of your Kinder friends that's>
T and tell me something that they>
T you like about them [itt] [t01]?
M hmm, cause they play with me [t02].
T yep [t03].
T cause your friend/s play with you.
T that/'s great.

Later in the SST the teacher departs from her stated plan only once and only partially. This departure was included as part of the same SST because it was still about the qualities of friendship in terms of the opposite side of the question of "what you like about your friends". Then the teacher explored what one could do about this situation and worked this back to something one could like about oneself, which was the main topic.

Example (b): Long SST dialogue showing departure

T Olive [t12]?
O hmm, they laugh at me when I do funny things [t13].
T do they [t14]?
T now, what about if some our Kinder friends aren't being very nice to us.

T how does that make us feel?
C sad [t15].
T sad [t16].
T when we feel sad though.
T do we need to let the things that people say to us make us feel really, really sad?
T or should we just let it make us feel a little bit sad.
T but then think, I'm super, super good and then try to be happy again?
L yea [t17].
T yep [t18]?
T do you remember when we've been talking about being confident?
T who can tell me some of the things that confident people do?
N (raises hand, only one to do so).
T Nicky.
N hmm, stand straight up when you get asked [t19].
T yep [t20].
T standing straight up.
T and what do we do>
T what do confident people do with their eyes?
M look at people [t21].
T look at people, that's right [t22].
M when they're talk/ing [t23].
T that's right [t24].

The next sequence at the end of this SST shows how the teacher made sure every child was included, first with the same child that had the previous negative response and at this point was distracted and then with a child who could not think of something immediately. It also contains the one point where the teacher reminded a child of this room's conversational rules.

Example (b): Long SST dialogue showing inclusiveness

T Kylie, what makes you special?
T can you think of something that makes you special?

T or do you want me to come back to you and I'll ask the others first?
K ask the others [t74].
T Ok, I'll come back to you in a moment [t75].
T keep thinking.
T Nicole, what makes you special?
N because, hmm, when Mum sometimes I'll x to pick up my room [t76].
T right [t77].
T so you listen to others do you?
T and do what your mum asks you to do.
T excellent.
T Lynn, what makes you special?
L <hmm, because I pick flowers for my mum> [t78].
M <x x x x> (aside to K). **no turn given as not part of SST**
T lovely [t79]. **turn given as this related to L's contribution**
T Matthew, is it your turn to talk or my turn to talk at the moment?
M (no sound or visible move).
T thanks. **no turns for M or T as off-topic**
T alright, Kylie, have you thought of something that makes you special? **still turn 79**
K yes [t80].
T yep [t81].
K my friends play games with me [t82].
T lovely [t83].
T alright.

In this example (b) of a long SST, it can be seen that the teacher pursued an exploration of children's thinking about why they might be special for the purpose of the upcoming drawing activity. Each exchange with a child in isolation might not be considered an SST as these were rather simple and often took only 4 turns. However, the entire activity was experienced and witnessed by each child who heard the other children's out of school experience and how the teacher helped each to think through what this might mean in the production of a drawing/writing activity. As such this

could be considered a sustained exploration of their thinking as a group. Only the negative comment received a more extensive exploration, with the result of teacher finally finding a positive characteristic that could be used in certain situations.

The following example (c) of a long SST of 62 turns comes from the room 'h' Writing activity; there were two child-initiated short SSTs where the teacher pursued the thought of the child for a few turns and then returned to the main topic. The activity was drawing and writing words that could be used to tell the absent teacher, Natasha, what happened during an outing. The coding for turns has been included to show the two different SST episodes, and the code for a child-initiated SST which has an equally shared lead [ice] (***i***nitiated, ***c***hild, ***e***qually) is also included. Note that the transcription marks < > indicated overlapping speech.

Example (c): Long SST dialogue

T who is it though [t37]?
X Eliza [t38].
T it's Eliza [t39].
T you made your sister, didn't you (in the sculpture)?
T do you think perhaps we need to tell Natasha that you made a beautiful sculpture?
X <Yes> [t40].
E (has been pointing to a photo) <What's this> [ice][t01]?
T <Yeah>? **probably responding to X's "yes" which was overspoken by E**
T What's that one there [t02]? **now responding to E's question**
E Yeah [t03].
T That's a fairy [t04].
T You can see her wings.
E I can see her arms [t05].
T And her arms and her legs [t06].
T So we can tell Natasha that we made sculptures [t41] (returning to previous SST).
T and maybe you could draw a picture of your sculpture.

In this example (c) of a long SST, child E interrupted the activity of thinking about the class outing activities that could be shared with Natasha, by asking the teacher about a picture. The teacher took a few turns to clarify what was in the picture (both wings and arms and legs of a fairy), and then the teacher initiated the return to the topic of the original long SST. This short exchange is an SST because the teacher has helped the child extend their concept of 'fairy' to include wings and the child participated with thinking by also noting that there are arms as well, with the teacher confirming this as well as extending the thinking again at that point by adding "and legs".

Shorter SSTs were usually characterized by two qualities: 1) The initiation of the SST came out of an opportunity in the text or activity, or a child response to the text or activity; and 2) there was less persistence in the pursuit of the topic by the teacher. Less persistence was exemplified by a move to another topic, a return to the activity at hand or by an interruption after which the topic was not taken up again.

In the following short SST example (d), from the room 'i' Writing activity, the topic was about the concept of making a paint colour lighter by adding water which arose from the child's stated desire for a lighter colour. This was talked about earlier and here one child was doing it and the teacher initiated this SST dialogue by asking about how much water had been added.

Example (d): Short SST dialogue

T How much water did you put in [itt] [t01]?
G I put the water on and turn it off (demonstrating turning tap) [t02].
T just a little bit [t03].
G (nods affirmative at T) [T04].
T let's see what happens [t05].

L It's a little bit lighter [t06]!
T It is a little bit lighter [t07].
M Told you it would make it lighter [t08].
T you had dark green, now you know how to make light green [t09].
M very good (totally absorbed watching G paint) [t10].
G Are we going outside now? **ignored by teacher**
T How are you going Mandy? **change of focus, ending SST**
T your beans are delicious, aren't they?

The teacher ended this short SST example (d) about lightening colours with water by asking Mandy how her work was going and ignoring G's bid to get outside. This is an example of a frequent situation where it appears the teacher pursues checking up on each child's work rather than pursuing a topic in more depth. In this case the teacher could have elaborated the concept of colour mixing to a variety of colours, shades or contexts, although at the expense of time and other children's work.

The following short SST example (e) comes from the room 'j' Reading activity and shows the teacher using a child-initiated opportunity to extend thinking. There are two boys, R and H, and two girls, A and M, listening to the story *Where the Wild Things Are*. In this example, the counting of initiatives or challenges between the children and the teacher is shown, such that in this case the SST is child-initiated and equally led with "equally" defined as within a 40 to 60% split.

Example (e): Short SST dialogue

T and there's the title of the story again (where-the-wild-things-are).
A (where-the-wild-things-are, nodding).
T oh.
A here's more wild things (pointing)[ice] [t01]. **Child-initiated equally led SST**
T here's some more wild things [t02]. **teacher follows**
A and it looks like a girl, <only it x x x> [t03]. **Child-initiated observation**

T <I think there is too>, and why do you think that [t04]? **T follows then challenges**
A cuz it has long hair [t05]. **child follows**
T yeah [t06].
T and look : < > what's this [t07]? **teacher challenge**
A <It's>.
A that's a boy, i think [t08]. **child follows**
T it is a boy [t09].
T and we'll find out what his name is in a minute. **Teacher-led giving information**
T his name is Max (turning to look at R & H who are the two boys).
M Max [t10].
A Max [t11].
T Max, yeah (looking at Maxim) [t12].
A two Maxes [t13]! **Child-initiated observation (boy named Max in their room)**
T yeah, like Max in our class, isn't it [t14]? **teacher follows**
T (returns to reading the story: "the night Max wore his wolf suit…") .

This short SST example (e) starts a guessing game of concepts shared between the wild things and real boys and girls which continued later in various short SSTs. In this SST the children share the lead of the dialogue with questions or concepts such as the idea of a girl wild thing, and noting that the boy wild thing has the same name as a classmate. The dialogue about the wild thing named Max is included in the SST because it is an extension of the idea of gender in wild things by having a male name. The teacher ends the SST by simply returning to reading the story. This typifies the SSTs in the Reading activity in room 'j' which were of 30, 26, 17, 15, 15, 11, 10, 10, 7, 7, and 4 turns.

In conclusion of the analysis of the short SSTs in the Writing and Selected activities, they appeared to end because of the teacher's pursuit of each child's work. Sometimes the length of the SST increased when more children became involved. On the other hand, in the Reading activities, short SSTs mostly occurred during pauses

between the episodes of reading the story and were ended when the teacher continued reading.

This raises the question as to what characterized longer SSTs in the Reading activities if short SSTs end because of the teacher returning to reading the story. Examination of these longer SSTs showed that all Reading activity SSTs longer than 33 turns occurred only after the story had ended, they were all teacher initiated and were pursued with all children on either of two general topics: (a) how a concept in the story applied to each of the children's own personal lives, or (b) a review of the story's concepts for deeper understanding by the teacher systematically questioning children's understanding and then extending ideas.

Type (a) SST examples included a 52-turn SST in room 'h' from the story *Bears Can't Fly* where the main theme is that bears should do what they are good at and not try to fly, after which the teacher asked each child what they thought they were good at doing; a 44-turn SST in room 'a' from the story *Tickly Octopus* about whether each child was ticklish and who tickled them at home; and a 36-turn SST in room 'r' from the story *My Cat Likes to Hide in Boxes* about whether each child owned a pet and how they cared for it.

SSTs of type (b) in Reading activities included a 65-turn SST in room 'e' after reading *Brown Bear Brown Bear What Do You See* where the teacher pursued the topic of how a clue in the text could be used to help think of a word; a 58-turn SST in room 'd' that looked at the real-life logic of concepts used in *There's a Sea in My Bedroom*; a 45-turn SST in room 'c' about why in *Mr. McGee and the Big Bag of Bread* he did not obey the signs "don't feed the animals"; and finally, a 37-turn SST

also in room ‘c’ about what the crocodile might be doing under the water and how the children knew the cat was scared in the story.

It will be recalled that Figure 1 (p. 115) showed how the SSTs in each room were distributed across three activities on a bar graph providing a visual ratio comparison. Table 4 shows the details of the SSTs that contributed to that ratio in each room.

Table 4

SST episodes by length of turns in three activities ordered by the longest SST episodes and consistency across three activities.

Room	SST turns/min	Sustained Shared Thinking Episodes by length in three activities			Persis-tence	Consis-tency
		Reading	Writing	Selected		
c	9.3	45,37,21,14	106,73,18	48	Long	3
b	12.0	**10,7**	104	81	Long	2
k	6.1	**17,3**	**30**	83	Long	1
a	12.1	44,18,18,9,5,5,3	56,20,19,19,14,10,8	67	Mixed	3
f	8.2	9,8,7,6,4	62,7,6	34,19,12,11,8,7,4	Mixed	3
h	7.5	52,10,6,5,3	62,13,11,8,7,6,5	16,10,9,8	Mixed	3
d	9.2	58,24,13,8,7,6,5,3,3	60,26,13,8,3	**0**	Mixed	2
e	8.4	65,33,26,17,17,16,8,6,6,5,4,4,3	38	**0**	Mixed	2
m	5.5	32,3	64,8	**0**	Mixed	2
n	5.4	**5**	**4**	61,38,32,19	Mixed	1
g	7.9	27,15,7,6	11,9,7	26,25,14,9,5,5,3,3,3,3	Short	3
i	7.1	33,10,8,4,3,3	39,25,17,16,10,10,9,9,6,5,3,3	23,14,5,4,3,3,3	Short	3
l	5.7	15,11	14,10,7,5,3	44,5,3	Short	3
p	4.8	20,17,16,13,9,7	22,4	27,19,7	Short	3
j	6.5	30,26,17,15,15,11,10,10,7,7,4	26,25,15,7,3	**3**	Short	2
o	5.3	16,5,3	**13**	24	Short	2
q	4.7	18,12,7,6,3,3	39,19,14	**0**	Short	2
r	3.6	36,17,3	27	**0**	Short	2
s	3.0	22,10,7,4	25,12,10,3	**6**	Short	2
u	2.8	**13,5**	38,11,4	18,10	Short	2
v	2.5	13,6,4	21,17,15,7	**0**	Short	2
t	2.9	**11,7**	**10,7**	39,8,6	Short	1
w	0.5	**10,6**	**0**	**0**	Short	0

Table 4 shows the rooms ordered first by the length categories of Long, Mixed and Short where the column heading for these patterns is now called “persistence” based on the idea that the longer SSTs come from teacher persistence in orchestrating the dialogue. Another category has been added called “consistency” with the designation of 1, 2, or 3 indicating the number of activities (Reading, Writing or Selected) which had “significant” SST activity. This category distinguishes between teachers who do and do not behave similarly across the three activities in terms of SST activity to make apparent this difference for analysis. “Significant” was determined for the “Long” pattern by whether the activity had one or more SSTs longer than 44, which was the break separating Short from Long. In the Mixed and Short categories, “significant” was determined by a natural break in short SST lengths between 18 and 23 turns. Of the 69 activities across 23 rooms, there were 7 with zero SST activity and then there were rooms with total turns of: 3, 4, 5, 6, 13, 16, 17, 18, 18, (break) 23, 24, 25, 26, 26, 27, and 27. The natural break between 18 and 23 was taken somewhat arbitrarily to indicate an amount below which too few SST turns occurred to be considered as having a “significant” amount of SST activity. Thus a room with a “Long 3” designation had long SSTs of more than 44 turns in all three activities, while a “Mixed 2” had either long (more than 44 turns) or short SSTs totalling more than 18 turns in each of 2 of the three activities. A “Short 2” had only short SSTs totalling more than18 (but less than 44) turns in each of two of three activities. For clarity, the activities which failed these criteria for consistency of significant SST activity and therefore reduced that room’s ranking from 3 to 2, or 2 to 1, are bolded.

It can be seen that teachers behaved quite differently in terms of the spread of SST activity across the three different activities. It can also be seen that the top 6 rooms by combined SST turns per minute, rooms ‘a’ to ‘f’ from Table 2 (p. 114), remained in the top 9 by this sorting in Table 4, and that the bottom 10 rooms, ‘o’ to ‘w’ in Table 2, remained in the bottom 11 in Table 4, but in a different order. It can also be seen that the rooms which had the least consistency of SST activity, with a category of ‘1’, tended also to be the rooms in that category of Long, Mixed or Short with the least SST turns per minute. There was no such consistency between rooms that had more substantial SST activity in two or three activities. However, within each category, there are only 5 rooms out of order by less than their original ranking by SST turns per minute, ‘b’, ‘d’, ‘g’, ‘j’ and ‘o’. This can be seen in the first two columns where these rooms have their letter designation bolded. It can be seen that the most they are below other rooms with less SST turns per minute is by two places or less.

It can be concluded from this that there is a relationship between these two teacher behaviours of persistency and consistency with the most persistent and consistent teachers in SST activity also being more likely to have higher rates per minute of SST turns. This is partly because both persistency and consistency indicate more SST activity. Within categories, SST turns per minute is closely related to the ranking by persistency and consistency.

The *Results Navigation Guide* shows the analysis is now at the third main line of enquiry.

Chapter 4 Turns/ min in SSTs	1st line of enquiry by turns/ min	**1.** Table 2 - Turns/min combined 3 activities by room Ordered a-w	**2.** Figure 1 Turns/min across 3 activities Ordered a-w
	2nd line of enquiry by SST length	**3.** Table 3 - SSTs by length in total turns PLUS Discourse analysis	**4.** Table 4 - SSTs by length/trns in 3 activities Persistent and Consistency
	3rd line of enquiry	**5.** Table 5 - Ordered by turns/ min highest rate by activity	**6.** Discourse analysis of SST "Quality"
			7. Conclusion

Extreme differences are apparent in the data patterns of SST activity in Table 4 in terms of teacher consistency. One way to quantify this for further analysis was to compare SST turns per minute within each activity instead of combining all activities. These differences are shown in Table 5 which is ordered in rank by the highest rate of SST turns per minute of any of the three activities. Also note that the rooms originally lettered ‘a’ to ‘w’ are now capitalized for the last 11 rooms ‘L’ to ‘W’ in order to make clear the overall pattern changes between the top and lower halves of the rooms in terms of the original ranking by the combined SST turns per minute. The activity in each room with the highest SST turns per minute rate is bolded for clarity.

Table 5

SST turns per minute in three activities ordered by the highest rate in any one activity and showing rank difference.

Room	SST turns/min 3 activities			Persis-	Consis-	SST turns/minute		Combined	'Best'	change Combi - Best	
a - W	Reading	Writing	Selected	tence	tency	Combined 3	'Best' of 3	rank	rank	rank	SST/m rate
N	0.6	0.3	**18.6**	Mixed	1	5.4	18.6	14	1	**13**	**13.2**
P	**18.5**	1.5	4.6	Short	3	4.8	18.5	16	2	**14**	**13.7**
a	**17.5**	12.2	6.7	Mixed	3	12.1	17.5	1	3	-2	5.4
e	**17.5**	2.5	0.0	Mixed	2	8.4	17.5	5	4	1	9.1
j	**17.1**	6.4	0.3	Short	2	6.5	17.1	10	5	5	10.6
d	**15.7**	9.7	0.0	Mixed	2	9.2	15.7	4	6	-2	6.5
b	4.4	14.0	**14.8**	Long	2	12.0	14.8	2	7	-5	2.7
c	8.3	**14.4**	4.2	Long	3	9.3	14.4	3	8	-5	5.2
h	**13.6**	7.8	3.9	Mixed	3	7.5	13.6	8	9	**-1**	6.1
g	**13.6**	3.1	9.9	Short	3	7.9	13.6	7	10	-3	5.7
k	4.0	2.6	**13.4**	Long	1	6.1	13.4	11	11	0	7.3
i centre	**13.1**	8.9	7.3	Short	3	7.1	13.1	9	12	-3	6.0
R	**13.0**	2.5	0.0	Short	2	3.6	13.0	18	13	5	9.4
f	4.8	**10.5**	8.9	Mixed	3	8.2	10.5	6	14	**-8**	2.3
Q	**10.4**	5.0	0.0	Short	2	4.7	10.4	17	15	2	5.7
O	**8.7**	3.0	5.5	Short	2	5.3	8.7	15	16	**-1**	3.4
L	**8.2**	5.4	5.1	Short	3	5.7	8.2	12	17	-5	2.5
V	**7.9**	4.4	0.0	Short	2	2.5	7.9	22	18	4	5.4
M	5.2	**7.1**	0.0	Mixed	2	5.5	7.1	13	19	-6	1.6
T	2.9	1.1	**6.3**	Short	1	2.9	6.3	20	20	0	3.4
S	**5.8**	3.5	0.6	Short	2	3.0	5.8	19	21	-2	2.8
U	1.4	**4.3**	2.9	Short	2	2.8	4.3	21	22	**-1**	1.5
W	**4.2**	0.0	0.0	Short	0	0.5	4.2	23	23	0	3.7

The ranking of the rooms in Table 5 is by the "Best of 3" column, with the centre of that ranking marked for clarity. The data in this table shows that some teachers produced dialogue with high rates of SST turns per minute, but did so only in one or two activities. The room letters were capitalized for the lower 11 rooms to show clearly that most of the rooms remained either in the top or bottom half regardless of either 'Combined' or 'Best' ranking. The exceptions to this, with bolded letters for clarity, were rooms 'N', 'P' and 'f'. Room 'f' was the only top half room in the combined SST turns per minute rate to fall into the lower half and was the most consistent of all the rooms in the three activities in the centre range of SST rate per minute. Rooms 'N' and 'P', on the other hand, had the greatest rate differences between the three activities combined and the best of the three activities, and had the highest rate of SST turns per minute in that best activity. It is also of note that most of the 'Short' category rooms remained in the lower half with this reordering. Most teachers (15) produced their highest SST turns per minute in the Reading activity while four teachers did so in the Writing activity and four teachers did so in the Selected activity. One teacher (room 'b') had almost equally high rates in both Writing and Selected, but very low in Reading.

It is clear that teachers can produce high rates of SST activity in one activity while producing little activity in another. This is not entirely consistent across teachers with regard to the three types of activities, with eight teachers outside the trend of having the highest rate in the Reading activity. This implies that most teachers have made an intentional decision to create SST dialogue in certain types of activities but differ on that choice.

It will be remembered that only teacher self-generated talk was transcribed so that the book reading, or in one case singing together in a Selected activity, was not recorded as teacher talk in terms of words or the time taken. This made these activities, especially the Reading activity talk outside the actual storybook reading, relatively "dense" in terms of opportunity to engage in SSTs while the Writing or Selected activities usually had teachers spending a larger portion of the time sorting out details of the activity for each child and therefore less percentage of time was available to engage in SSTs. This may account for the predominance of Reading as the activity with higher rates of SST turns per minute.

Qualitative investigation of rooms 'N' and 'P'

The teacher of room 'N' accomplished the high rate of 18.6 SST turns per minute primarily in SSTs of 61, 38 and 32 turns during a Selected activity of 8.15 minutes which represented 27% of the combined time of all three activities. The teacher of room 'P' accomplished an equally high rate of 18.5 SST turns per minute in a larger number of short SSTs of less than 20 turns each in a Reading activity of 4.37 minutes representing 13% of the total time in three activities. The teacher of room 'P' was exceptional in having the highest rate of open questions of any teacher in any activity at more than 5 per minute and also was the teacher who used the highest rate of acknowledgements of strategies of thinking (code [as]) during any activity. The teacher of room 'N', on the other hand, accomplished the high rate of SST turns per minute in the Selected activity with 5 times as many closed questions as there were open questions, and used a high number of acknowledgements of products (code [ap]). Unlike room 'P', there were no acknowledgements of strategies of thinking. Room 'N' had four children participating while room 'P' had five children. In both rooms the balance of child participation was such that all participated and no child

had more than 2.7 turns times that of any other child. This is to say that both teachers were similar in the balance of child participation. In room 'N' child turns were 27, 11, 11, 22, and 10; while in room 'P' child turns were 8, 7, 15 and 18. Although these two teachers achieved similar high rates of SST turns per minute in an activity with similarly balanced child participation, they did so very differently. Examples from these activities follow.

The following short SST from room 'P' during a pause in the story reading is a 16-turn SST, 1 minute and 10 seconds long, initiated by a child after the teacher of room 'P' stops reading.

Example (f) room 'P' reading pause

- 0:04:13 (T reading)
- 0:05:49 (T reading: "…no one can stop the time, you know")

M people *can* stop the time [ice] [t01]! **Child-initiated and equally led SST**
M you can just turn the clock and hold it where it is (and then they)>
M then, people will be able to have time.
T oh, maybe we could try that one day: and see what happens [t02].
T what will happen to the rest of all the other children if we put the clock back [t03] [oe]? **open question asking child to expand on their thinking**
M it would be too much time (and it will could be) <and it will > [t04]^
K <and> it would be muddled up and we will have dinner at breakfast time [t05].
T we could [as] [t06]. acknowledges child's strategy of thinking
T what do you think Bxxx [oi] [t07]? open question requiring inference
B (turns head away with an "I don't know" gesture).
T if we turned my clock back for one hour (glances at her watch)>
B could [t08].
T and we keep thinking: we are an hour either behind the time>
T what would happen to the rest of everything else [oi] [t09]?
M they'll have breakfast (laughing) [t10].
T hmm, could be a mixed up day [as] [t11].
K <we cannot>^

F <I know and the clocks> will be mixed up [t12].

T they might be mixed up [as] [t13].

T what will happen to the traffic, the people and the businesses [oi]?

M they miss it, start going home [t14].

T they might start going home [as] [t15].

T then I should be on the road with x.

- 0:06:59 (reading…)

- 0:07:47 (finishes reading "I can't stop the time, but for you I could just stop the clock for a little while")

T so you are right Mxxx, they stopped the clock [as] [t16]. **Teacher acknowledges thinking strategy, in this case M remembering information to answer a question**

This SST occurred during a pause in the book reading by the teacher and is typical of how these 23 teachers created SSTs using topics prompted by the story in book reading. This example was exceptional only in the final turn being after the next reading and also shows this teacher's determination to acknowledge child thinking.

The teacher of room 'P' in addition, but less typically of other rooms, constructed two SSTs before starting the book reading, firstly with a book orientation exercise where she held the book in the wrong position repeatedly while the children objected.

Example (g) room 'P' from a 20-turn SST

T (turns book sideways) [t03].

M <no> [t04].

K <no>.

T (turns the book back to front saying nothing) [t05].

C no [t06]! **Note: C means Chorus response from all children**

T (turns the book sideway/s still wrong page) [t07].

C no [t08]!

T why not [oe] [t09]? **open question requiring expansion of child's thinking**

F because it's sideway/s [t10].

M you can't read it if it's <sideway/s> [t11].

T <can it go> that way [cy] (turns it upside down still backward) [t14]?

C no [t13]!

F That's upside down [t14].

T how do you know it's upside down [oe] [t14]?

F (because the people), because the words and people and all the other things are upside down [t15].

M even the clock is upside down [t16].

T (T righted the book while M was talking) [t17].

M now it's up [t18].

B yeah, that looks nice [t19].

M Yep, that's right [t20].

In this example, the two open questions [oe] asking children to expand or reveal their thinking make this SST appear of higher "quality" in terms of thinking than some other SSTs.

The following example from room 'P' in a short SST was followed immediately by another short SST where the teacher asked about the writing on the front page that tells the children the title and what the story is about, who wrote it and who illustrated it.

Example (h) room 'P' from an 18-turn SST

T and the little words (pointing to book).

T what do they tell you [ck]? **closed question with a known answer**

F they tell you that it's a story [t10].

T who remembers what those other words tell you too [ri] [t11]? **recall question**

T you've written some books : remember [ri]?

F (nodding) [t12].

T and one day you did the (T mimes drawing using hand to scribe a circle) [ri] [t13]~

B a house [t14].

T a house [ap] [t15].

T and then you were the illustrator of the book.

T the next time you put the words in, and then you were [ri]~

T what was that other word we learned about the other day [ri]?
T was it called authors [cy]? **closed yes or no question**
F yeah [16].
U yeah.
T and then when you went with Victoria [t17].
T and she put the book together.
T what did you become then [ck]? **closed question T knows the answer**
T do you remember that word [cy]?
T was it called the publisher [cy]?
F yes [t18].

In this SST, the teacher explored the words on the front page that signify who wrote, illustrated and published the book, and then connected these to activities the children had done themselves, emphasizing that this is a classroom where the children write, illustrate and bind books. The dialogue connected the concepts being taught with actual child experience and is therefore an example of "material anchors". This is also an example of how even a short dialogue can reveal a great deal about the culture of a classroom, in this case that in this room children engage in book writing, illustrating and publishing.

The following long SST example is from room 'N' during the Selected activity where there were cards with pictures and where the children were asked by the teacher how to order the pictures to make a story. In the first part of this 3-minute SST, the teacher led the children in constructing a story from three pictures of a bare foot, a sock on a foot and finally a shoe and sock on a foot.

Example (i) room 'N' long SST

M and then the < sock over there (pointing)> [t12]^
T <so where will> we put this one [cn] [t13]? **closed question, answer not known**
M <in the middle (pointing) > [t14].

T ok [t15].

T would you like to tell us that story [cy] (looking at M)?

M (nods yes) [t16].

T what's happening in this story now [oi] [t17]?

M because there's a foot without a sock [t18].

M and there's a sock's in.

M and now hmm (there) there's a shoe on.

T right, he's got his shoe on [ap][t19].

T Gxx, could we rearrange them a different way and make another story [cy]?

G (nods yes) [t20].

T how could we do that [oe] [t21]?

G the shoe can go in the middle [t22].

T we put the shoe>

T this one [cy] [t23]?

G in the middle [t24].

T this one in the middle [cy] [t25]?

G (nods yes) [t26].

T is that where you want it [cy] [t27]?

T ok.

T where will we put this one [cn]?

G on the side [t28].

T on this side [cy] [t29]?

G yes [t30].

T and what about the foot [cn]?

T will we leave that there [cy] [t31]?

G (nods yes) [t32].

T ok [t33].

T would you like to tell me a story about this [oi]?

G there's a foot [t34].

T there's a foot [ap] [t35].

T and what's happened to the foot [ck]?

G it hasn't got a shoe [t36].

T it hasn't got a shoe [ap] [t37].

A or a sock [t38].

T or a sock [ap] [t39].

T and then what's happening in this one [ck]?
G he has his shoes on [t40].
T he has his shoe and his sock on [ap] [t41]. [T corrects child]
Note: the SST proceeded through turns 42 to 56 to construct another story
T how does this story go Abby [oi] [t57]?
A hmm, the first sh*>
A the foot is in the shoe with the sock and then [t58].
A (the) the person is taking off the shoe and the sock.
T so there's this one [t59].
T he's taken off his shoe.
T and this one he's taken off his sock.
T so that was a different way of telling the story wasn't it [si]?
A (nods yes) [t60].
T that was very well done [ap] [t61].
U how many more stories left (depressed sounding)?
T not many.

This SST of 61 turns is the third during this activity with previous ones of 38 and 31 turns, each using a different set of cards. This SST is followed within 20 seconds by another SST of 28 turns using a new set of pictures, which, with the previous ones, accounts for almost all the dialogue in the activity.

It can be seen that a great number of turns are spent on details of rather simplistic points about a few picture cards and how they are arranged with deeper thinking occurring only occasionally. Reading this SST is rather tedious and one child voices this sentiment.

In conclusion from this qualitative comparison of rooms 'N' and 'P', it can be seen that the level of challenge and difficulty of questions and thinking are quite different in these two rooms and these two different activities. This may be related to the types of activities the teacher chooses to do rather than the culture of the

classroom over a longer period. It can be concluded, however, that in these circumstances, these two teachers constructed SSTs rather differently using different types of questions and acknowledgements. Both are credited with the same very high rate of SST turns per minute in their 'Best activity'.

The *Results Navigation Guide* shows the analysis is now at the final stage for this chapter.

Chapter 4 Turns/ min in SSTs	1st line of enquiry by turns/ min	**1.** Table 2 - Turns/min combined 3 activities by room Ordered a-w	**2.** Figure 1 Turns/min across 3 activities Ordered a-w
	2nd line of enquiry by SST length	**3.** Table 3 - SSTs by length in total turns PLUS Discourse analysis	**4.** Table 4 - SSTs by length/trns in 3 activities Persistent and Consistency
	3rd line of enquiry	**5.** Table 5 - Ordered by turns/ min highest rate by activity	**6.** Discourse analysis of SST "Quality"
			7. Conclusion

Conclusion to chapter

In this chapter, distinguishing differences between SSTs firstly used an analysis of turns per minute, length and patterns of consistency and persistency across the three activities. A qualitative analysis of "quality" difference was then done. A more systematic and quantitative method of analysis of "quality" is now required. This will be accomplished in the next chapter by counting different kinds of questions, acknowledgements and other important differences identified in the literature review.

CHAPTER 5: RESULTS – QUALITY INDICATORS

This chapter will explore research question two by examining the 69 transcripts using the indicators of quality in terms of the entire dialogue, leaving the comparison between SST and non-SST dialogue for the next chapter. Question two was: Is SST activity associated with four identified quality indicators of teacher use of: questions, acknowledgements, blended spaces and Gricean maxims? The *Results Navigation Guide* shows the analysis for this chapter starts with data logic.

Chapter 5	**Data logic**	**1.** Data treament fig.2	
Quality Indicators	1st line of enquiry	**2.** Tables 6 - 9 Five quality indicators frequency	**3.** Table 10 - summary five indicators across 23 rooms
	2nd line of enquiry	**4.** Table 11 - Six indicators z-scores added - one score to rank 23 rooms quality	**5.** Discourse analysis of SST "Quality"
	3rd line of enquiry	**6.** Tables 12-13 - rank change analysis original a-w SST turns versus 6 indicator rank	**7.** Conclusion

The data for each of these four indicators across 23 rooms was organized in an Excel spreadsheet and a Pearson product-moment correlation was calculated between the main criterion of inquiry (SST turns per minute) against each indicator, and against the subcategories of types of questions and acknowledgements to assess the predicted associations. These indicators were either displayed per minute or as a ratio, so that differing lengths of transcripts was discounted. Questions and Acknowledgement subcategories are described in two different sections and tables. To test for normalcy using the Kolmogorov-Smirnov Goodness-of-Fit test and to make a visual plot to assess linearity and homoscedasticity, each data set where a correlation was tested was first run against a comparison to a normal curve using an

Excel spreadsheet developed for this purpose (Guth, 2012). The example shown in Figure 2 tests the SST turns per minute data set of the 23 rooms for normalcy. The data is from smallest to largest to test against an ideal normal curve. Which room goes with each value is not important here and appears in the relevant table.

Normal Quantile Plot - Test for Non-Normality

SST turns per minute	Cumulative proportion	*z*-score	Test result Sample Size	Critical Value Using $\alpha = .01$	**Critical Value Using $\alpha = .05$**	Critical Value Using $\alpha = .10$
0.54	1/24	-1.731664396	23	0.936579552	**0.955396274**	0.963974678
2.47	1/12	-1.382994127	***r***	Conclusion Using α=.01	**Conclusion Using α=.05**	Conclusion Using α=.10
2.84	1/8	-1.15034938	**Correlation Coefficient**			
2.89	1/6	-0.967421566	**0.988140122**	Sample data do not give sufficient evidence to warrant rejection of the claim that these values come from a normal population.	Sample data do not give sufficient evidence to warrant rejection of the claim that these values come from a normal population.	Sample data do not give sufficient evidence to warrant rejection of the claim that these values come from a normal population.
3.02	5/24	-0.812217801				
3.60	1/4	-0.67448975				
4.67	7/24	-0.548522283				
4.77	1/3	-0.430727299				
5.29	3/8	-0.318639364				
5.41	5/12	-0.210428394				
5.51	11/24	-0.104633456				
5.73	1/2	0				
6.05	13/24	0.104633456				
6.54	7/12	0.210428394				
7.15	5/8	0.318639364				
7.47	2/3	0.430727299				
7.90	17/24	0.548522283				
8.22	3/4	0.67448975				
8.36	19/24	0.812217801				
9.19	5/6	0.967421566				
9.26	7/8	1.15034938				
12.04	11/12	1.382994127				
12.11	23/24	1.731664396				

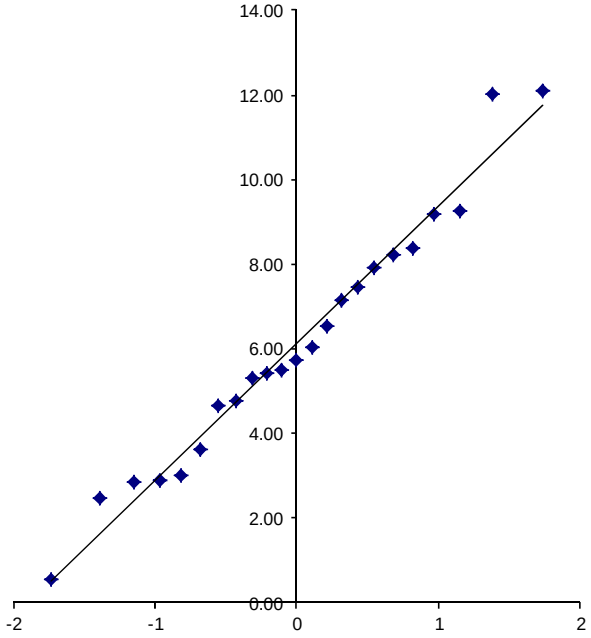


Figure 2 Test for normally distributed data and visual check of the scatter plot for the data set "SST turns per minute" of 23 rooms.

It can be seen that the commonly selected critical value of alpha at 0.05 passes the test for normalcy. All the data sets in this chapter also passed this test. It can be

seen on the scatter plot that the data is linear and does not stray very far off a straight line, thus passing a visual test for linearity and homoscedasticity and this was the case with all other data sets used in this chapter. This allows claims to be made from the correlation testing of the data.

For the purposes of description rather than inference, and searching for patterns rather than causation, each data set was tested for the probability that the correlation occurred by chance, and if found to be less than 0.05 (5% chance) then the correlation was considered significant, and in the following tables these significant values are bolded for clarity. In this chapter, but not later chapters, a one-tailed test for significance was used because it was hypothesized based on the literature that these factors would all be positively correlated, e.g. track together in the positive direction. Probability is reported showing the degrees of freedom, n-2, or in this case as: *r* (21) and the probability *p* is shown as a decimal value where figures less than 0.05 are significant correlations. Online software was used for these calculations (Soper, 2013) which is based on the formula and logic articulated by Cohen, Cohen, West and Aiken (2003).

The *Results Navigation Guide* show the analysis is now at the first line of enquiry.

Chapter 5	Data logic	**1.** Data treament fig.2	
Quality Indicators	**1st line of enquiry**	**2.** Tables 6 - 9 Five quality indicators frequency	**3.** Table 10 - summary five indicators across 23 rooms

For the first analysis, questions were divided into the categories of open, closed or statement questions. Table 6, below, shows the relationship using Pearson product-moment correlation between SST turns per minute and the other factors. This is indicated here and throughout by the word Pearson below the column that is

common to the comparison of the other columns. The two highest scoring associations, open questions and the total of all question types, were also displayed as z-scores in the last two columns for a side-by-side comparison. The column titled "Open divided by Closed" is the ratio of open to closed questions and was done this way so that the values would run in the same positive direction as the other data sets. This was tested as a factor based on previous research which had found the ratio of opened to closed questions was significantly related to quality conversations.

Table 6

Question type associations with SST turns per minute

Room	SST turns per minute	Question type per minute rate for comparison to SST turns/ minute					z-score for comparison		
		Closed Qs/min	Open Qs/min	Open divided by Closed	Statement Qs/min	Total All Qs/min	Open Qs/m z-score	All Qs/m z-score	Open - All z-score
a	12.11	2.96	1.81	0.61	0.42	5.2	1.49	0.22	1.27
b	12.04	6.56	0.60	0.09	0.89	8.0	-0.93	1.92	-2.85
c	9.26	3.59	1.46	0.41	0.23	5.3	0.80	0.42	0.38
d	9.19	3.26	2.09	0.64	1.01	6.4	2.07	0.63	1.43
e	8.36	3.30	1.55	0.47	0.78	5.6	0.98	0.28	0.70
f	8.22	4.07	1.01	0.25	0.60	5.7	-0.11	0.44	-0.55
g	7.90	1.55	1.33	0.86	1.07	4.0	0.54	-1.12	1.67
h	7.47	5.01	1.58	0.32	1.29	7.9	1.05	1.53	-0.48
i	7.15	2.72	0.61	0.23	0.56	3.9	-0.89	-0.80	-0.09
j	6.54	4.70	0.86	0.18	1.34	6.9	-0.40	0.79	-1.18
k	6.05	2.05	1.59	0.78	0.91	4.5	1.06	-0.59	1.65
l	5.73	1.36	0.15	0.11	0.19	1.7	-1.83	-2.11	0.28
m	5.51	2.32	0.57	0.24	0.77	3.7	-0.99	-1.13	0.14
n	5.41	4.01	1.12	0.28	0.65	5.8	0.12	0.48	-0.36
o	5.29	5.98	0.69	0.12	0.61	7.3	-0.73	1.58	-2.32
p	4.77	3.38	1.07	0.32	0.24	4.7	0.01	-0.01	0.03
q	4.67	3.36	0.93	0.28	1.70	6.0	-0.27	-0.13	-0.14
r	3.60	3.43	1.39	0.41	1.13	5.9	0.66	0.26	0.40
s	3.02	3.65	0.88	0.24	0.79	5.3	-0.36	0.05	-0.41
t	2.89	2.86	1.32	0.46	0.56	4.7	0.51	-0.20	0.71
u	2.84	3.76	0.20	0.05	0.17	4.1	-1.72	-0.35	-1.36
v	2.47	3.06	1.01	0.33	0.59	4.7	-0.10	-0.28	0.18
w	0.54	1.28	0.64	0.50	0.10	2.0	-0.84	-1.81	0.97
	Average	3.40	1.06	0.35	0.72	5.2			
	STDEV	1.32	0.50	0.21	0.72	1.6			
r (21)	Pearson	0.33	**0.40**	0.17	0.17	**0.44**			
p	one-tailed	0.062	**0.029**	0.219	0.219	**0.018**	significant	< 0.05 bolded	

Table 6 shows that the Open/Closed Question ratio had a low correlation with SST turns per minute at 0.17. This was somewhat unexpected as previous research suggested that this category would correlate with higher SST activity. Statistically significant correlations were found with the Total of All Questions at 0.44 and then with Open Questions at 0.40. The z-scores were calculated for these two categories and are shown in the last two columns. A side-by-side comparison was made to determine which category to include in further analysis as the most relevant marker of question contribution to SST dialogue. The final column subtracted these two z-scores to show the differences. Three of the top four rooms and rooms ‘k’, 'g', 'o' and ‘u’ showed substantial differences between these two categories, with the greatest difference being room ‘b’ at 2.85 standard deviations difference. Rooms ‘a’ and ‘d’ had the highest z-scores of all 23 rooms for Open Questions per minute, while rooms ‘b’ and ‘h’ had the highest z-scores of all 23 rooms for Total Questions per minute. This is also somewhat surprising considering that open questions is a subset of all questions, and one might expect them to track more closely.

Qualitative data analysis of question types

A qualitative analysis of these four rooms determined that each teacher’s use of questions to construct an SST dialogue could be substantially different. The following dialogue comes from room ‘b’, the highest room in the Total Question z-score, and is from the Writing activity. This sample shows how an SST was constructed using primarily closed questions and acknowledgements. The use of Gricean maxims is also shown as it appears from later analysis to be more highly associated with teachers who use primarily closed questions.

Example (j) room 'b' Writing – closed questions and acknowledgements

K Wain (had his has x x) had his birthday.

T Wain had his birthday [sa] ? **statement question acknowledging**

T did you go to his birthday [gqi] [cy] [itt][t01] ? **teacher-initiated and led SST, Gricean: T wants child statement to contain more information**

K (nods head yes) [t03].

T what did you have at your birthday (to W) [cn] [t04]? **closed not known**

W x x x x [t05].

T Did someone come to your birthday [cy] [t06]?

W a magician [t07].

K A magician [t08].

T and what did the magician [t09]^

A (patting T on arm for attention) [t10].

T did you see the magician at Wain's birthday [cy] [t11]?

A and he had a magic (demonstrating in the air) [t12]>

T he had a magic wand [gma] [t13][si]? **statement question adding information, Gricean: reduce ambiguity (of gesture) using language**

T what did he do with the magic wand [gqi] [cn]? **closed not known, limited range of answers, Gricean: more information required**

W I want to tell you all x x (T looks at him, then back to A) [t14].

W He wrote his name ^

A He went abracadabra at this x and that bird disappeared [t15].

T he made the bird disappear [gmo] [gma] [cy] [t16]? **Gricean: reduce ambiguity and use orderliness**

A uhhuh [t17].

W and I.

W I wrecked his wand [t18].

T you wrecked his wand (incredulous tone) [oc] [t19]? **open clarification, e.g. "please explain further" based on teacher's tone and child reaction**

W in three pieces [t20].

T what did he say when you wrecked his wand [cn] [t21]?

W x x x x [t22].

T he wasn't bothered that you wrecked his wand [sa] [t23]?

T did he make things disappear [cy]?

W yes [t24].

T did he make anything appear, or just disappear [cn] [t25]?

W no he didn’t x x [t26].

T disappeared some things [t27].

A he made a bird disappear [t28].

T he made a bird>

T a real bird or a toy bird [gqi] [cn] [t29]? **Gricean: more information**

A a real bird [t30].

T a real bird [sa] [t31]?

A (nods maybe says yes) [t32].

T a real bird disappeared [t33] [cy]?

A (nods, maybe says something, sheet of paper hiding mouth) [t34].

K and you know what [t35]?

J you know he made him disappear when he waved it over [t36]?

T yeah [t37].

J and then, and he x x x x when he looked in his cage [t38].

J he said who took this bird.

T did the bird have a name [cy] [t39]?

J I don’t know his name [t40].

T or did he just call it a bird [cy] [t41]?

T was it a^

J no, it was a name, but I can’t remember [t42].

T you can’t remember [t43] [ap].

T do you remember the name of the bird (to W) [cy]?

W (slight shake head no or some indication to T) [t44].

T or did you forget too [sa] [t45]?

T was it just a little white bird or a big bird or a black bird [cn] [t46]?

J a little white bird [t47].

T a little white bird [ap] [t48].

W a big white bird [t49].

T a fairly big white bird [t50] [ap].

T and it was allowed to be inside your house [cy]?

J really, no, he was in the [t51]^

W that was when everyone went in the shed [t52].

T oh yeah [t53].

T you did it in the shed [gma]. **Gricean: modeling reducing ambiguity**

A x x a magician [t54].

T that's where the magician came (to A so response to what he said) [gma] [ap] [t55].
T did he wear special clothes or just normal clothes [cn]?
W special clothes [t56].
T what did he wear [cn] [t57]?
W silly clothes [t58].
T silly clothes [sa] [t59]?
T why were they silly clothes [gqi] [oc]?
W because he was wearing x x [t60] .
T ah [t61].
J you know he's on TV x x [t62].
T he told you that he's been on TV [gte] [cy] [t63]? **Gricean: evidence for assertion**
J no, my mum knows it [t64].

This 64-turn sample dialogue from a 104-turn SST illustrates how the teacher succeeded in extending a conversation using primarily closed questions, statement questions and acknowledgements. The SST explored children's experience and memory of a birthday party almost entirely without using open questions. It appears that the judicious use of closed-not-known questions to bring out children's memory combined with closed-yes-or-no questions to confirm teacher suppositions and understandings have effectively extended the children's dialogue. The level of challenge and depth of exploring children's thinking, however, appears to be somewhat less than the following examples. Very similarly, this teacher had an 81-turn SST in the Selected activity that required each child to answer specific questions about what their dad likes to do, following on from a recent activity where the topic was what their mothers like to do. While this approach created much child talk in response to the questions, it did not explore concepts or understandings of complex situations. The teacher moved quickly between children for each question and although there were many opportunities to explore the dad's choices more deeply in terms of concepts, this did not happen, with, for example, a simple question like

"why does your dad like…?". Indeed, the word "why" never appears in the entire 1400-word transcript. The teacher did correct child language output in terms of Gricean maxims which seemed to demonstrate an association between the use of closed questions and explicating Gricean maxims in children's production, indicating that the teacher was paying attention to children's utterance structure and details quite consistently. A more detailed discussion of relationships between question types and other indicators is left for Chapter 7.

Open questions SST examples

The following examples are from a 58-turn SST in the room 'd' Reading activity and a 60-turn SST in the room 'd' Writing activity. The teacher uses primarily open questions to lead the dialogue.

Example (k) open questions in room 'd' Reading activity

T well, do you want to know something [pr]? **pseudo question**
T when he was at the beach, in his bedroom, he found something [itt] [t01].
U that's a bottle [t02] (teacher produced a real bottle with a paper in it from a shelf).
T a bottle [ap].
T how do you think that got in his bedroom [ow] [t03]? **open world experience**
U from the sea [t04].
T from the sea [ap] [t05].
T it's got something inside.
W oh, it's a message [t06].
T a message [ap] [t07].
T you think it's a message [sa]? **statement question acknowledging**
W (nods head yes a few times) [t08].
T shall we open the message [cy] [t09]?
C yes [t10].
T here it is (starting to slide it out of bottle) [t11].
U let's see what it is [t12].
U where did the bottle come from [t13]?

T where did the bottle come from [sa] [t14]?

T where do you think it came from [ow]? **open question from world experience**

U in the sea [t15].

U the sea.

T from the sea [ap] [t16].

U I think it x [t17].

J someone threw it in the sea (pointing) [t18].

W maybe it was a pirate [t19].

T ah! [ap]?

T you think it was a pirate [sa] [t20]?

T what's he sent [ck] (teacher is holding up the note)? **closed known question**

J <broke> (pointing) [t21].

A <a pirate> [t22].

W he sent a broken message [t23].

T a broken message [ap], it is a bit broken, isn't it [sa][t24]?

T it's got some words on it.

K x what, it's from a pirate [t25].

T you think it's from a pirate, Kylie [sa] [t26]?

J look (pointing) [t27].

T well, it has got some words in it [t24].

T it actually says: "start here".

T why do you think we need to start here [oo]? **open opinion**

W because <that's where the pirates> were and then they sailed away [t25].

U <the pirates x>.

T ok [ap], what did they do first [oi] [t27]? **open interpretation of text**

U they climbed through the trees [t28].

T climbed some trees [ap] [t29].

T what did they come upon next (pointing at text) [oi]?

C a crocodile [t30].

T a crocodile [ap] [t31].

T how do you know it's a crocodile, Emma [ow]? **open question about world experience**

E x x x [t32]. **3 words not clear, presume child answered satisfactorily**

T the real pirate sent a message through David's bedroom on how to find what [oi] [t33]?

U the treasure [t34].

T the treasure [ap] [t35].

These 35 turns included seven open questions, two closed questions, five statement questions and eight acknowledgements of products [ap] from the teacher.

The following example is from room ‘d’ Writing activity and is where the teacher is recording the children’s dictated text.

Example (l) open questions in room ‘d’ Writing activity

T see all these words that we’re writing [cy] [t38]?
W try not to wake up the ti* [t39].
T try not to wake up the tiger (writing it) [t40].
T what would happen if you wake the tiger up [ow]?
W he might get you for tea [t41].
T he might get you, or eat you [oc] [t42]? **open clarification, be more specific**
W get you [t43].
T get you for tea [t44].
W and try not to let the snake see you, cause if he does, he might get you [t45].
T ok, so do we have, how are we gonna go past the snake then [oe] [t46]? **open expansion of thinking about this**
W x x first gotta to draw his x in [t47].
T you’re gonna go, go past him, slowly [cy] [t48]?
W so he doesn’t try to get [t49]>
T or very quickly [cy] [t50]?
W no, because if you go slowly, he just thinks you’re a friend of him [t51].
T ah, so how would you like people to go past the snake then [oc] [t52]?
W very tiptoe slowly [t53].
T tiptoe, slowly past the snake (writing) [t54].
T and where is the treasure [cn]?
T how are we going to get from the snake to the treasure [oe]?
W you’ve gotta get your boat again and sail over there [t55].
T ok, get back in your boat [t56].
T in your boat and sail to (writing).
T what’s this here Wxx [cn]?

W that is the treasure [t57].

These 19 turns included five open questions and five closed questions and no acknowledgements.

The following Table 7 shows the totals of either open or closed question and acknowledgement codes of the previous three examples.

Table 7

Question and Acknowledgement code totals in three examples.

Code	Room, activity and SST length		
	'b' Writing 104 turns	'd' Reading 58 turns	'd' Writing 60 turns
[ck]	0	2	0
[cn]	11	1	3
[cy]	17	2	10
Total Closed Qs	28	5	13
[oe]	0	0	7
[op]	0	0	0
[oi]	0	8	0
[ow]	0	4	1
[oo]	0	2	0
[oc]	2	0	5
[ri]	0	0	0
Total Open Qs	2	14	13
Open/Closed ratio	0.07	2.80	1.00
Statememt Questions			
[sa]	6	5	1
[si]	1	0	0
Pseudo Question			
[pr]	0	2	0
Acknowledge Product			
[ap]	6	14	2

The values in Table 7 are true counts and not per minute so a ratio of open to closed questions was calculated and this showed that room ‘b’ Writing had less than a tenth open questions compared to closed questions (0.07), whereas room ‘d’ Reading had 2.8 times as many open questions as closed. Room ‘d’ Writing had equal numbers of open and closed questions. It is also clear that some SST episodes,

although extended conversations involving shared thinking, were of lesser challenge than other SST episodes. This was seen in the comparison of rooms 'N' and 'P' at the end of the last chapter and was also apparent from a qualitative analysis of all the interactions.

The independent correlation and association of Closed Questions and Open Questions with SST turns per minute from Tables 6 (p. 146) and 7, and the qualitative analysis of the four rooms that differed substantially on these measures showed that at least two very different patterns of question-use were effective in constructing SST dialogue. It was therefore decided that both these indicators would be adopted as lead indicators for distinguishing the quality characteristics of SST activity.

The data of the use of acknowledgements by teachers is shown in Table 8, below, as categories of acknowledging the child's effort, use of a thinking strategy, a product, or use of a virtue (see Table 1, Chapter 3, pages 94 – 100) .

Table 8

Acknowledgements across 23 rooms and association with SST activity

Room	SST turns /minute	Teacher Acknowledgements of children's behaviour						
		effort	thinking strategy	product	virtue	total Acknowl	Acknowl /minute	product % total
a	12.1	1	3	66	0	70	2.7	94%
b	12.0	0	0	37	0	37	2.2	100%
c	9.3	0	1	46	1	48	1.2	96%
d	9.2	2	1	59	1	63	2.4	94%
e	8.4	1	3	42	0	46	1.6	91%
f	8.2	1	4	55	1	61	2.5	90%
g	7.9	1	0	30	0	31	1.4	97%
h	7.5	1	2	37	3	43	1.4	86%
i	7.1	0	1	27	0	28	0.7	96%
j	6.5	0	2	87	0	89	2.5	98%
k	6.1	0	0	42	1	43	2.0	98%
l	5.7	1	1	18	0	20	1.0	90%
m	5.5	2	0	13	0	15	0.8	87%
n	5.4	0	2	59	2	63	2.1	94%
o	5.3	0	0	11	0	11	1.0	100%
p	4.8	0	9	19	1	29	0.9	66%
q	4.7	0	0	37	0	37	1.4	100%
r	3.6	1	5	47	1	54	2.3	87%
s	3.0	2	5	33	0	40	1.3	83%
t	2.9	0	0	12	0	12	0.4	100%
u	2.8	0	0	7	0	7	0.2	100%
v	2.5	2	0	36	0	38	1.1	95%
w	0.5	0	1	24	0	25	0.8	96%
	Average						1.47	
	ST DEV						0.73	
r (21)	Pearson						**0.58**	
p	one-tailed		significant	< 0.05 bolded			**0.002**	

Table 8 shows that the predominant type of teacher acknowledgement was for children's products. A Pearson correlation of 0.58 between SST turns per minute and the total acknowledgement types per minute indicates a moderate to high association. Rates of 2.0 per minute and more were seen in eight rooms which was 10 times the rate of the lowest room. All the rooms in the top half except 'i' had rates of 1.2 acknowledgements per minute or more. The data also shows the variety of teacher strategies in a few cases, such as the teacher of room 'p' who used acknowledgement of thinking strategies 31% of the time, with rooms 'r' and 's' also showing use of this strategy. The last column shows the percentage of acknowledgements that were for children's products, with only four rooms at less than 90%. The dialogue example

from room ‘d’ Reading, previously shown above, showed how eight acknowledgements were woven in with the seven open questions, two closed questions, and five statement questions to construct an SST.

The use of Gricean maxims and blended space is shown in Table 9. Blends are counted as single episodes and the 10 Gricean maxim types of the Cooperative Principle are totalled here into one score as no systematic differences were visually apparent in the data.

Table 9

Gricean maxims and blended space use across 23 rooms

Room	SST turns /minute	Blends	Blends /minute	Gricean maxims	Gricean /minute
a	12.11	6	0.23	21	0.8
b	12.04	1	0.06	52	3.1
c	9.26	5	0.13	86	2.2
d	9.19	3	0.12	20	0.8
e	8.36	1	0.03	31	1.0
f	8.22	2	0.08	31	1.2
g	7.90	5	0.22	29	1.3
h	7.47	6	0.19	62	2.0
i	7.15	6	0.16	19	0.5
j	6.54	7	0.19	37	1.0
k	6.05	3	0.14	26	1.2
l	5.73	1	0.05	20	1.0
m	5.51	2	0.10	39	2.0
n	5.41	2	0.07	28	1.0
o	5.29	0	0.00	20	1.7
p	4.77	4	0.12	9	0.3
q	4.67	1	0.04	30	1.2
r	3.60	1	0.04	11	0.5
s	3.02	3	0.09	46	1.4
t	2.89	2	0.07	15	0.5
u	2.84	4	0.11	18	0.5
v	2.47	2	0.06	14	0.4
w	0.54	0	0.00	2	0.1
	Average		0.10		1.1
	STDEV		0.07		0.7
r (21)	Pearson		**0.48**		**0.56**
p	one-tailed		**0.01**		**0.003**

Table 9 shows that there was a great deal of variability in the frequency of teacher use of Blends and Gricean maxims. Although they had respectively moderate

to strong correlations to SST turns per minute, the spread of scores was rather different as seen in the first two rooms which were each the highest in one category, but quite a lot lower in the other. Room ‘c’ was the second highest in Gricean maxims, and above average in Blends. Rooms ‘g’ and ‘h’ had the highest rates that also showed a closer balance between these two factors.

The selected indicators of quality showed high variability across the 23 rooms and moderate to high correlation with SST turns per minute and therefore were each likely to discriminate somewhat differently between rooms for overall quality of dialogue associated with SST activity. Because questions are an important and significant driver of SST activity, as the literature indicates as well as in the examples shown, and the two mostly highly correlated question categories of Open and Total questions discriminated differently, it was decided to use both to assess dialogue quality. Table 10, below, shows the five indicators as z-scores so they are comparable and can be added for a five-indicator total z-score. The ranking of rooms remained ordered as before in this chapter by SST turns per minute.

Table 10

Five indicator z-scores across 23 rooms

Room	Indicators per minute z-scores						
	Total Questions /min z	Open Questions /min z	Acknow-ledgements /min z	Blends /min z-score	Gricean /min z-score	five indicator total z	SST turns /min z-score
a	0.22	1.49	1.67	2.01	-0.43	4.96	2.05
b	1.92	-0.93	1.01	-0.43	2.75	4.32	2.02
c	0.42	0.80	-0.33	0.55	1.51	2.96	1.06
d	0.63	2.07	1.33	0.38	-0.48	3.93	1.03
e	0.28	0.98	0.11	-0.80	-0.10	0.46	0.75
f	0.44	-0.11	1.35	-0.14	0.18	1.73	0.70
g	-1.12	0.54	-0.13	1.88	0.23	1.41	0.59
h	1.53	1.05	-0.11	1.49	1.23	5.18	0.44
i	-0.80	-0.89	-0.99	1.00	-0.85	-2.54	0.33
j	0.79	-0.40	1.38	1.50	-0.13	3.14	0.11
k	-0.59	1.06	0.67	0.66	0.09	1.90	-0.06
l	-2.11	-1.83	-0.68	-0.59	-0.21	-5.42	-0.17
m	-1.13	-0.99	-0.96	0.19	1.23	-1.65	-0.24
n	0.48	0.12	0.92	-0.31	-0.23	0.98	-0.28
o	1.58	-0.73	-0.71	-1.29	0.85	-0.29	-0.32
p	-0.01	0.01	-0.84	0.41	-1.19	-1.62	-0.50
q	-0.13	-0.27	-0.06	-0.73	0.05	-1.14	-0.54
r	0.26	0.66	1.20	-0.67	-0.89	0.56	-0.90
s	0.05	-0.36	-0.29	0.06	0.45	-0.09	-1.11
t	-0.20	0.51	-1.47	-0.35	-0.87	-2.38	-1.15
u	-0.35	-1.72	-1.74	0.36	-0.84	-4.29	-1.17
v	-0.28	-0.10	-0.47	-0.44	-0.98	-2.26	-1.30
w	-1.81	-0.84	-0.86	-1.29	-1.46	-6.26	-1.97
	0.44	0.40	0.58	0.48	0.56	0.77	Pearson *r*(21)
	0.018	0.029	0.002	0.01	0.003	<0.001	*p one-tailed*

Table 10 shows the wide variety of scores between the five indicators, both across the 23 rooms and also within each room across the indicators. No room had entirely above average z-scores as indicated by the presence of at least one negative z-score in each room, while the bottom two rooms are the only ones with entirely negative scores. The column adding the z-scores starts to give some coherence to the data, but interestingly, the ranking does not correspond precisely with the final ordering column of SST turns per minute as shown by the high but not perfect Pearson coefficient of 0.77.

Figure 3 uses the Table 10 data as its source with a linear trend line added to show the general direction of each indicator and to help visualize the overall direction of association.

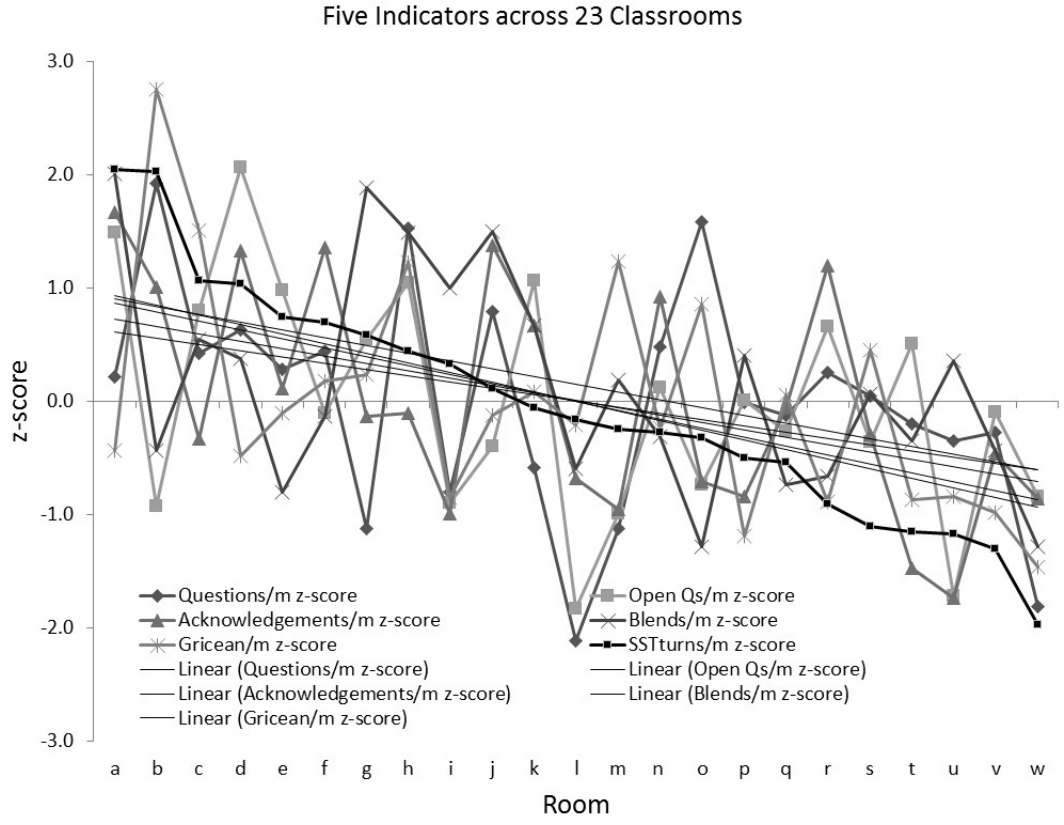


Figure 3 Five-indicator z-scores across 23 rooms ordered by SST per minute and showing linear trend lines.

Figure 3 shows that the five indicators of total questions, open questions, acknowledgements, blends and Gricean maxims as z-scores and ordered by SST per minute from Table 10, vary with each other across the 23 rooms in a very general way. The sharp rise and fall of all the indicators, sometimes together, makes it visually apparent that the five quality indicators vary together in a loosely organised pattern but with great variety. It is also apparent that using only SST turns per minute to order the rooms was insufficient to systematically order the amount of the other five quality indicators in a completely coherent and meaningful way.

The *Results Navigation Guide* shows the analysis is now at the second line of enquiry for this chapter.

Quality Indicators	1st line of enquiry	**2.** Tables 6 - 9 Five quality indicators frequency	**3.** Table 10 - summary five indicators across 23 rooms
	2nd line of enquiry	**4.** Table 11 - Six indicators z-scores added - one score to rank 23 rooms quality	**5.** Discourse analysis of SST "Quality"

The previously discussed qualitative observations that teachers use a wide variety of questioning and acknowledgements are here somewhat demonstrated by the quantitative comparison as shown in Figure 3, which provided some of the details of the indicators associated with these observed differences. This coherence was then extended to include the main variable of SST turns per minute. The five indicators along with SST turns per minute as the sixth and equally weighted indicator, had their z-scores averaged in the following Table 11 to create a single score for ranking and ordering the rooms for further analysis. Due to the lack of research evidence specific enough to determine how to weight each factor, giving each factor equal weight was somewhat arbitrary but unavoidable. Table 11 and Figure 4 show this data and the resulting reordering.

Table 11

Six indicators z-scores averaged sort of 23 rooms

Room	Indicators per minute z-scores							Pattern
	Questions Total/min z-score	Questions Open/min z-score	Acknow-ledge /min z-score	Blends /min z-score	Gricean /min z-score	SST turns /min z-score	six indicator average z	
a	0.22	1.49	1.67	2.01	-0.43	2.05	1.17	Mixed 3
b	1.92	-0.93	1.01	-0.43	2.75	2.02	1.06	Long 2
h	1.53	1.05	-0.11	1.49	1.23	0.44	0.94	Mixed 3
d	0.63	2.07	1.33	0.38	-0.48	1.03	0.83	Mixed 2
c	0.42	0.80	-0.33	0.55	1.51	1.06	0.67	Long 3
j	0.79	-0.40	1.38	1.50	-0.13	0.11	0.54	Short 2
f	0.44	-0.11	1.35	-0.14	0.18	0.70	0.40	Mixed 3
g	-1.12	0.54	-0.13	1.88	0.23	0.59	0.33	Short 3
k	-0.59	1.06	0.67	0.66	0.09	-0.06	0.31	Long 1
e	0.28	0.98	0.11	-0.80	-0.10	0.75	0.20	Mixed 2
N	0.48	0.12	0.92	-0.31	-0.23	-0.28	0.12	Mixed 1
R	0.26	0.66	1.20	-0.67	-0.89	-0.90	-0.06	Short 2
O	1.58	-0.73	-0.71	-1.29	0.85	-0.32	-0.10	Short 2
S	0.05	-0.36	-0.29	0.06	0.45	-1.11	-0.20	Short 2
Q	-0.13	-0.27	-0.06	-0.73	0.05	-0.54	-0.28	Short 2
M	-1.13	-0.99	-0.96	0.19	1.23	-0.24	-0.32	Mixed 2
P	-0.01	0.01	-0.84	0.41	-1.19	-0.50	-0.35	Short 3
i	-0.80	-0.89	-0.99	1.00	-0.85	0.33	-0.37	Short 3
T	-0.20	0.51	-1.47	-0.35	-0.87	-1.15	-0.59	Short 1
V	-0.28	-0.10	-0.47	-0.44	-0.98	-1.30	-0.59	Short 2
U	-0.35	-1.72	-1.74	0.36	-0.84	-1.17	-0.91	Short 2
L	-2.11	-1.83	-0.68	-0.59	-0.21	-0.17	-0.93	Short 3
W	-1.81	-0.84	-0.86	-1.29	-1.46	-1.97	-1.37	Short 0
	0.69	0.64	0.74	0.54	0.57	0.86	Pearson *r* (21)	
	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	*p* one tailed	

Despite the wide variety of scores across rooms, the averaging and different sorting procedures, it can be seen that the top and bottom five rooms still contain the original top and bottom four rooms in terms of the rate of SST turns per minute. The original pattern categorization remained somewhat related with the ‘Long 2’, ‘Long 3’ and ‘Mixed 3’ at or near the top, while the bottom rooms are all Short with the last room remaining the same throughout, showing a ‘robustness’ of the various iterations of sorting by patterns and quality indicators in the sense that they seem related. This is supported by the high correlations, but interestingly, if one had to pick a single ‘marker’ for quality that related closely to SST turns per minute from this data set, it would be acknowledgements, not questions, as one would have expected from the literature related to questions.

Qualitative analysis of exceptions

Looking in detail at exceptions can inform important differences. From the original room order, only 'i' shifted position substantially into the opposite half, suggesting that room 'i', with a fairly average rate of SST turns per minute at a z-score of 0.33, may have accomplished SST construction rather differently and in a way that minimized other quality factors. Looking at the z-scores of room 'i', it can be seen that of the six factors, the largest negative scores from -0.80 to -0.99 are in both question categories, acknowledgements and Gricean maxims. Room 'i' is also distinguished for having more short SSTs, with 18 of 10 turns or less, than any other room (referring to Table 3 in Chapter 4, p.116). An example of an SST from room 'i', which comes from the Writing activity, has an SST started by a child and no genuine questions were used by the teacher, which is exceptional.

Example (m) no questions SST in room 'i' Writing.

T Would you (to L and M both sitting with paper and pens) perhaps like to draw a picture of the beans first [pr]? **pseudo question as activity already set up**

T and then we can write the type of beans that we planted are called broad beans.

G B for beans, B for beans.

T B for beans, that's right [ap].

T Gracie, would you like to take a seat here next to Mitch [pr]?

G Hmm, yes.

M I know a way of doing it [icc] [t01] **Note: although M is responding to the original pseudo question by T, the SST [icc] only starts with M's initiative**

G what [t02]?

M like if we had a clear piece [t03].

T if you had a [t04]^

M you know we could press it [t05].

M and then the colour would come off.

T Ah, just like it would be a print [t06].

M Yeah, make a print [t07].

T Well, you're good at writing and drawing [as] [t08]. **acknowledge skill**

T so you could make this <only if this x x x x x>^
M <Like if we could see> through it [t09].
G a pen.
T I'll get you a pen (to G and T leaves table).
T here you go, Georgia.
G Do I need to draw a bean first?
T Yeah.

This is an SST because the teacher adds the word-label "print" to help M clarify his idea and then supports the child's effort with the comment about being good at two skills that involve thinking and perhaps additional helpful information which, although an indecipherable five words were spoken, as indicated by x x x x x in the transcript, may have contributed to M's understanding about seeing through the print. However, no questions were involved except two pseudo-questions at the start. Perhaps no questions were needed as the child took the initiative and the teacher supported it. The SST ends when the dialogue returns to organizing the material for the activity.

Figure 4, below, shows how the six indicators related to each other when ordered by their average z-scores.

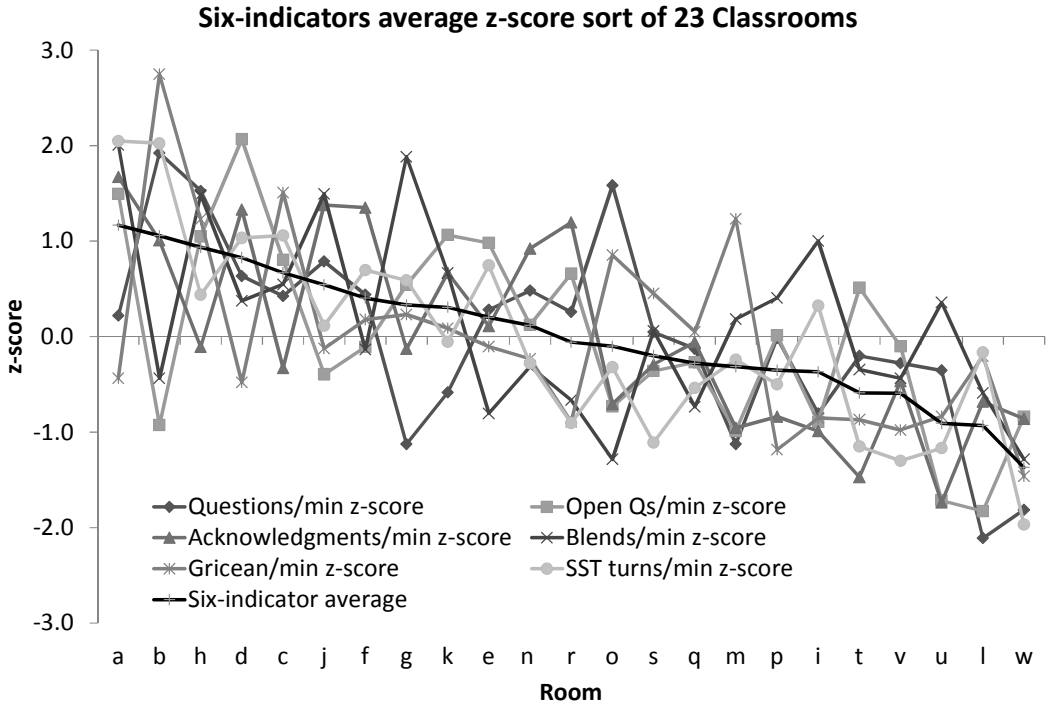


Figure 4 Six indicators average z-score sort of 23 rooms

It can be seen visually that the general trends between these indicators are related to each other across the 23 rooms. This ranking of rooms on the average of six quality indicators will be used throughout the remainder of the data analysis as the organizing pattern against which other data analysis will be compared. The *Results Navigation Guide* shows the analysis is now at the third line of enquiry.

Quality Indicators	1st line of enquiry	**2.** Tables 6 - 9 Five quality indicators frequency	**3.** Table 10 - summary five indicators across 23 rooms
	2nd line of enquiry	**4.** Table 11 - Six indicators z-scores added - one score to rank 23 rooms quality	**5.** Discourse analysis of SST "Quality"
	3rd line of enquiry	**6.** Tables 12-13 - rank change analysis original a-w SST turns versus 6 indicator rank	**7.** Conclusion

Detailed rank changes in the ordering of rooms from the original rank by SST turns per minutes, ‘a’ to ‘w’, to a new ranking ‘1’ to ‘23’ by the addition of five measures of various quality factors are displayed in Table 12. The greatest changes of five or more places are bolded. This Table adds quantitative values to the rank changes that were first seen in Table 11 (p. 162).

Table 12

Rank change from SST turns per minute to six-indicator sort

	Rankings				
room original a - W	original SST turns per minute	final six indicators z-score	change original to final	Long, Mixed Short & 1,2,3 ordering	final ranking designation
a	1	1	0	4	1 a
b	2	2	0	2	2 b
h	8	3	**5**	6	3 h
d	4	4	0	8	4 d
c	3	5	-2	1	5 c
j	10	6	4	15	6 j
f	6	7	-1	5	7 f
g	7	8	-1	11	8 g
k	11	9	2	3	9 k
e	5	10	**-5**	9	10 e
N	14	11	3	10	11 N
R	18	12	**6**	19	12 R
O	15	13	2	18	13 O
S	19	14	**5**	16	14 S
Q	17	15	2	17	15 Q
M	13	16	-3	7	16 M
P	16	17	-1	12	17 P
i	9	18	**-9**	13	18 i
T	20	19	1	22	19 T
V	22	20	2	20	20 V
U	21	21	0	21	21 U
L	12	22	**-10**	14	22 L
W	23	23	0	23	23 W
	0.83	Pearson *r* (21)		0.77	
	<0.001	*p* two-tailed		<0.001	

Table 12 shows that the addition of five factors to the original sorting of rooms by SST turns per minute resulted in large changes in rank for only a few rooms, with 14 rooms remaining the same or changing only one or two places in rank. At the top, three rooms did not change rank while room ‘c’ dropped two places in rank. Rooms ‘f’ and ‘g’ only dropped by one place. At the bottom, two rooms remained the same

while two others changed one and two places. Room ‘i’ was the only room to move substantially into the opposite half. The rank according to the pattern of persistency and consistency with Long, Mixed and Short categories is also shown for comparison with a Pearson correlation calculated. This ranking correlates strongly at 0.77, but is less than the original SST turns per minute ranking correlation of 0.83.

It appears that the rooms that scored either very high or very low in SST turns per minute changed the least, while rooms in the middle of the rankings were more susceptible to rank order changes. Although the ranking changed, the correlations show that this was not extreme, with a very high level of relationship and therefore the addition of six indicators was a ‘refinement’ rather than a radical change in ordering.

Extreme rank changes

The rooms that changed five or more places consisted of three that went up and three that dropped in rank. To explore which of the five factors might have accounted most for these changes, the details of the five-factor z-scores and the changes are displayed in Table 13 by comparing their departure from a ‘standard’ ranking, taken as the original SST turns per minute, which is done only to provide a z-score number from which to calculate change.

Table 13

Most extreme rank changes from SST turns per minute sorting to six-indicators sorting

Room original	Room final	Rank change	SST turns /m z rank Standard	Questions total /min z-score	Q's Total z difference w/ Standard	Open Questions /min z	Open Qs z diff Standard	Acknow - ledgement /min z	Ackn z diff w/ Standard	Blends /min z-score	Blends z difference w/ Standard	Gricean maxims /min z	Gricean z difference w/ Standard
e	*10*	*-5*	*0.75*	*0.28*	-0.47	*0.98*	0.23	*0.11*	**-0.64**	*-0.80*	**-1.55**	*-0.10*	**-0.85**
i	*18*	*-9*	*0.33*	*-0.80*	**-1.13**	*-0.89*	**-1.22**	*-0.99*	**-1.32**	*1.00*	0.67	*-0.85*	**-1.18**
L	*22*	*-10*	*-0.17*	*-2.11*	**-1.94**	*-1.83*	**-1.66**	*-0.68*	**-0.52**	*-0.59*	-0.43	*-0.21*	-0.04
h	3	5	0.44	1.53	**1.09**	1.05	**0.61**	-0.11	-0.55	1.49	**1.05**	1.23	**0.79**
R	12	6	-0.90	0.26	**1.16**	0.66	**1.56**	1.20	**2.10**	-0.67	0.24	-0.89	0.01
S	14	5	-1.11	0.05	**1.16**	-0.36	**0.75**	-0.29	**0.82**	0.06	**1.17**	0.45	**1.56**

Table 13 summarizes data for rooms that moved by five or more places from the original SST turns per minute rank by showing the differences in z-scores for each of the five factors to that of the original SST turns per minute z-score, marked on the table as ‘Standard’. This is a measure of change in rank by z-score comparison to the original ranking. The first three dropped in rank and the second three went up in rank. The bolded numbers are changes of 0.50 or more in z-score in the main direction of change and appear in a column headed with “diff w/ standard” meaning this factor’s difference with the standard z-score ranking by SST turns per minute in the fourth column.

If the difference was in the opposite direction of the change in rank, even though more than 0.50 z-score, it is not bolded because it did not contribute to the change. As shown in Table 13, room ‘e’ was the only room that did not have significant contributions to change in rank from total questions and open questions per minute. Room ‘e’ dropped in rank, primarily from a drop in acknowledgements, blends and Gricean maxims per minute. Room ‘h’ increased five places because of increases in four categories, despite a 0.55 drop in acknowledgements. The five rooms other than ‘e’ all had substantial change contribution from both kinds of questions and also acknowledgements, while blends and Gricean maxims were inconsistent in contributing to change. Only one room did not have significant change influence contribution from use of acknowledgements. The two rooms with the largest change, ‘i’ and ‘L’, dropped respectively 10 and 9 places, with this change almost entirely due to lower levels of the use of questions and acknowledgements. It appears that these teachers have very different approaches.

Except for room ‘e’, use of questions and acknowledgements contributed most consistently to changes, with less consistent contributions of differences from blends and Gricean maxims. Two rooms, ‘h’ and ‘S’, had more contribution to change from the total questions rather than open questions, indicating, again, a difference in teacher use of question types to construct SSTs.

The *Results Navigation Guide* shows the analysis for chapter five is now complete.

Chapter 5	Data logic	**1.** Data treament fig.2	
Quality Indicators	1st line of enquiry	**2.** Tables 6 - 9 Five quality indicators frequency	**3.** Table 10 - summary five indicators across 23 rooms
	2nd line of enquiry	**4.** Table 11 - Six indicators z-scores added - one score to	**5.** Discourse analysis of SST "Quality"
	3rd line of enquiry	**6.** Tables 12-13 - rank change analysis original a-w SST turns versus 6 indicator rank	**7. Conclusion**

Conclusion to chapter

The five indicators of quality were shown in the analysis in this chapter to be highly associated with SST turns per minute, but each in different patterns across the 23 rooms. This provided the rationale of including each of the 5 along with SST turns per minute as having some distinct contribution toward SST construction. In the next chapter these indicators will be used both for quantitative analysis of how SST dialogue differs from non-SST dialogue and as a rank ordering for correlation testing.

CHAPTER 6

COMPARING NON-SST AND SST DIALOGUE

The last chapter ended with a ranking of 23 rooms on teacher use of six indicators of quality in the combined dialogue of the three activities. This chapter examines the data with regard to research question 3: What are the differences between non-SST dialogue and SST dialogue in terms of: (a) the identified quality indicators, and later in this chapter part (b) the children/teacher talk ratio? The *Results Navigation Guide* shows the complete outline for Chapter Six which starts with the data treatment logic.

Chapter 6	**Data logic**	**1.** Data treament Table 14	
Change from non-SST to SST dialogue	1st line Question 3a 5 indicators	**2.** Tables 15-17 Five indicator changes non-SST to SST dialogue	**3.** Table 18 - 20 pattern search using z-scores and correlations
	2nd line Question 3b talk ratio	**4.** Table 21 - T/C talk ratio Number Total Words changes nSST to SST	**5.** Table 22 - T/C talk ratio significant correlations
		6. Qualitative discourse analysis of SST starts	**7.** Conclusion Qs 3a & 3b

The comparison between non-SST and SST dialogue was accomplished by extracting all SST episodes from the combined transcripts and creating an SST-only transcript and a non-SST-only transcript for each room. The actual time spent in each type of dialogue was lost because time stamps were not done at the beginning and end of each SST episode during transcription. To compare the rate of the six quality indicators of SST turns per minute, questions (two types), acknowledgements, blends and Gricean maxims between non-SST and SST dialogue, a new metric was used. This was the rate per utterance rather than the original rate per minute, an utterance being a distinct and single unit of meaning. An utterance was defined in the methods chapter as: “complete communicative units, which may consist of single words,

phrases, clauses and clause combinations spoken in context" (Carter & McCarthy, 2006).

The transcripts were created as one line equalling one utterance, as has been seen in the dialogue examples in the previous results chapters. Both SST and non-SST rates were calculated the same way and then the change was determined as a per cent of change. The changes were ordered in the following tables according to the six-indicator quality z-score ranking. "Change" here can be thought of as "caused" by the teacher creating an SST or following a child and therefore assisting in the creation of an SST. The analytical treatment of the data is the same as if this was an "intervention". Teachers were not instructed to do this, so this is not an experimental situation but rather the teachers are acting as the "interventionists" in the naturalistic context of talk interactions. There is no examination of motive or underlying cause of the teacher's decision, but it is taken that they have "decided" in the flow of talk interactions to "do" something different than just continue with non-SST dialogue.

Table 14 shows teachers' number of verbal utterances in both non-SST and SST dialogue in the 23 rooms now ranked with numbering 1a – 23W which will be used from here on.

Table 14

Teacher Verbal Utterances

Room		Teacher Utterances	
		Total nSST	Total SST
1	a	175	292
2	b	164	161
3	h	465	253
4	d	255	224
5	c	306	416
6	j	635	182
7	f	199	219
8	g	279	174
9	k	206	183
10	e	384	231
11	N	336	175
12	R	436	60
13	O	157	51
14	S	462	76
15	Q	427	113
16	M	207	108
17	P	341	141
18	i	252	222
19	T	449	125
20	V	436	89
21	U	681	96
22	L	171	117
23	W	441	9

Room 23W with nine utterances in SST dialogue is so low that including this room was problematic for purposes of comparing non-SST and SST dialogue. It was therefore removed from further analysis. The *Results Navigation Guide* shows the analysis now proceeds to the first line of enquiry.

Chapter 6	Data logic	**1.** Data treament Table 14	
Change from non-SST to SST dialogue	**1st line Question 3a 5 indicators**	**2.** Tables 15-17 Five indicator changes non-SST to SST dialogue	**3.** Table 18 - 20 pattern search using z-scores and correlations

Changes in six indicators from non-SST to SST dialogue

The analysis of changes in the six quality indicators proceeded with the 22 remaining rooms. Three tables follow that show how the changes in these indicators were derived from the raw data. Then these changes are summarized in Table 18 (p. 180) for ease of comparing changes in all six indicators together. The indicators'

rate per utterance was calculated using the formula: Total number of the indicator divided by the total number of verbal utterances.

Table 15 shows open and closed questions per utterance and then the ratio of open to closed questions and how these three measures changed from non-SST to SST dialogue across 22 rooms. The change columns are bolded for ease of viewing and at the bottom the number of rooms that increased, decreased or stayed the same in their rates are shown.

Table 15

Teacher change in closed and open question use from non-SST to SST dialogue

Room		Teacher Utterances		Closed questions / utterance change					Open questions / utterance change					Open/Closed ratio change			Six
		Total nSST	Total SST	Cl.Q nSST	Cl.Q SST	Cl.Q /Ut nSST	Cl.Q /Ut SST	**Cl.Q/Ut change**	Op.Q nSST	Op.Q SST	Op.Q/Ut nSST	Op.Q/Ut SST	**Op.Q/Ut change**	O/C ratio nSST	O/C ratio SST	**O/C ratio change**	indicators av z-score
1	a	175	292	30	55	0.17	0.19	**0.02**	7	32	0.04	0.11	**0.07**	0.23	0.58	**0.35**	1.17
2	b	164	161	48	62	0.29	0.39	**0.09**	5	3	0.03	0.02	**-0.01**	0.10	0.05	**-0.06**	1.06
3	h	465	253	92	65	0.20	0.26	**0.06**	6	13	0.01	0.05	**0.04**	0.07	0.20	**0.13**	0.94
4	d	255	224	46	41	0.18	0.18	**0.00**	9	39	0.04	0.17	**0.14**	0.20	0.95	**0.76**	0.83
5	c	306	416	55	86	0.18	0.21	**0.03**	20	25	0.07	0.06	**-0.01**	0.36	0.29	**-0.07**	0.67
6	j	635	182	130	37	0.20	0.20	**0.00**	13	20	0.02	0.11	**0.09**	0.10	0.54	**0.44**	0.54
7	f	199	219	54	48	0.27	0.22	**-0.05**	3	20	0.02	0.09	**0.08**	0.06	0.42	**0.36**	0.40
8	g	279	174	22	14	0.08	0.08	**0.00**	4	24	0.01	0.14	**0.12**	0.18	1.71	**1.53**	0.33
9	k	206	183	19	26	0.09	0.14	**0.05**	6	23	0.03	0.13	**0.10**	0.32	0.88	**0.57**	0.31
10	e	384	231	64	35	0.17	0.15	**-0.02**	14	24	0.04	0.10	**0.07**	0.22	0.69	**0.47**	0.20
11	N	336	175	67	54	0.20	0.31	**0.11**	10	10	0.03	0.06	**0.03**	0.15	0.19	**0.04**	0.12
12	R	436	60	57	22	0.13	0.37	**0.24**	14	2	0.03	0.03	**0.00**	0.25	0.09	**-0.15**	-0.06
13	O	157	51	52	17	0.33	0.33	**0.00**	4	4	0.03	0.08	**0.05**	0.08	0.24	**0.16**	-0.10
14	S	462	76	94	23	0.20	0.30	**0.10**	8	7	0.02	0.09	**0.07**	0.09	0.30	**0.22**	-0.20
15	Q	427	113	69	21	0.16	0.19	**0.02**	8	7	0.02	0.06	**0.04**	0.12	0.33	**0.22**	-0.28
16	M	207	108	34	12	0.16	0.11	**-0.05**	6	5	0.03	0.05	**0.02**	0.18	0.42	**0.24**	-0.32
17	P	341	141	89	25	0.26	0.18	**-0.08**	5	23	0.01	0.16	**0.15**	0.06	0.92	**0.86**	-0.35
18	i	252	222	44	58	0.17	0.26	**0.09**	2	17	0.01	0.08	**0.07**	0.05	0.29	**0.25**	-0.37
19	T	449	125	74	15	0.16	0.12	**-0.04**	10	18	0.02	0.14	**0.12**	0.14	1.20	**1.06**	-0.59
20	V	436	89	88	16	0.20	0.18	**-0.02**	6	8	0.01	0.09	**0.08**	0.07	0.50	**0.43**	-0.59
21	U	681	96	107	25	0.16	0.26	**0.10**	2	3	0.00	0.03	**0.03**	0.02	0.12	**0.10**	-0.91
22	L	171	117	15	13	0.09	0.11	**0.02**	0	3	0.00	0.03	**0.03**	0.00	0.23	**0.23**	-0.93
average		337	169	61	35	0.185	0.215	**0.030**	7	15	0.023	0.086	**0.062**	0.137	0.507	**0.370**	
CHANGE		**up,**	*down,*	same				**12,** *6*, 4					**20,** *2*, 0			**19,** *3*, 0	
average % change						(0.030 / 0.185)		16%			(0.062 / 0.023)		267%	(0.037 / 0.137)		271%	

The results of change from non-SST to SST dialogue are summarized on the row marked 'CHANGE **up,** *down,* same', which indicates the total number of rooms which changed in those directions or not, in each indicator. In the category of closed questions per utterance, for example, 12 rooms increased the rate, 6 decreased and 4 stayed the same. All rooms had an increase in open questions per utterance except two with very small decreases of - 0.01. These were 2b and 5c, with 2b also having an exceptionally low number of open questions both in non-SST and SST dialogue. The ratio of open to closed questions increased in 19 rooms and decreased in 3 and was the measure that showed the highest averages in both SST dialogue and in the change. It is also important to note the average percentage change, as this is comparable across indicators. Open question rates across all rooms increased by 267% and the ratio of open to closed questions increased by an average of 271% across all rooms.

The use of open questions and the ratio of open to closed questions changed considerably from non-SST to SST dialogue. Further conclusions were made after all indicators were examined.

Table 16 shows the total questions in non-SST and SST dialogue, their rate per utterance and then the same for the ratio of open and closed questions to total questions. The same summaries and comparisons are shown as in Table 15 except that the total utterance columns have been removed for simplicity, as these were only used for calculation and have already been shown twice.

Table 16

Teacher changes from non-SST to SST dialogue in total questions and open and closed question ratios to total questions use

Room		Total questions / utterance change					Open / total ratio change			Closed / total ratio change			Six
		Tot Qs nSST	Tot Qs SST	T.Qs/Ut nSST	T.Qs/Ut SST	**T.Qs/Ut change**	O/T.Qs ratio	O/T.Qs ratio SST	**O/T.Qs change**	C/T.Qs ratio	C/T.Qs ratio SST	**C/T.Qs change**	indicators av z-
1	a	46	110	0.26	0.38	**0.11**	0.15	0.29	**0.14**	0.65	0.50	**-0.15**	1.17
2	b	67	76	0.41	0.47	**0.06**	0.07	0.04	**-0.04**	0.72	0.82	**0.10**	1.06
3	h	157	110	0.34	0.43	**0.10**	0.04	0.12	**0.08**	0.59	0.59	**0.00**	0.94
4	d	76	107	0.30	0.48	**0.18**	0.12	0.36	**0.25**	0.61	0.38	**-0.22**	0.83
5	c	89	131	0.29	0.31	**0.02**	0.22	0.19	**-0.03**	0.62	0.66	**0.04**	0.67
6	j	187	80	0.29	0.44	**0.15**	0.07	0.25	**0.18**	0.70	0.46	**-0.23**	0.54
7	f	73	81	0.37	0.37	**0.00**	0.04	0.25	**0.21**	0.74	0.59	**-0.15**	0.40
8	g	49	61	0.18	0.35	**0.17**	0.08	0.39	**0.31**	0.45	0.23	**-0.22**	0.33
9	k	40	68	0.19	0.37	**0.18**	0.15	0.34	**0.19**	0.48	0.38	**-0.09**	0.31
10	e	106	88	0.28	0.38	**0.10**	0.13	0.27	**0.14**	0.60	0.40	**-0.21**	0.20
11	N	120	73	0.36	0.42	**0.06**	0.08	0.14	**0.05**	0.56	0.74	**0.18**	0.12
12	R	114	37	0.26	0.62	**0.36**	0.12	0.05	**-0.07**	0.50	0.59	**0.09**	-0.06
13	O	65	24	0.41	0.47	**0.06**	0.06	0.17	**0.11**	0.80	0.71	**-0.09**	-0.10
14	S	149	36	0.32	0.47	**0.15**	0.05	0.19	**0.14**	0.63	0.64	**0.01**	-0.20
15	Q	132	50	0.31	0.44	**0.13**	0.06	0.14	**0.08**	0.52	0.42	**-0.10**	-0.28
16	M	57	29	0.28	0.27	**-0.01**	0.11	0.17	**0.07**	0.60	0.41	**-0.18**	-0.32
17	P	115	59	0.34	0.42	**0.08**	0.04	0.39	**0.35**	0.77	0.42	**-0.35**	-0.35
18	i	78	92	0.31	0.41	**0.10**	0.03	0.18	**0.16**	0.56	0.63	**0.07**	-0.37
19	T	116	44	0.26	0.35	**0.09**	0.09	0.41	**0.32**	0.64	0.34	**-0.30**	-0.59
20	V	152	29	0.35	0.33	**-0.02**	0.04	0.28	**0.24**	0.58	0.55	**-0.03**	-0.59
21	U	157	33	0.23	0.34	**0.11**	0.01	0.09	**0.08**	0.68	0.76	**0.08**	-0.91
22	L	25	17	0.15	0.15	**0.00**	0.00	0.18	**0.18**	0.60	0.76	**0.16**	-0.93
average		99	65	0.29	0.39	**0.10**	0.08	0.22	**0.14**	0.62	0.55	**-0.07**	
CHANGE		**up,**	*down,*	same		**19,** *2* , 1			**19,** *3* , 0			**8,** *13* , 1	
average % change					(0.10 / 0.29)	34%		(0.14 / 0.08)	176%		(-0.07 / 0.62)	-12%	

The changes from non-SST to SST dialogue showed the rate of total questions per utterance increased in 19 of 22 rooms on average from 0.29 to 0.39, which is a change of 0.10 and a 34% increase. The ratio of open questions to total questions increased on average from 0.08 to 0.22, which is nearly a threefold increase. The ratio of closed questions to total questions, on the other hand, decreased for 13 rooms with an average decrease of 12%. Rooms 2b and 5c were now joined by 12R in rooms that showed an opposite trend to the majority of rooms, this time in Open to Total Questions ratio category.

The use of total questions increased in 19 of 22 rooms on average 34% from non-SST to SST dialogue. However, open questions ratio to total questions increased also in 19 of 22 rooms by a great deal more with an average increase of 176%. Combined with the previous table, it can be concluded that the main change in questions between most teachers' non-SST and SST dialogue was a very large increase in the rate of open questions. It also can be concluded that a small number of rooms seem to have an opposite trend.

Table 17 shows the changes from non-SST to SST dialogue in acknowledgements, blends and Gricean maxims. The same summaries and comparisons are shown as in Table 16. Blends are not calculated per utterance because unlike the other indicators, they consist of a whole series of related utterances, although often separated by other dialogue, that when combined, are more like an SST episode and are therefore not logically related to a per utterance metric (see Appendix A for an example).

Table 17

Teacher changes from non-SST to SST dialogue in acknowledgements, blends and Gricean maxims use

Room		Acknowledgements / Utterance change					Blends change			Gricean Maxims / Utterance change					Six indicators av z-
		Ackn nSST	Ackn SST	Ack/Ut nSST	Ack/Ut SST	**Ack/Ut change**	Blends nSST	Blends SST	**Blends change**	Gricean nSST	Gricean SST	Grice/Ut nSST	Grice/Ut SST	**Gricean change**	
1	a	20	52	0.114	0.178	**0.064**	2	6	**4**	3	19	0.017	0.065	**0.048**	1.17
2	b	7	30	0.043	0.186	**0.144**	0	0	**0**	5	47	0.030	0.292	**0.261**	1.06
3	h	27	16	0.058	0.063	**0.005**	1	5	**4**	6	56	0.013	0.221	**0.208**	0.94
4	d	27	37	0.106	0.165	**0.059**	0	3	**3**	4	17	0.016	0.076	**0.060**	0.83
5	c	20	29	0.065	0.070	**0.004**	0	5	**5**	12	74	0.039	0.178	**0.139**	0.67
6	j	68	23	0.107	0.126	**0.019**	2	6	**4**	11	26	0.017	0.143	**0.126**	0.54
7	f	27	33	0.136	0.151	**0.015**	0	2	**2**	12	18	0.060	0.082	**0.022**	0.40
8	g	17	14	0.061	0.080	**0.020**	3	5	**2**	10	21	0.036	0.121	**0.085**	0.33
9	k	22	21	0.107	0.115	**0.008**	0	3	**3**	5	21	0.024	0.115	**0.090**	0.31
10	e	19	25	0.049	0.108	**0.059**	0	0	**0**	18	13	0.047	0.056	**0.009**	0.20
11	N	46	17	0.137	0.097	**-0.040**	0	2	**2**	17	11	0.051	0.063	**0.012**	0.12
12	R	50	5	0.115	0.083	**-0.031**	0	1	**1**	9	2	0.021	0.033	**0.013**	-0.06
13	O	6	5	0.038	0.098	**0.060**	0	0	**0**	9	11	0.057	0.216	**0.158**	-0.10
14	S	35	6	0.076	0.079	**0.003**	0	3	**3**	25	21	0.054	0.276	**0.222**	-0.20
15	Q	24	13	0.056	0.115	**0.059**	0	1	**1**	5	25	0.012	0.221	**0.210**	-0.28
16	M	10	6	0.048	0.056	**0.007**	0	2	**2**	15	24	0.072	0.222	**0.150**	-0.32
17	P	14	16	0.041	0.113	**0.072**	0	4	**4**	0	9	0.000	0.064	**0.064**	-0.35
18	i	17	13	0.067	0.059	**-0.009**	0	5	**5**	6	14	0.024	0.063	**0.039**	-0.37
19	T	6	6	0.013	0.048	**0.035**	1	2	**1**	4	12	0.009	0.096	**0.087**	-0.59
20	V	28	10	0.064	0.112	**0.048**	1	1	**0**	9	5	0.021	0.056	**0.036**	-0.59
21	U	2	5	0.003	0.052	**0.049**	2	3	**1**	5	13	0.007	0.135	**0.128**	-0.91
22	L	12	9	0.070	0.077	**0.007**	0	1	**1**	6	14	0.035	0.120	**0.085**	-0.93
average		23	18	0.072	0.101	**0.030**	0.55	2.7	**2.2**	9	22	0.030	0.132	**0.102**	
CHANGE		**up,**	*down,*	same		**19,** *3* , 0			**18,** *0* , 4					**22,** *0,* 0	
average % change				(0.03 / 0.072)		42%		(2.2/ 0.55)	400%			(0.102 / 0.030)		340%	

The data from Table 17 showed that in 19 rooms the use of acknowledgements increased, with the average rate per utterance increasing by 42%. The use of blends increased in 18 rooms, down in none and stayed the same in 4, 3 of which had zero both in non-SST and in SST dialogue. The change was very large, with the average number increasing fivefold from 0.55 to 2.7. The use of Gricean maxims increased in all 22 rooms and on average more than fourfold from a rate of 0.030 per utterance to 0.132 per utterance.

The use of acknowledgements, blends and Gricean maxims increased in almost all rooms when moving from non-SST to SST dialogue with blends and Gricean maxims showing a three- to fourfold increase.

Summary of changes in six indicators

Table 18 shows all the change columns from previous tables together to facilitate understanding of patterns of change across the six indicators measures. The original room SST pattern classifications are shown and a final column is a count of the number of categories for a room which changed not at all, or in a negative direction. This was to check for any systematic patterns.

Table 18

Brief summary of teacher changes in use of indicators moving from non-SST to SST dialogue

SST Pattern	Room	Indicator changes moving from non-SST dialogue into SST episodes							Number negative or no change
		Closed Q / Ut	Open Qs / Ut	Op/Cl Qs ratio	Total Qs / Ut	Acknow / Ut	Blends	Gricean / Ut	
Mixed 3	1 a	0.02	0.07	0.35	0.11	0.064	4	0.048	0
Long 2	2 b	0.09	**-0.01**	**-0.06**	0.06	0.144	**0**	0.261	3
Mixed 3	3 h	0.06	0.04	0.13	0.10	0.005	4	0.208	0
Mixed 2	4 d	**0.00**	0.14	0.76	0.18	0.059	3	0.060	1
Long 3	5 c	0.03	**-0.01**	**-0.07**	0.02	0.004	5	0.139	2
Short 2	6 j	**0.00**	0.09	0.44	0.15	0.019	4	0.126	1
Mixed 3	7 f	**-0.05**	0.08	0.36	**0.00**	0.015	2	0.022	2
Short 3	8 g	**0.00**	0.12	1.53	0.17	0.020	2	0.085	1
Long 1	9 k	0.05	0.10	0.57	0.18	0.008	3	0.090	0
Mixed 2	10 e	**-0.02**	0.07	0.47	0.10	0.059	**0**	0.009	2
Mixed 1	11 N	0.11	0.03	0.04	0.06	**-0.040**	2	0.012	1
Short 2	12 R	0.24	**0.00**	**-0.15**	0.36	**-0.031**	1	0.013	3
Short 3	13 O	**0.00**	0.05	0.16	0.06	0.060	**0**	0.158	2
Short 2	14 S	0.10	0.07	0.22	0.15	0.003	3	0.222	0
Short 2	15 Q	0.02	0.04	0.22	0.13	0.059	1	0.210	0
Mixed 2	16 M	**-0.05**	0.02	0.24	**-0.01**	0.007	2	0.150	2
Short 3	17 P	**-0.08**	0.15	0.86	0.08	0.072	4	0.064	1
Short 3	18 i	0.09	0.07	0.25	0.10	**-0.009**	5	0.039	1
Short 3	19 T	**-0.04**	0.12	1.06	0.09	0.035	1	0.087	1
Short 2	20 V	**-0.02**	0.08	0.43	**-0.02**	0.048	**0**	0.036	2
Short 3	21 U	0.10	0.03	0.10	0.11	0.049	1	0.128	0
Short 3	22 L	0.02	0.03	0.23	**0.00**	0.007	1	0.085	1
average		0.03	0.06	0.37	**0.10**	0.030	2.18	0.102	
Change: **up** *down*, same		**12**, *6*, 4	**20**, *2*, 0	**19**, *3*, 0	**19,** *2*, 1	**19**, *3*, 0	**18**, *0*, 4	**22**, *0*, 0	
average	% change	16%	267%	271%	161%	42%	400%	340%	

Table 18 indicates that for most rooms the teacher increased the use of open questions, the ratio of open to closed questions and all types of questions. Acknowledgements, blends and the use of Gricean maxims also increased in SST exchanges. The largest changes by per cent were open questions, the open to closed question ratio, blends and Gricean maxims. A visual check indicated that every classroom had some changes in the positive direction and no room had more than three out of seven of the measures scoring as no change or a negative change. These are shown as bolded numbers which are totalled in the last column. It can also be seen that there was no systematic clustering of rooms by rank in this column. The rooms with two or three indicators that decreased or stayed the same were distributed more or less evenly.

It is apparent that all teachers changed the way they talked when they engaged in SST dialogue compared to their non-SST dialogue and did so in substantially large ways by changes in a variety of indicators. The way they did this varied considerably, except that they all increased the use of Gricean maxims and almost all teachers increased the use of open and total questions and acknowledgements.

Between rooms analysis of changes summary

To further examine the possibility that there were systematic patterns of change or lack of change between rooms, the change values shown in Table 18 of each indicator considered so far in this chapter were calculated as z-scores and averaged. These scores were run against the six-quality-indicator z-score using Pearson's correlation coefficient to test for any relationship, using the one-tailed test, as scores were expected to be positive.

Table 19

Between rooms comparison using z-scores of teacher changes from non-SST to SST dialogue

SST Pattern	Room		Teacher changes moving from non-SST dialogue into SST episodes as Zscores								
			Cl.Q/Ut z-score	Op.Q/ Ut z-score	O/C ratio z-score	Tot.Qs/Ut z-score	Ack/Ut z-score	Blends z-score	Grice/Ut z-score	Change av z-score	Six-indicator av z-score
Mixed 3	1	a	-0.18	0.16	-0.05	0.17	0.84	1.10	-0.72	1.32	1.17
Long 2	2	b	0.87	-1.61	-1.07	-0.44	2.84	-1.32	2.13	1.40	1.06
Mixed 3	3	h	0.40	-0.51	-0.59	-0.03	-0.62	1.10	1.42	1.17	0.94
Mixed 2	4	d	-0.38	1.67	0.97	0.96	0.73	0.50	-0.56	3.89	0.83
Long 3	5	c	-0.04	-1.46	-1.11	-0.92	-0.64	1.71	0.49	-1.98	0.67
Short 2	6	j	-0.44	0.60	0.18	0.54	-0.27	1.10	0.31	2.03	0.54
Mixed 3	7	f	-1.14	0.31	-0.02	-1.17	-0.37	-0.11	-1.07	-3.58	0.40
Short 3	8	g	-0.39	1.34	2.92	0.90	-0.26	-0.11	-0.23	4.17	0.33
Long 1	9	k	0.28	0.75	0.50	0.93	-0.55	0.50	-0.15	2.25	0.31
Mixed 2	10	e	-0.63	0.12	0.24	0.06	0.72	-1.32	-1.23	-2.04	0.20
Mixed 1	11	N	1.10	-0.75	-0.84	-0.48	-1.74	-0.11	-1.20	-4.03	0.12
Short 2	12	R	2.86	-1.32	-1.32	3.07	-1.53	-0.72	-1.19	-0.15	-0.06
Short 3	13	O	-0.39	-0.20	-0.53	-0.52	0.75	-1.32	0.75	-1.46	-0.10
Short 2	14	S	0.96	0.28	-0.38	0.62	-0.67	0.50	1.60	2.90	-0.20
Short 2	15	Q	-0.08	-0.41	-0.38	0.40	0.72	-0.72	1.43	0.97	-0.28
Mixed 2	16	M	-1.15	-0.97	-0.33	-1.29	-0.57	-0.11	0.64	-3.78	-0.32
Short 3	17	P	-1.58	1.88	1.24	-0.23	1.06	1.10	-0.51	2.97	-0.35
Short 3	18	i	0.79	0.14	-0.31	0.06	-0.97	1.71	-0.84	0.58	-0.37
Short 3	19	T	-1.04	1.30	1.75	-0.08	0.12	-0.72	-0.20	1.13	-0.59
Short 2	20	V	-0.72	0.31	0.16	-1.48	0.45	-1.32	-0.89	-3.49	-0.59
Short 3	21	U	1.02	-0.73	-0.68	0.16	0.48	-0.72	0.35	-0.12	-0.91
Short 3	22	L	-0.09	-0.79	-0.35	-1.22	-0.58	-0.72	-0.23	-3.98	-0.93
			0.04	-0.03	-0.05	0.17	0.22	**0.36**	0.15	0.33	Pearson *r* (20)
							0.16	**0.05**		0.20	*p* one-tailed

A visual inspection of Table 19 of the shaded z-scores selected as those at - 0.50 or lower shows a discernible pattern only for blends which had a small correlation of $r = 0.36$ (20) with a significance at $p = 0.05$.

The tests to this point have been of change scores. Now the absolute scores within SST dialogue of individual indicators were tested against the six-indicator average z-score ranking and this is shown in Table 20.

Table 20

Individual indicators within SST dialogue correlation check

Room		Indicators per utterance in SST dialogue only						Six-indicator
		Closed Qs/Ut	Open Qs /Ut	Total Qs /Ut	Acknowl /Ut	Blends in SSTs	Gricean /Ut	average z-score
1	a	0.19	0.11	0.38	0.178	6	0.065	1.17
2	b	0.39	0.02	0.47	0.186	0	0.292	1.06
3	h	0.26	0.05	0.43	0.063	5	0.221	0.94
4	d	0.18	0.17	0.48	0.165	3	0.076	0.83
5	c	0.21	0.06	0.31	0.070	5	0.178	0.67
6	j	0.20	0.11	0.44	0.126	6	0.143	0.54
7	f	0.22	0.09	0.37	0.151	2	0.082	0.40
8	g	0.08	0.14	0.35	0.080	5	0.121	0.33
9	k	0.14	0.13	0.37	0.115	3	0.115	0.31
10	e	0.15	0.10	0.38	0.108	0	0.056	0.20
11	N	0.31	0.06	0.42	0.097	2	0.063	0.12
12	R	0.37	0.03	0.62	0.083	1	0.033	-0.06
13	O	0.33	0.08	0.47	0.098	0	0.216	-0.10
14	S	0.30	0.09	0.47	0.079	3	0.276	-0.20
15	Q	0.19	0.06	0.44	0.115	1	0.221	-0.28
16	M	0.11	0.05	0.27	0.056	2	0.222	-0.32
17	P	0.18	0.16	0.42	0.113	4	0.064	-0.35
18	i	0.26	0.08	0.41	0.059	5	0.063	-0.37
19	T	0.12	0.14	0.35	0.048	2	0.096	-0.59
20	V	0.18	0.09	0.33	0.112	1	0.056	-0.59
21	U	0.26	0.03	0.34	0.052	3	0.135	-0.91
22	L	0.11	0.03	0.15	0.077	1	0.120	-0.93
		0.19	0.16	**0.36**	**0.63**	**0.36**	0.15	Pearson *r* (20)
				0.05	**<0.01**	**0.05**		*p* one-tailed

The acknowledgements rate per utterance within SST dialogue showed a very significant relationship with the six-indicator average z-score ranking and this would be considered a strong correlation at an r (20) = 0.63 with the probability that this is by chance being very low with a p less than 0.01. Total questions and blends had a small correlation of r (20) = 0.36, p 0.05.

To this point in this chapter it can be seen that all 22 teachers changed their dialogue behaviour substantially when changing from non-SST to SST dialogue but did so somewhat differently. The combined information from these last two tables, 19 and 20, suggest that there were three behaviours that trended in the same ranking

direction as the six indicators, with the strong likelihood that those who rank higher on the six indicators in their total dialogue would also have a higher rate of acknowledgements within SST dialogue and a small probability that they used more questions and blends than those who ranked lower on the six indicators. The *Results Navigation Guide* shows the analysis now moves to the second line of enquiry.

Chapter 6	Data logic	**1.** Data treament Table 14	
Change from non-SST to SST dialogue	1st line Question 3a 5 indicators	**2.** Tables 15-17 Five indicator changes non-SST to SST dialogue	**3.** Table 18 - 20 pattern search using z-scores and correlations
	2nd line Question 3b talk ratio	**4.** Table 21 - T/C talk ratio Number Total Words changes nSST to SST	**5.** Table 22 - T/C talk ratio significant correlations

The examination between non-SST and SST dialogue continues now with research question 3(b): What are the differences between non-SST dialogue and SST dialogue in terms of children/teacher talk ratio? This will be examined in terms of the Number of Total Words (NTW).

Number of Total Words: non-SST versus SST dialogue

The children's dialogue is combined by the SALT language analysis program as though they were one speaker. Therefore, the measures of dialogue are for each teacher and all the children in that room combined. The Number of Total Words (NTW) was counted from intelligible verbal utterances for both children and teacher in a transcript. This was done for three different sets of dialogue:

1. Non-SST dialogue,
2. SST dialogue, and the
3. start of SST dialogue by using the first four turns.

This last choice was to investigate factors that might help understand how an SST is started.

Multiple word names of a person, book, character or song were transcribed, for example, as The_Very_Hungry_Caterpillar which SALT therefore counts as a single word. Repeated words or repeated phrases of any kind were ignored by the SALT software by being transcribed in square brackets [repeated word]. Words that were read from a book, recounted by memory by the teacher or sung in a song were curly bracketed and also not counted. For example, in the story "The Gingerbread Man", the refrain "run, run as fast as you can, you can't catch me…" would not be counted when said by anyone. The count of NTW therefore included only self-generated words and only the final product if the child or teacher reformulated what they were saying. If the teacher asked a question, however, and children used a set of words from a text to answer the question (other than "refrains" as exampled above), then these were counted. The selection of four turns to test the start of an SST was based on the observation that even if a child started an SST, the teacher then would do something within the first exchange to perpetuate the conversation.

The first set of columns in Table 21, below, shows the word counts for children and teachers. The second set of columns calculated simple ratios by dividing the combined children's NTW by the teacher's NTW. This arrangement was used to emphasize the children's participation. The third set of columns shows the percentage change moving from 1) non-SST dialogue to the entire SST dialogue, 2) from non-SST dialogue to just the start of SSTs, and finally 3) from SST dialogue to just the start of SSTs. At the bottom of the columns, average scores for each column were calculated along with the number of rooms that showed an **increase (up)**, *decrease (down),* or no change (same) in each change column. The three columns of change scores have bolded scores if they were negative, so that these scores' clustering pattern toward the top of the table can easily be seen in terms of percentage change.

Table 21

Number of Total Words (NTW) of children and teachers in non-SST dialogue, SST dialogue and 4 turns at the start of SSTs

Pattern Consistent Persistent	Room	Number of Total Words (NTW) teachers (T) all children (C)						NTW Child/Teacher ratio			NTW C/T percentage change			Six-indicator average z-score
		teacher nSST	children nSST	teacher SSTs	children SSTs	teacher SSTstart	children SSTstart	nSST	SST	SST start	nSST to SST	nSST to SST start	SST to SST start	
Mixed 3	1 a	974	581	1590	425	281	26	0.60	0.27	0.09	***-55%***	***-84%***	***-65%***	1.17
Long 2	2 b	900	340	893	362	40	24	0.38	0.41	0.60	7%	59%	48%	1.06
Mixed 3	3 h	2405	932	1450	393	367	69	0.39	0.27	0.19	***-30%***	***-51%***	***-31%***	0.94
Mixed 2	4 d	1375	806	1194	491	254	104	0.59	0.41	0.41	***-30%***	***-30%***	0%	0.83
Long 3	5 c	1710	739	2107	607	151	47	0.43	0.29	0.31	***-33%***	***-28%***	8%	0.67
Short 2	6 j	2907	1596	941	429	151	57	0.55	0.46	0.38	***-17%***	***-31%***	***-17%***	0.54
Mixed 3	7 f	1227	477	1321	220	376	60	0.39	0.17	0.16	***-57%***	***-59%***	***-4%***	0.40
Short 3	8 g	1695	947	914	322	304	79	0.56	0.35	0.26	***-37%***	***-53%***	***-26%***	0.33
Long 1	9 k	1340	834	1142	254	95	27	0.62	0.22	0.28	***-64%***	***-54%***	28%	0.31
Mixed 2	10 e	1946	735	1226	389	266	66	0.38	0.32	0.25	***-16%***	***-34%***	***-22%***	0.20
Mixed 1	11 N	1880	648	943	370	98	15	0.34	0.39	0.15	14%	***-56%***	***-61%***	0.12
Short 2	12 R	2049	915	259	51	43	11	0.45	0.20	0.26	***-56%***	***-43%***	30%	-0.06
Short 3	13 O	870	376	291	104	92	43	0.43	0.36	0.47	***-17%***	8%	31%	-0.10
Short 2	14 S	2320	1604	418	235	135	50	0.69	0.56	0.37	***-19%***	***-46%***	***-34%***	-0.20
Short 2	15 Q	2596	804	770	228	192	60	0.31	0.30	0.31	***-4%***	1%	6%	-0.28
Mixed 2	16 M	1186	771	549	474	58	40	0.65	0.86	0.69	33%	6%	***-20%***	-0.32
Short 3	17 P	1802	1057	698	412	143	69	0.59	0.59	0.48	1%	***-18%***	***-18%***	-0.35
Short 3	18 i	1471	649	1157	558	348	156	0.44	0.48	0.45	9%	2%	***-7%***	-0.37
Short 3	19 T	3043	480	816	156	287	38	0.16	0.19	0.13	21%	***-16%***	***-31%***	-0.59
Short 2	20 V	2179	895	394	181	65	47	0.41	0.46	0.72	12%	76%	57%	-0.59
Short 3	21 U	3281	1066	478	182	136	47	0.32	0.38	0.35	17%	6%	***-9%***	-0.91
Short 3	22 L	1045	660	722	261	125	91	0.63	0.36	0.73	***-43%***	15%	101%	-0.93
	average	1827	814	922	323	182	56	0.47	0.38	0.37	-17%	-20%	-2%	
	change: **up**,	*down,*	same								**7**, *14,* 1	**7**, *14,* 1	**8,** *13,* 1	

Table 21 shows that in SST dialogue compared to non-SST dialogue, and in most rooms, particularly at the top of the six-indicator ranking, children's Number of Total Words (NTW) compared to teacher's NTW decreased (bolded results), meaning that most teachers increased their talk compared to children when engaged in episodes of SST and even more so at the start of an SST. The three comparisons were: a) non-SST to SST dialogue with an average change of -17% and where 14 rooms decreased, b) non-SST to the start of SSTs with an average change of -20% and where14 rooms decreased, and c) from SSTs to the start of SSTs where 13 rooms decreased and the average change was -2%. This last percentage is skewed by the bottom room increase of 101%, which if removed, would make the average change -7%. There was a clear proclivity for teachers at the top of the six-indicator ranking to increase their contribution to the SST dialogue more so than teachers at the bottom of the ranking, except for room 2b in all three categories of change.

The pattern of the negative scores primarily in the top half of the ordering by the six-indicator ranking of rooms seems to indicate that there is a systematic difference related to these indicators that also applied to the teachers using more words in SSTs and at the start of SSTs compared to non-SST dialogue than teachers at the bottom of the six-indicator ranking. This could be related to similar differences in longer and shorter SSTs, or more or less teacher use of all or some of the six quality indicators that are similarly ranked.

This was tested by comparing the changes in NTW with the changes in individual indicators and also the six-indicator average z-score. Only those indicators that had significant correlations with a *p* value of 0.05 or less were included in Table 22, which shows these results.

Table 22

Number of Total Words (NTW) child/teacher ratio correlations with indicators

Room		teacher changes nSST to SST		Number of Total Words Child/Teacher ratio						Six indicator
				NTW C/T ratio			NTW C/T ratio change			
		Tot.Qs/ Ut change	Blends change	nSST	SST	SST start	nSST to SST	nSST to SST start	SST to SST start	average z-score
1	a	0.11	4	0.60	0.27	0.09	***-0.33***	***-0.50***	***-0.17***	1.17
2	b	0.06	**0**	0.38	0.41	0.60	0.03	0.22	0.19	1.06
3	h	0.10	4	0.39	0.27	0.19	***-0.12***	***-0.20***	***-0.08***	0.94
4	d	0.18	3	0.59	0.41	0.41	***-0.17***	***-0.18***	0.00	0.83
5	c	0.02	5	0.43	0.29	0.31	***-0.14***	***-0.12***	0.02	0.67
6	j	0.15	4	0.55	0.46	0.38	***-0.09***	***-0.17***	***-0.08***	0.54
7	f	**0.00**	2	0.39	0.17	0.16	***-0.22***	***-0.23***	***-0.01***	0.40
8	g	0.17	2	0.56	0.35	0.26	***-0.21***	***-0.30***	***-0.09***	0.33
9	k	0.18	3	0.62	0.22	0.28	***-0.40***	***-0.34***	0.06	0.31
10	e	0.10	**0**	0.38	0.32	0.25	***-0.06***	***-0.13***	***-0.07***	0.20
11	N	0.06	2	0.34	0.39	0.15	0.05	***-0.19***	***-0.24***	0.12
12	R	0.36	1	0.45	0.20	0.26	***-0.25***	***-0.19***	0.06	-0.06
13	O	0.06	**0**	0.43	0.36	0.47	***-0.07***	0.04	0.11	-0.10
14	S	0.15	3	0.69	0.56	0.37	***-0.13***	***-0.32***	***-0.19***	-0.20
15	Q	0.13	1	0.31	0.30	0.31	***-0.01***	0.00	0.02	-0.28
16	M	**-0.01**	2	0.65	0.86	0.69	0.21	0.04	***-0.17***	-0.32
17	P	0.08	4	0.59	0.59	0.48	0.00	***-0.10***	***-0.11***	-0.35
18	i	0.10	5	0.44	0.48	0.45	0.04	0.01	***-0.03***	-0.37
19	T	0.09	1	0.16	0.19	0.13	0.03	***-0.03***	***-0.06***	-0.59
20	V	**-0.02**	**0**	0.41	0.46	0.72	0.05	0.31	0.26	-0.59
21	U	0.11	1	0.32	0.38	0.35	0.06	0.02	***-0.04***	-0.91
22	L	**0.00**	1	0.63	0.36	0.73	***-0.27***	0.10	0.37	-0.93
		Pearson	*r* (20)	0.10	-0.31	**-0.42**	-0.41	**-0.49**	-0.21	
		p two-tailed				0.05		0.02		
			Pearson	0.39	0.12	-0.26	-0.22	**-0.53**	**-0.46**	*r* (20)
			p two-tailed					0.01	0.03	
				0.12	-0.26	-0.40	-0.39	**-0.49**	-0.23	Pearson
								0.02		*p* two-tailed

Table 22 shows that all the significant correlations were negative, meaning that an increase in the teacher's share of the number of total words spoken either in SSTs or at the start of SSTs, was significantly related to teacher increases in total questions, blends and the six-indicator average z-score ranking. Total questions rate per utterance was significantly related to the greater increase in teacher's share of NTW in SST dialogue with an r (20) = -0.42, p = 0.05 and even more so with the start of SSTs, r (20) = -0.49, p = 0.02. The starting of a blend was also highly related to the start of SSTs with an r (20) = -0.53, p = 0.01.

These two indicators of total questions and blends would therefore be the main reason that the six indicators' average z-score ranking was also correlated, which at r (20) = -0.49, p = 0.02 was equal to or close to the correlation for these two indicators. It can also be concluded from this that the other indicators or their combined z-scores would not have detracted from this result over most of the rooms, which can be seen visually in Table 22. Thus, the combined result of the six indicators was significantly related to the changes in the number of total words ratio between children and their teacher. It could be, that to engage in more of the six indicators, it requires of the teacher a greater amount of talking. As these are overall averages only, a look at exceptions will now be undertaken to see what the extremes of variability in teacher behaviour might be. The *Results Navigation Guide* shows the analysis now moves to qualitative discourse analysis on the second line of enquiry.

Chapter 6	Data logic	**1.** Data treament Table 14	
Change from non-SST to SST dialogue	1st line Question 3a 5 indicators	**2.** Tables 15-17 Five indicator changes non-SST to SST dialogue	**3.** Table 18 - 20 pattern search using z-scores and correlations
	2nd line Question 3b talk ratio	**4.** Table 21 - T/C talk ratio Number Total Words changes nSST to SST	**5.** Table 22 - T/C talk ratio significant correlations
		6. Qualitative discourse analysis of SST starts	**7.** Conclusion Qs 3a & 3b

Qualitative analysis of SST starts

A survey of SST starts revealed that when the teacher appeared to have planned a topic for enquiry, which occurred more often in longer SSTs, there would be a more extended explanation at the beginning than there was with SSTs which started from an opportunity that arose without plan, often a child comment or something related to the text, and these were more often shorter SSTs. The extended explanations are termed "complex starts" for this discussion and an example of this from the room 'c' Writing activity in an SST of 73 turns taking four minutes follows.

This Writing activity was to draw and make signs and immediately followed the storybook Reading activity about “Mr. McGee in the Zoo” who had not been obeying the signs “don’t feed the animals”. The teacher spent two minutes questioning the children about signs they could see in their room, such as the Exit sign, and then proceeded to the following SST dialogue about interpreting signs with symbols or words on them and how this could be useful for telling people what they should do.

Example (n) complex SST start in room ‘c’ Writing

T up here this morning when I was packing up the train set [itt] [t01] .
T I thought, here’s some more signs.
T that we play with when we’re using the train set.
T so there’s this one (showing a small sign with a simple arrow on it).
T <what> do you think that might mean [oi] ? **open question to interpret**
A up (pointing up) [t02].
T an arrow <so go> [t03].
J <goes like> [t04]^
T go that way [t05][cy]?
T go up [cy]?
A up [t06].
T (positions token pointing left) [t07].
H go down [t08].
T go down (pointing it down now T is doing what child said) [t09][sa]?

In this start of the SST and in some of the following dialogue, it is easy to see how the teacher used more words than the children in order to start and then extend the thinking.

Example (o) teacher word use in room ‘c’ Writing

T what about this one [23] [ck] (holding up a new sign)?
J (walking) walking [t24].
A walking sign [t25].
H walking [t26].

T so you could use that for walking outside [t26]. **extend context**
T who's walking on this sign [ck]? **extending their interpretation**
A me [t27].
H adult and a kid [t28].
T and what are they doing with their hands [t29][ck]? **extend interpretation**
C holding [t30].
T holding hands [ap] [t31] . **add information**
T so that might be telling you to look out. **extending understanding of message**
T because there's people walking [oe] ~ **prompt for extending thinking**
J or cars coming [t32].
T the cars [ap] [t33].
T so cars can drive slowly if they know there's adults and children walking.
T and these people are walking <safely> together. **completing full concept**
X <I know>. **overspoken and ignored**
T because they are holding their hands. **concept connection to sign**
X he's coming and she is x x [t34].

Qualitative analysis of exceptional room 'b'

The highest ranked and consistent exception to the pattern of increased teacher words in SST dialogue was room 2b in all three categories of change. It will also be remembered from Chapter 5, that room 'b' was exceptional as the highest room in the Total Question z-score, and an example was given of an SST constructed using primarily closed questions and acknowledgements. It is also of note that room 'b' only had four SSTs that contributed to these results. Of these, two were started by children and two by the teacher. The following examples from these SSTs are typical of the child and teacher starts in this room. In the following example of a child-initiated SST start, two children drive the dialogue even after the teacher tries to start the reading.

Example (p) child SST start in room 'b'

P he's the one.

P he's from my day care [icc] [t01]. **child start, child led**
T do you know a Jackson from your day care [cy] [t02]?
P but I don't know him anymore [t03].
T he's not there anymore [t04].
N Jackson used to be my boyfriend [t05].
T we used to know a Jackson with a name like this [t06].
T Ok. **teacher first signal to end dialogue and start reading**
T Jackson's Footy (turning the page of the book of this name).
N yeah but he used to be my boyfriend [t07]. **child ignores T attempt**

Example (q) teacher SST start in room 'b'

T did you go to his birthday [cy] **[itt][t01] ?**
K (nods head yes) [t02].
T what did you have at your birthday (to W) [cn] [t03]?
W x x x x [t04]. (clearly 4 words, but unintelligible to transcriber)
T Did someone come to your birthday [cy] [t05]?
W a magician [t06].
K a magician [t07].

It can be seen that this teacher-initiated SST had a higher ratio of words by the teacher than did the child-initiated one shown previously, and it appears that this was because she was leading through closed questions which required only simple nods or a few words from children to proceed.

This same teacher (2b) was the main exception to the overall pattern of teachers' increased NTW in SSTs and was exceptional in other ways as seen in Chapter 5, with the highest rate of use of Gricean maxims with a z-score of 2.75, the highest rate of use of total questions with a z-score of 1.92, the second highest rate of SST turns per minute (2.02), but with negative z-scores on open questions (-0.93) and on blends (-0.43). This data provides additional quantitative evidence that this teacher used a somewhat different method of constructing an SST, as was seen in the

qualitative analyses, than other teachers. Because the teacher of this room did not use as many questions and used them differently (opening a teacher led SST with three closed questions rather than open questions), it may be that most of the other teachers' increase in the ratio of words was related to the increase use of complex questioning as their method to start and extend an SST.

It will be remembered that room 2b was also one of three rooms to use very long SSTs and did this consistently in two activities. The three rooms with the Long pattern of persistency (5c, 2b and 9k) were the only ones in the top 11 rooms of Table 22 to have a positive change in the category of change from SST dialogue to SST start. The other eight rooms in the top half had negative scores except for one with a zero score (4d).

The *Results Navigation Guide* shows the analysis for this chapter is now complete.

Chapter 6 Change from non-SST to SST dialogue	Data logic	**1.** Data treament Table 14	
	1st line Question 3a 5 indicators	**2.** Tables 15-17 Five indicator changes non-SST to SST dialogue	**3.** Table 18 - 20 pattern search using z-scores and correlations
	2nd line Question 3b talk ratio	**4.** Table 21 - T/C talk ratio Number Total Words changes nSST to SST	**5.** Table 22 - T/C talk ratio significant correlations
		6. Qualitative discourse analysis of SST starts	**7. Conclusion Qs 3a & 3b**

Conclusion to chapter

In the change from non-SST to SST dialogue, all teachers altered their use of the six indicators substantially but differently from each other, except that they all increased the use of Gricean maxims and almost all increased their use of open questions and acknowledgements. Only the teachers' acknowledgements rate per utterance within SST dialogue showed a significant relationship with the six

indicators' average z-score ranking. The increase in the teachers' share of the number of total words spoken in the change from non-SST to SST dialogue, and more so at the start of SSTs, was also correlated to the six indicators, as well as the increase in total questions and blends. Teachers who ranked higher on the six indicators also changed more in terms of use of acknowledgements and increase in their share of the Number of Total Words. The teacher ranked second highest on the six indicators was a main exception to this pattern and did not use as many questions and used them differently, thus showing that there are substantially different ways to gain a high level of SST activity. The next chapter continues the examination of changes in language in SST dialogue compared to non-SST dialogue.

CHAPTER 7: RESULTS – DIALOGUE QUALITY

The previous chapter compared the non-SST and SST dialogues in terms of changes in the six indicators and the number of total words spoken. This chapter continues the comparison between non-SST and SST dialogue in terms of two markers of quality or complexity of language production: Mean Length of Utterance (MLU) and Type Token Ratio (TTR). This continues to answer questions about what constitutes quality within SST dialogue and how SST dialogue is different from other dialogue, and addresses research question four: Are there differences between non-SST and SST dialogue in the quality of children and teachers' language in terms of: (a) Mean Length of Utterance (MLU), and (b) Type Token Ratio (TTR)? The *Results Navigation Guide* shows the analyses steps for this whole chapter, which is quite extensive and complex. It starts with an explanation of the data analysis logic.

Chapter 7 Change from non-SST to SST continued	**Data logic**	**1.** Measuring MLU & TTR	
	1st line of enquiry MLU	**2.** Tables 23 - 24 MLU differences and changes	**3.** Table 25 correlation check SES and MLU
	2nd line of enquiry TTR	**4.** Tables 26 - 29 TTR differences and changes	**5.** Table 30 child TTR correlation with Teacher Acknowledgements
	3rd line MLU and TTR patterns	**6.** Tables 31 - 32 Compare child MLU and TTR with Teacher use of 5 indicators	**7.** Fig 5 - Three approach groups distinguished by z-score range
	4th line - 3 approaches checks	**8.** Table 33 3 approach groups check against previous data analyses	**9.** Table 34 - new correlations of 5 indicators by approach group
	5th line - discounting confounds	**10.** Table 35 child participation by turns influence on data analysis	**11.** Table 36 - approach groups and SST turns in 3 activity - pattern checking
			12. Conclusions

The children's dialogue is combined by the SALT language analysis program as though they were one speaker. The measures of dialogue are (a) for the teacher and (b) for all the children in that room combined.

Measuring MLU and TTR

Both MLU and TTR in non-SST dialogue were measured for both teachers and all children combined (aggregated) using an average score from a number of equal length samples of 150 words taken from systematically determined parts of the dialogue. TTR measurement is particularly sensitive to length of sample if accurate comparison is to be made as was discussed in Chapter 2 in the section Vocabulary and Type Token Ratio, including the use of aggregated data in this kind of research. The higher number of teachers' words compared to children's allowed taking one more sample of the teacher's dialogue for a more representative average score for teachers. Because the comparison is between teachers in non-SST and teachers in SST dialogue and not between teachers and children, the increase in samples for teachers is of no concern. Because the combined transcripts always started with the Reading activity and because some teachers had a very long reading exercise compared to others, one of the samples was taken from the beginning of the Writing activity. Writing was chosen over the Selected activity because Writing was introduced by all the teachers in a more consistent format compared to Selected. The 150-word samples start from the first utterances in both Writing and the combined transcript and then again from the combined transcript at utterances number 15, 30, 45, 60 and 90. For teachers, these seven samples were averaged and this average was used in a comparison with a single 150-word sample from the start of the combined SST-only dialogue. Children's combined dialogue had six samples taken for averaging which meant there was no cut at 90 utterance cut point in the children's combined dialogue as there was with teachers because of the shorter length.

MLU and TTR in SST dialogue were measured for both teachers and all children combined using a single 150-word sample, because the amount of SST

dialogue in some rooms was too short for more samples. This was still too much for room 'w' which therefore had to be left out of the calculation altogether. A single turn for children was often accomplished with very few words, and thus obtaining 150 words for the combined children's SST dialogue was the limiting factor.

Mean Length of Utterance (MLU)

MLU was counted by the number of words in each verbal utterance, an utterance being a unit of meaning. If the transcriber heard a distinct word but did not understand it, this was transcribed as an 'x' and was counted by the SALT software as a word. If this had not been done, then the amount of children talk would be somewhat reduced. Because the comparison is between the same room's children's total word count in non-SST versus SST dialogue, the consistency of the transcribers across activities would be the main variable that could skew the data. This was double-checked by a review of all transcripts. Pearson correlations were not calculated for MLU because some of the data sets failed the test for normality and in all but one case this was from a single outlier. The *Results Navigation Guide* shows the analysis now moves to first line of enquiry investigating MLU.

Chapter 7	Data logic	**1.** Measuring MLU & TTR	
Change from non-SST to SST continued	**1st line of enquiry MLU**	**2.** Tables 23 - 24 MLU differences and changes	**3.** Table 25 correlation check SES and MLU

Table 23 shows the samples for teachers taken from each room's dialogue and the calculations. The average of seven samples of non-SST dialogue had the single SST sample subtracted to show the change. This absolute change column shows whether that room's teacher's MLU increased, decreased or stayed the same when moving from non-SST to SST dialogue, with the sum of these shown at the bottom. Some of these changes were very small. An additional way to show which changes

were more likely to be significantly different is shown in the column ‘MLU SST 150-word cut’. Those values that were outside the range of any values in non-SST dialogue word cuts are underlined with bolded font for values larger than any non-SST word cut samples and italicized for values less than any non-SST samples. The totals for these two categories are shown at the bottom of the table.

Table 23

Teacher changes in Mean Length of Utterance from an average of 7 samples of non-SST dialogue to SST dialogue

Room		MLU 150-word cuts of nSST dialogue starting at utterance number:							MLU nSST average of 7 cuts	**MLU SST 150-word cut**	Change nSST av to SST	% Change nSST av to SST	% Change top - bottom average
		Writing	Combined nSST dialogue: cuts start at 1 - 90 utterances										
		1	1	15	30	45	60	90					
1	a	4.7	6.5	5.2	4.1	4.4	5.2	5.2	5.0	4.7	-0.34	-7%	top 10
2	b	5.4	4.7	5.0	4.6	5.0	5.4	5.4	5.0	5.4	0.31	6%	
3	h	7.5	5.8	5.4	6.5	7.1	7.5	5.4	6.5	*5.1*	-1.31	-20%	
4	d	6.5	5.0	6.0	5.6	5.6	4.7	4.7	5.4	5.5	0.09	2%	
5	c	6.0	5.8	4.8	6.5	7.5	6.5	5.4	6.1	*4.7*	-1.38	-23%	
6	j	5.0	5.4	4.8	4.7	4.6	4.2	5.8	4.9	4.8	-0.10	-2%	
7	f	6.3	5.8	5.6	5.4	6.0	5.6	6.3	5.8	**6.5**	0.70	12%	
8	g	7.1	6.8	8.8	7.1	6.8	6.0	6.3	7.0	*5.5*	-1.48	-21%	3 up
9	k	7.9	8.3	6.8	7.5	7.9	6.3	7.1	7.4	*5.8*	-1.63	-22%	7 down
10	e	4.8	5.6	4.7	4.6	6.0	7.5	4.8	5.4	5.4	-0.07	-1%	Av -8 %
11	N	8.8	6.5	5.8	4.8	5.8	6.3	5.2	6.2	7.5	1.34	22%	natural
12	R	5.6	4.8	4.4	4.8	5.6	5.4	3.7	4.9	5.4	0.47	10%	break
13	O	6.5	4.7	5.8	6.8	6.0	5.2	7.1	6.0	5.5	-0.50	-8%	
14	S	5.8	3.8	3.4	3.8	4.0	4.7	5.6	4.4	5.0	0.59	13%	
15	Q	8.3	8.3	7.5	10.0	8.8	6.0	5.4	7.8	7.9	0.13	2%	
16	M	5.8	6.3	6.3	7.1	5.2	5.6	5.2	5.9	5.7	-0.21	-4%	
17	P	5.6	5.8	6.3	5.8	5.0	4.7	5.4	5.5	5.2	-0.32	-6%	
18	i	6.0	5.8	7.9	9.4	5.4	5.6	5.0	6.4	5.7	-0.73	-11%	
19	T	6.5	8.8	9.4	7.5	8.3	10.0	5.4	8.0	8.7	0.72	9%	bottom 12
20	V	5.4	5.8	4.8	5.0	5.4	4.7	3.9	5.0	5.3	0.34	7%	8 up
21	U	6.0	6.0	6.0	4.3	3.7	3.4	4.7	4.9	5.2	0.31	6%	4 down
22	L	6.3	6.8	8.8	5.8	5.0	5.2	5.8	6.2	6.4	0.16	3%	Av 4%
average		6.3	6.0	6.1	6.0	5.9	5.7	5.4	5.9	5.8	-0.1	-1.6%	
change,		**up,**	*down,*	same						**1,** *4*	**11,** *11,* 0		

Note: values in "MLU SST 150-word cut" outside the range of any nSST cut, are underlined with **bold for increases** and *italics for decreases*

Table 23 shows that teachers were evenly divided between an MLU that increased or decreased when moving from non-SST dialogue to SST dialogue. These ranged in percentage changes from -23% to 22%. However, there was a natural break in the percentage change column between the top 10 and the bottom 12 rooms. This is shown in the last column where it can be seen that in the top 10 group, three rooms increased and seven decreased with a percentage change in MLU of -8%. There was one increase over 10% and four decreases over 20%. The bottom 12 rooms, on the other hand, had eight rooms increasing with three over 10%, four rooms decreasing with one over 10% and an average change of 4%. This is a difference of 12% in MLU change between the top and bottom rooms. In the top group there were four rooms that had the teacher MLU decrease by 20% or more, while one room in the bottom increased by 22%. The MLU values in the SST 150-word cut that were entirely outside any value in non-SST samples showed four decreases and one increase, all in the top half rooms.

There was a systematic and substantial difference in teacher behaviour in constructing their dialogue such that those at the top of the six-indicator ranking were more likely to decrease their MLU with larger changes than those at the bottom, who were more likely to increase their MLU with smaller changes.

Table 24 was arranged similarly to Table 23. The children's MLU was the aggregated MLU in words of all the children's verbal utterances. The 150-word samples start from the first utterance in both the Writing activity and the combined transcript and then again from the combined transcript at utterance number 15, 30, 45 and 60. These six samples were averaged and then compared to a single 150-word cut from SST dialogue.

Table 24

Children changes in Mean Length of Utterance from the average of six samples of non-SST dialogue to SST dialogue

Room	MLU 150-word cuts of nSST dialogue starting at utterance number:						MLU nSST	**MLU SST**	Change	% Change	SES index	SES
	Writing	Combined nSST dialogue: cuts start at 1 - 60 utterances					average	**150-word**	nSST av	nSST av	children	decile
	1	1	15	30	45	60	of 6 cuts	**cut**	to SST	to SST	combined	rank
1 a	3.9	3.0	1.9	2.0	2.2	2.2	2.5	**5.2**	2.65	105%	989	7
2 b	3.4	2.6	2.9	2.9	3.3	3.5	3.1	**4.8**	1.74	56%	980	7
3 h	4.3	2.9	4.0	4.4	4.8	3.5	4.0	4.8	0.86	22%	1090	9
4 d	3.2	4.0	4.0	3.7	4.0	3.4	3.7	**4.4**	0.72	19%	997	7
5 c	3.5	3.6	4.1	4.0	2.8	2.4	3.4	**4.3**	0.89	26%	813	**1**
6 j	4.1	3.1	2.9	2.6	3.0	3.3	3.2	**4.6**	1.39	44%	1060	7
7 f	4.8	3.1	3.2	4.1	4.8	4.4	4.1	4.4	0.35	9%	988	7
8 g	5.2	2.6	**5.8**	**6.8**	**6.3**	5.0	5.3	*4.8*	*-0.43*	-8%	1029	9
9 k	4.0	3.6	3.9	3.8	4.0	4.1	3.9	**6.0**	2.15	56%	1006	7
10 e	3.9	2.8	3.0	3.4	3.9	4.0	3.5	3.8	0.28	8%	1099	**9**
11 N	2.9	2.3	3.0	3.7	3.3	3.3	3.1	**4.6**	1.46	47%	1061	9
12 R	4.1	2.8	3.6	4.2	3.6	4.0	3.7	**4.6**	0.96	26%	1103	9
13 O	3.7	3.2	3.6	3.8	3.6	3.3	3.5	**4.7**	1.14	33%	993	7
14 S	3.2	2.2	2.2	2.0	2.1	2.2	2.3	**3.8**	1.43	62%	1026	**7**
15 Q	3.9	2.8	3.6	4.2	4.6	4.6	3.9	**6.8**	2.91	74%	1149	**10**
16 M	4.1	4.4	4.4	4.4	4.3	3.9	4.2	**5.4**	1.13	27%	1035	8
17 P	5.8	7.5	3.7	2.4	2.4	2.5	4.0	5.8	1.73	43%	1152	10
18 i	3.3	3.7	3.2	3.4	3.3	3.3	3.4	**6.0**	2.62	77%	1137	10
19 T	3.3	2.8	3.1	3.7	4.1	5.2	3.7	4.6	0.96	26%	1123	10
20 V	2.9	3.2	3.4	2.9	3.1	3.5	3.2	**4.8**	1.67	52%	1035	8
21 U	3.3	3.3	3.3	3.5	3.7	3.1	3.4	**4.2**	0.82	24%	894	**2**
22 L	3.4	4.1	4.1	4.4	5.0	4.1	4.2	5.0	0.83	20%	1060	9
average	3.8	3.3	3.5	3.6	3.7	3.6	3.6	4.9	1.3	39%		
change,	**up,**	*down,*	same					**15,** *0*	**21,** *1,* 0			
					0.14	0.37		**0.44**		*r* (20)	Pearson	
								***p* 0.02**	significance one-tailed			

Note: values in "MLU SST 150-word cut" outside the range of any nSST cut, are underlined with **bold for increases** and *italics for decreases*

The changes in Mean Length of Utterance of the aggregated children samples from non-SST to SST dialogue in Table 24 showed that in all except one room their combined MLU increased, and by very large amounts in most cases when compared to teacher changes. The most significant changes, as shown in column 'MLU SST 150-word cut' had 15 rooms where the MLU value was greater than any sample in non-SST 150-word cuts. Room 8g was the only room that had a decrease. This room also had the highest MLU average in non-SST dialogue with three cuts being very high, and maintained an MLU score in SST dialogue at close to the average of all rooms. Therefore, the small drop in MLU of 8% compared to an average change of 39% was not due to a low MLU in SST dialogue, but rather a very high level in non-SST dialogue. Room 8g's SST sample was within the range of the non-SST 150-word cuts and therefore less likely to be significantly different. These almost universally large increases in children's aggregated MLU scores when comparing non-SST and SST dialogue appear to be unrelated to changes in teachers' MLU.

In Table 24 the last two columns were included to see if there were any systematic differences that might be due to the SES status of the children. The Socio-economic Indexes for Areas (SEIFA) index scores appear in the second to last column and in the final column are shown more simply as a decile ranking ("decile" scale 1 – 10 highest). Both of these data sets passed the test for normalcy and then were compared against those MLU cuts which also were tested as normal. This showed a significant relationship with the SST 150-word cut using a Pearson one-tailed test, $p = 0.44$ r (20). To have a clearer view of these relationships, these data were sorted by MLU ranking as shown in Table 25 below, rather than by room number ranking as was done in Table 24.

Table 25

Children's Mean Length of Utterance in SST dialogue compared to SES ranking

Room	MLU SST 150-word cut	SES children rank by index	SES children rank by decile
15 Q	6.8	1149	10
9 k	6.0	1006	7
18 i	6.0	1137	10
17 P	5.8	1152	10
16 M	5.4	1035	8
1 a	5.2	989	7
22 L	5.0	1060	9
2 b	4.8	980	7
3 h	4.8	1090	9
8 g	4.8	1029	9
20 V	4.8	1035	8
13 O	4.7	993	7
12 R	4.6	1103	9
19 T	4.6	1123	10
6 j	4.6	1060	7
11 N	4.6	1061	9
4 d	4.4	997	7
7 f	4.4	988	7
5 c	4.3	813	1
21 U	4.2	894	2
10 e	3.8	1099	9
14 S	3.8	1026	7
	0.44	Pearson *r* (20)	
	***p* 0.02**	significance one-tailed	

Table 25 shows that the rooms with higher SES decile-ranked neighbourhoods cluster in the top of the table when sorted by higher MLU of the combined children's dialogue in the SST 150-word cut. There are exceptions to this with three decile 9 and one decile 10 in the lower half, and three decile 7s in the upper half.

It appears that the main systematic differences contributing to the Pearson correlation of 0.44, *r* (20), are the three rooms of decile 10 ranked in the top four and the decile 1 and 2 rooms near the bottom. There were also more rooms ranked 7 in the lower half than in the top.

The *Results Navigation Guide* shows the analysis now moves to the second line of enquiry investigating Type Token Ratio.

Chapter 7 Change from non-SST to SST continued	Data logic	**1.** Measuring MLU & TTR	
	1st line of enquiry MLU	**2.** Tables 23 - 24 MLU differences and changes	**3.** Table 25 correlation check SES and MLU
	2nd line of enquiry TTR	**4.** Tables 26 - 29 TTR differences and changes	**5.** Table 30 child TTR correlation with Teacher Acknowledgements

Type Token Ratio (TTR)

Type Token Ration (TTR) was analysed using the same word cuts as MLU. However, because TTR is very sensitive to the method of sampling, an added analysis was done to test the data for consistency across the samples from non-SST dialogue.

Table 26 shows the variability in the 150-word cuts of each teacher's TTR. A Pearson correlation comparison was done against the six indicators ranking to see if there was a systematic relationship.

Table 26

Variability of the 7 samples of Teachers' Type Token Ratio in non-SST dialogue

Room	Teacher TTR 150-word cuts of nSST dialogue starting at utterance number:							TTR nSST	STDEV	% variation	Six-indicator
	Writing	Combined nSST dialogue cuts start at 1 - 90 utterances						average	of average	STDEV /	average
	1	1	15	30	45	60	90	of 7 cuts	of 7 cuts	average	z-score
1 a	0.53	0.54	0.62	0.55	0.48	0.42	0.49	0.52	0.063	12%	1.17
2 b	0.44	0.51	0.59	0.51	0.53	0.45	0.53	0.51	0.051	10%	1.06
3 h	0.40	0.45	0.52	0.48	0.47	0.43	0.56	0.47	0.054	11%	0.94
4 d	0.56	0.57	0.55	0.43	0.47	0.53	0.63	0.53	0.066	12%	0.83
5 c	0.51	0.44	0.58	0.61	0.57	0.63	0.59	0.56	0.065	12%	0.67
6 j	0.51	0.55	0.53	0.53	0.55	0.54	0.55	0.54	0.015	3%	0.54
7 f	0.51	0.41	0.38	0.40	0.44	0.52	0.51	0.45	0.059	13%	0.40
8 g	0.55	0.50	0.45	0.57	0.55	0.47	0.53	0.52	0.045	9%	0.33
9 k	0.52	0.55	0.54	0.59	0.54	0.52	0.58	0.55	0.027	5%	0.31
10 e	0.49	0.58	0.46	0.48	0.51	0.49	0.50	0.50	0.038	8%	0.20
11 N	0.47	0.71	0.60	0.57	0.55	0.55	0.49	0.56	0.079	14%	0.12
12 R	0.45	0.51	0.59	0.57	0.44	0.49	0.54	0.51	0.057	11%	-0.06
13 O	0.45	0.52	0.48	0.44	0.45	0.47	0.45	0.47	0.028	6%	-0.10
14 S	0.47	0.63	0.63	0.65	0.67	0.63	0.49	0.60	0.081	14%	-0.20
15 Q	0.49	0.50	0.55	0.56	0.47	0.59	0.53	0.53	0.043	8%	-0.28
16 M	0.53	0.42	0.48	0.58	0.54	0.53	0.55	0.52	0.053	10%	-0.32
17 P	0.52	0.51	0.51	0.53	0.53	0.47	0.47	0.51	0.026	5%	-0.35
18 i	0.49	0.54	0.54	0.48	0.49	0.50	0.54	0.51	0.027	5%	-0.37
19 T	0.51	0.58	0.57	0.52	0.54	0.51	0.54	0.54	0.028	5%	-0.59
20 V	0.46	0.52	0.54	0.51	0.43	0.45	0.47	0.48	0.041	8%	-0.59
21 U	0.49	0.49	0.49	0.50	0.53	0.50	0.47	0.50	0.018	4%	-0.91
22 L	0.57	0.47	0.57	0.50	0.48	0.55	0.55	0.53	0.043	8%	-0.93
										9% average	
										3% - 14%	range
								0.00	0.40	**0.44**	Pearson *r* (20)
									0.065	**0.04**	*p* two-tailed

Each room's seven samples of 150-word cuts were averaged and the standard deviation calculated. On Table 26 these figures appear horizontally on the same line. The standard deviation was divided by the average for that room to arrive at the percentage that room's standard deviation was of the average, or in other words, how far the standard deviation varied from the mean as a percentage. The variability within each room's samples ranged from 3 to 14 per cent. There was a positive correlation with the six indicators at r (20) = 0.44, two-tailed p = 0.04.

The variability as measured from 3 to 14% is not large and shows that all teachers' TTR remained somewhat consistent across the samples of their dialogue. Even so, the systematic relationship of r (20) = 0.44, p 0.04 meant that teachers with higher scores on the six indicators varied their TTR more than those with lower scores. This is consistent from the teacher's MLU trends in Table 23 (p. 198) showing that teachers at the top of the six-indicator rankings had changed their language production somewhat differently than those in the bottom and had greater changes on average.

Table 27 shows the same procedure for children's TTR non-SST dialogue over six samples of 150-word cuts.

Table 27

Variability of the six samples of Children's Type Token Ratio in non-SST dialogue

Room	Children TTR 150-word cuts nSST starting at utterance number:						TTR nSST	STDEV	% variation	Six-indicator
	Writing	Combined nSST dialogue cuts start at 1 - 90 utterances					average	of average	STDEV /	average
	1	1	15	30	45	60	of 6 cuts	of 6 cuts	average	z-score
1 a	0.50	0.33	0.35	0.37	0.42	0.49	0.41	0.072	18%	1.17
2 b	0.50	0.49	0.55	0.43	0.44	0.53	0.49	0.048	10%	1.06
3 h	0.48	0.41	0.51	0.49	0.47	0.50	0.48	0.036	7%	0.94
4 d	0.50	0.48	0.52	0.51	0.51	0.49	0.50	0.015	3%	0.83
5 c	0.47	0.53	0.49	0.56	0.47	0.53	0.51	0.037	7%	0.67
6 j	0.45	0.56	0.45	0.47	0.45	0.45	0.47	0.044	9%	0.54
7 f	0.43	0.46	0.54	0.51	0.55	0.52	0.50	0.047	9%	0.40
8 g	0.50	0.39	0.51	0.49	0.51	0.51	0.49	0.047	10%	0.33
9 k	0.40	0.37	0.39	0.45	0.51	0.51	0.44	0.061	14%	0.31
10 e	0.49	0.43	0.49	0.45	0.50	0.55	0.49	0.042	9%	0.20
11 N	0.48	0.45	0.48	0.47	0.48	0.47	0.47	0.012	2%	0.12
12 R	0.53	0.43	0.49	0.51	0.55	0.57	0.51	0.050	10%	-0.06
13 O	0.55	0.42	0.51	0.43	0.47	0.57	0.49	0.062	13%	-0.10
14 S	0.49	0.56	0.45	0.49	0.53	0.48	0.50	0.039	8%	-0.20
15 Q	0.45	0.48	0.47	0.44	0.49	0.51	0.47	0.026	5%	-0.28
16 M	0.46	0.41	0.47	0.49	0.44	0.51	0.46	0.036	8%	-0.32
17 P	0.58	0.46	0.58	0.61	0.56	0.53	0.55	0.053	10%	-0.35
18 i	0.50	0.45	0.51	0.50	0.45	0.51	0.49	0.029	6%	-0.37
19 T	0.51	0.54	0.49	0.52	0.54	0.53	0.52	0.019	4%	-0.59
20 V	0.57	0.56	0.57	0.53	0.55	0.49	0.55	0.031	6%	-0.59
21 U	0.45	0.48	0.57	0.55	0.45	0.45	0.49	0.055	11%	-0.91
22 L	0.43	0.50	0.37	0.33	0.33	0.39	0.39	0.065	17%	-0.93
									9% average	
									2% - 18%	range
							-0.15	0.05	0.06	Pearson *r* (20)
										p two-tailed

The children's data in Table 27 showed higher variability between rooms than teachers' data, ranging from 2% to 18% with an average of 9%. The Pearson correlations showed no relationships with these data and the six-indicator z-scores. These data indicate that children's TTR varied more than the teachers, but not so much as to indicate extreme errors in sampling.

Tables 28 and 29 showing the measurements of teachers' and children's TTR respectively are laid out as were Tables 23 (p. 198) and 24 (p. 200). In addition, Pearson correlation scores are shown between the teachers' and children's TTR scores at the bottom of the relevant column in Table 29.

Table 28

Teacher changes in Type Token Ratio from the average of seven samples of non-SST dialogue to one sample of SST dialogue

Room	TTR 150-word cuts of nSST dialogue starting at utterance number:							TTR nSST	**TTR SST**	Change	& Change	Six-indicator
	Writing	Combined nSST dialogue-cuts start at 1 - 90 utterances						average	**150-word**	nSST av	nSST av	average
	1	1	15	30	45	60	90	of 7 cuts	**cut**	to SST	to SST	z-score
1 a	0.53	0.54	0.62	0.55	0.48	0.42	0.49	0.52	0.51	-0.01	-2%	1.17
2 b	0.44	0.51	0.59	0.51	0.53	0.45	0.53	0.51	0.46	-0.05	-10%	1.06
3 h	0.40	0.45	0.52	0.48	0.47	0.43	0.56	0.47	0.49	**0.02**	4%	0.94
4 d	0.56	0.57	0.55	0.43	0.47	0.53	0.63	0.53	0.45	-0.08	-16%	0.83
5 c	0.51	0.44	0.58	0.61	0.57	0.63	0.59	0.56	0.45	-0.11	-20%	0.67
6 j	0.51	0.55	0.53	0.53	0.55	0.54	0.55	0.54	**0.59**	**0.05**	10%	0.54
7 f	0.51	0.41	0.38	0.40	0.44	0.52	0.51	0.45	0.51	**0.06**	13%	0.40
8 g	0.55	0.50	0.45	0.57	0.55	0.47	0.53	0.52	*0.40*	-0.12	-23%	0.33
9 k	0.52	0.55	0.54	0.59	0.54	0.52	0.58	0.55	0.53	-0.02	-3%	0.31
10 e	0.49	0.58	0.46	0.48	0.51	0.49	0.50	0.50	0.56	**0.06**	12%	0.20
11 N	0.47	0.71	0.60	0.57	0.55	0.55	0.49	0.56	0.55	-0.01	-2%	0.12
12 R	0.45	0.51	0.59	0.57	0.44	0.49	0.54	0.51	0.50	-0.01	-3%	-0.06
13 O	0.45	0.52	0.48	0.44	0.45	0.47	0.45	0.47	0.43	-0.04	-8%	-0.10
14 S	0.47	0.63	0.63	0.65	0.67	0.63	0.49	0.60	0.55	-0.05	-8%	-0.20
15 Q	0.49	0.50	0.55	0.56	0.47	0.59	0.53	0.53	0.59	**0.06**	12%	-0.28
16 M	0.53	0.42	0.48	0.58	0.54	0.53	0.55	0.52	*0.41*	-0.11	-21%	-0.32
17 P	0.52	0.51	0.51	0.53	0.53	0.47	0.47	0.51	*0.45*	-0.06	-11%	-0.35
18 i	0.49	0.54	0.54	0.48	0.49	0.50	0.54	0.51	*0.45*	-0.06	-12%	-0.37
19 T	0.51	0.58	0.57	0.52	0.54	0.51	0.54	0.54	**0.61**	**0.07**	13%	-0.59
20 V	0.46	0.52	0.54	0.51	0.43	0.45	0.47	0.48	0.48	0.00	0%	-0.59
21 U	0.49	0.49	0.49	0.50	0.53	0.50	0.47	0.50	0.49	-0.01	-1%	-0.91
22 L	0.57	0.47	0.57	0.50	0.48	0.55	0.55	0.53	0.49	-0.04	-7%	-0.93
average	0.50	0.52	0.54	0.53	0.51	0.51	0.53	0.52	0.50	-0.02	-4%	
change,	**up,**	*down,*	same						**2,** *5*	**6,** *15,* 1		
								0.00	-0.08	-0.08	-0.07	Pearson *r* (20)
												p two-tailed

Note: values in "TTR SST 150-word cut" outside the range of any nSST cut, are underlined with **bold for increases** and *italics for decreases*

The data from Table 28 shows that teachers' TTR decreased from non-SST to SST dialogue in 15 rooms, while there were six increases and one stayed the same. The average change was small and there was no correlation with the six-indicators ranking, nor did there appear to be any systematic differences in the scores between the top and bottom rankings by visual analysis. Only seven rooms had values of TTR in the SST 150-word cut that were entirely outside any of the non-SST samples, with two increases and five decreases.

These changes are counterintuitive to what might have been expected as SSTs are considered a more complex dialogue in terms of thinking. Given that most teachers' TTR decreased and five of the seven who had significant changes in the SST sample outside any non-SST cut had decreases, it appears that the majority of teachers may be systematically leading SSTs by simplifying their language and the teachers who ranked higher in the six indicators did this in shorter utterances as concluded from the analysis of data in Table 23 (p. 198).

Table 29 shows the children's aggregated TTR averaging of six 150-word non-SST samples and its comparison with a single 150-word sample of SST dialogue. In addition, the Pearson correlations with the teacher TTR data are shown at the bottom of the columns being compared.

Table 29

Children changes in Type Token Ratio from the average of six samples of non-SST dialogue to one sample of SST dialogue

Room	TTR 150-word cuts of nSST dialogue starting at utterance number:						TTR nSST	**TTR SST**	Change	% Change	Six-indicator
	Writing	Combined nSST dialogue-cuts start at 1 - 60 utterances					average	**150-word**	nSST av	nSST av	average
	1	1	15	30	45	60	of 6 cuts	**cut**	to SST	to SST	z-score
1 a	0.50	0.33	0.35	0.37	0.42	0.49	0.41	**0.58**	0.17	41%	1.17
2 b	0.48	0.41	0.51	0.49	0.47	0.50	0.48	**0.59**	0.11	23%	1.06
3 h	0.50	0.39	0.51	0.49	0.51	0.51	0.49	**0.53**	0.05	9%	0.94
4 d	0.50	0.49	0.55	0.43	0.44	0.53	0.49	0.49	0.00	0%	0.83
5 c	0.50	0.48	0.52	0.51	0.51	0.49	0.50	0.47	-0.03	-6%	0.67
6 j	0.43	0.46	0.54	0.51	0.55	0.52	0.50	0.52	0.02	4%	0.54
7 f	0.47	0.53	0.49	0.56	0.47	0.53	0.51	**0.58**	0.07	14%	0.40
8 g	0.40	0.37	0.39	0.45	0.51	0.51	0.44	0.49	0.05	12%	0.33
9 k	0.49	0.43	0.49	0.45	0.50	0.55	0.49	**0.56**	0.08	15%	0.31
10 e	0.45	0.56	0.45	0.47	0.45	0.45	0.47	0.50	0.03	6%	0.20
11 N	0.53	0.43	0.49	0.51	0.55	0.57	0.51	0.46	-0.05	-10%	0.12
12 R	0.49	0.56	0.45	0.49	0.53	0.48	0.50	0.52	0.02	4%	-0.06
13 O	0.46	0.41	0.47	0.49	0.44	0.51	0.46	0.48	0.02	4%	-0.10
14 S	0.43	0.50	0.37	0.33	0.33	0.39	0.39	**0.53**	0.14	35%	-0.20
15 Q	0.58	0.46	0.58	0.61	0.56	0.53	0.55	**0.62**	0.07	12%	-0.28
16 M	0.50	0.45	0.51	0.50	0.45	0.51	0.49	0.49	0.00	1%	-0.32
17 P	0.45	0.48	0.47	0.44	0.49	0.51	0.47	0.49	0.02	4%	-0.35
18 i	0.48	0.45	0.48	0.47	0.48	0.47	0.47	*0.36*	-0.11	*-24%*	-0.37
19 T	0.51	0.54	0.49	0.52	0.54	0.53	0.52	**0.56**	0.04	7%	-0.59
20 V	0.39	0.60	0.52	0.37	0.40	0.41	0.45	0.55	0.10	23%	-0.59
21 U	0.57	0.56	0.57	0.53	0.55	0.49	0.55	0.50	-0.05	-8%	-0.91
22 L	0.55	0.42	0.51	0.43	0.47	0.57	0.49	0.55	0.06	12%	-0.93
average	0.48	0.47	0.49	0.47	0.48	0.50	0.48	0.52	0.04	8%	
change,	**up,**	*down,*	same					**8,** *1*	**16,** *4,* 2		
							-0.25	0.16	0.28	0.28	Pearson *r* (20)
			Pearson *r* (20) with teachers' TTR scores				-0.13	**0.44**	0.21	0.18	*p* two-tailed
			p significance two-tailed					**0.04**			

Note: values in "TTR SST 150-word cut" outside the range of any nSST cut, are underlined with **bold for increases** and *italics for decreases*

The data from Table 29 shows that in most rooms, children's aggregated TTR increased, with 16 rooms increasing, 4 decreasing and 2 staying the same. The most significant changes in TTR in the SST 150-word cut column (bolded heading) showed that eight rooms increased and one decreased. The levels of TTR had no significant correlations with the six-indicators ranking. In the category of TTR within SST dialogue, the teachers' and children's scores were correlated at r (20) = 0.44, with a significance of p = 0.04.

The trend toward greater TTR values for the aggregated children's scores in most rooms seems to indicate that this may be a predominant feature of SST dialogue. The moderate correlation between children's and teachers' TTR in the SST, but not in non-SST dialogue suggests that teachers' language had an influence on children's language in SST dialogue that did not take place in non-SST dialogue. Room 1a, with the highest rank on the six-indicator average z-score, also had the highest changes in children's TTR at 41% (highest others 35%, 23%, 23%), and children's MLU at 105% (highest others 77%, 74%, 62%), indicating that this room is quite exceptional in terms of the aggregated children's quality of language changes. This room's ranking on the six indicators was the highest in SST turns per minute, acknowledgements and blends, and second highest in the use of open questions. In total questions, room 1a ranked in the middle and on Gricean maxims below average. This may indicate that some of the six indicators are more important in terms of changes in the quality of children's language as measured by TTR and MLU than are other indicators.

Children's TTR was compared to each indicator separately. A Pearson correlation was calculated against each indicator in both combined transcripts and

SST dialogue alone with the result that only one significant relationship was found. This was with teacher acknowledgments within SST dialogue only and for both absolute scores and change scores. Somewhat surprisingly, there was no relationship with any type of question score or the open to closed question ratio, which were all near zero. The only other indicator that came close to a significant Pearson correlation was teachers' use of Gricean maxims in SST dialogue. These relationships are shown in Table 30 where the significant correlations are bolded.

Table 30

Children's TTR comparison to teacher use of acknowledgements in SST dialogue

Absolute scores			Change scores		
Children TTR in SST 150-word cut	Teacher Acknowledgements per utterance in SST only	Room	Children TTR change nSST av to SST	Teacher Ack/Ut nSST av to SST	Teacher Gricean nSST av to SST
0.58	0.178	1 a	41%	6%	5%
0.59	0.186	2 b	23%	14%	26%
0.53	0.063	3 h	9%	1%	21%
0.49	0.165	4 d	0%	6%	6%
0.47	0.070	5 c	-6%	0%	14%
0.52	0.126	6 j	4%	2%	13%
0.58	0.151	7 f	14%	2%	2%
0.49	0.080	8 g	12%	2%	8%
0.56	0.115	9 k	15%	1%	9%
0.50	0.108	10 e	6%	6%	1%
0.46	0.097	11 N	-10%	-4%	1%
0.52	0.083	12 R	4%	-3%	1%
0.48	0.098	13 O	4%	6%	16%
0.53	0.079	14 S	35%	0%	22%
0.62	0.115	15 Q	12%	6%	21%
0.49	0.056	16 M	1%	1%	15%
0.49	0.113	17 P	4%	7%	6%
0.36	0.059	18 i	-24%	-1%	4%
0.56	0.048	19 T	7%	3%	9%
0.55	0.112	20 V	23%	5%	4%
0.50	0.052	21 U	-8%	5%	13%
0.55	0.077	22 L	12%	1%	8%
Pearson	**0.46**			**0.40**	0.31
$p < 0.05$ one-tailed	**0.02**			**0.03**	0.08
	0.49		Pearson	**0.36**	0.25
	0.01		$p < 0.05$ one-tailed	**0.05**	0.13
				Pearson	**0.36**
				$p < 0.05$ one-tailed	**0.05**

A one-tailed test for significance was used as these were expected to be positive correlations. It can be seen in Table 30 that children's absolute scores on TTR in SST dialogue correlated moderately with teachers' absolute scores in acknowledgements per utterance in SST dialogue with a Pearson of r (20) = 0.46, p = 0.02 and teachers' change scores less strongly with a Pearson of r (20) = 0.40, p = 0.03. The children's TTR change from non-SST dialogue to SST dialogue was

also tested and showed a small correlation of r (20) = 0.36, p 0.05 to teachers' acknowledgement changes and a moderate to strong correlation of r (20) = 0.49, p 0.01 to the absolute rate of acknowledgements in SST dialogue. The teachers' use of Gricean maxims, although not significantly correlated with children's TTR, was the only other indicator to show any positive tendency with regard to children's TTR scores. The use of Gricean maxims and acknowledgements did correlate independently and significantly with each other at r (20) = 0.36, p 0.05.

Children's TTR increases in SST dialogue appear to be related to teachers' increased use of acknowledgements and possibly somewhat weakly to the use of Gricean maxims. This will be further tested in the following analysis of each room's teacher's use of five indicators.

Beyond the changes scores, an examination of the absolute TTR scores in SST dialogue revealed that room 15Q had the highest score in children's TTR, followed by rooms 2b and 1a. Room 15Q also had the highest score in children's MLU within SST dialogue. Considering this room's ranking at 15th on the six quality indicators average z-score and therefore in the middle of the bottom half, it appears to be an exceptional case in that it shared the highest quality language for children's TTR in SSTs with the two top ranked rooms 1a and 2b and exceeded them both on children's MLU in SSTs. This led to a further examination of all previous indicator rankings to determine what patterns might distinguish the top rooms and what might be associated with the children's high scores on TTR and MLU and in room 15Q particularly.

The *Results Navigation Guide* shows the analysis now moves to the third line of enquiry, investigating patterns in the relationship of child TTR and MLU to teacher use of the quality indicators.

Chapter 7 Change from non-SST to SST continued	Data logic	**1.** Measuring MLU & TTR	
	1st line of enquiry MLU	**2.** Tables 23 - 24 MLU differences and changes	**3.** Table 25 correlation check SES and MLU
	2nd line of enquiry TTR	**4.** Tables 26 - 29 TTR differences and changes	**5.** Table 30 child TTR correlation with Teacher Acknowledgements
	3rd line MLU and TTR patterns	**6.** Tables 31 - 32 Compare child MLU and TTR with Teacher use of 5 indicators	**7.** Fig 5 - Three approach groups distinguished by z-score range

Three distinct approaches

Three patterns in use of five of the indicators emerged that distinguished rooms 1a, 2b and 3h. Table 31 shows all the rooms and scores, while Table 32 dispenses with the scores for simplicity and only shows rooms that followed the patterns of the three top ranked rooms 1a, 2b and 3h. Other rooms that tracked along with these three rooms were given a colour a shade lighter following the leading ranked room. Rooms 2b and 3h each had two rooms following their patterns, while room 1a seemed to be the most common approach archetype with six rooms following that pattern. Rooms not shown in Table 32 did not track consistently as can be checked in Table 31 by carefully following each room's scores across the columns. Note that the scores are ordered by the rank in each column and not by another column. In addition to these tables and immediately following them, Figure 5 summarizes the important data distinguishing the three approach-groups for clarity of comparison.

Table 31

Comparing children's TTR, MLU and five indicators scores between rooms and tracking three approaches, 1a, 2b and 3h in SST dialogue.

chidren's language quality				teachers' ranking on five indicators rates per utterance or ratios within SST dialogue only																	
children's TTR		children's MLU			C.Q / Ut		Open/Ut		O/Cratio		T.Qs/Ut		Ack/Ut		Blends		Grice/U				
Room	SST	Room	SST	Room	SST	Room	SST	Room	SST	Room	SST	Room	SST	Room	SST	Room	SST				
15 Q	0.62	**15 Q**	6.8	**2 b**	0.39	4 d	0.17	8 g	1.71	**12 R**	0.62	**2 b**	0.186	**1 a**	6	**2 b**	0.292				
2 b	0.59	**9 k**	6.0	**12 R**	0.37	17 P	0.16	**19 T**	1.20	4 d	0.48	**1 a**	0.178	**6 j**	6	**14 S**	0.276				
1 a	0.58	18 i	6.0	13 O	0.33	**19 T**	0.14	4 d	0.95	**14 S**	0.47	4 d	0.165	**3 h**	5	16 M	0.222				
7 f	0.58	17 P	5.8	11 N	0.31	8 g	0.14	17 P	0.92	**2 b**	0.47	**7 f**	0.151	8 g	5	**3 h**	0.221				
9 k	0.56	16 M	5.4	**14 S**	0.30	**9 k**	0.13	**9 k**	0.88	13 O	0.47	**6 j**	0.126	**5 c**	5	**15 Q**	0.221				
19 T	0.56	**1 a**	5.2	18 i	0.26	**6 j**	0.11	10 e	0.69	**15 Q**	0.44	**15 Q**	0.115	18 i	5	13 O	0.216				
20 V	0.55	**22 L**	5.0	21 U	0.26	**1 a**	0.11	**1 a**	0.58	**6 j**	0.44	**9 k**	0.115	17 P	4	**5 c**	0.178				
22 L	0.55	**2 b**	4.8	**3 h**	0.26	10 e	0.10	**6 j**	0.54	**3 h**	0.43	17 P	0.113	**9 k**	3	**6 j**	0.143				
3 h	0.53	**20 V**	4.8	**7 f**	0.22	**14 S**	0.09	**20 V**	0.50	17 P	0.42	**20 V**	0.112	**14 S**	3	21 U	0.135				
14 S	0.53	**3 h**	4.8	**5 c**	0.21	**7 f**	0.09	**7 f**	0.42	11 N	0.42	10 e	0.108	21 U	3	8 g	0.121				
6 j	0.52	8 g	4.8	**6 j**	0.20	**20 V**	0.09	16 M	0.42	18 i	0.41	13 O	0.098	4 d	3	**22 L**	0.120				
12 R	0.52	13 O	4.7	**1 a**	0.19	13 O	0.08	**15 Q**	0.33	10 e	0.38	11 N	0.097	**7 f**	2	**9 k**	0.115				
10 e	0.50	**12 R**	4.6	**15 Q**	0.19	18 i	0.08	**14 S**	0.30	**1 a**	0.38	**12 R**	0.083	**19 T**	2	**19 T**	0.096				
21 U	0.50	**19 T**	4.6	4 d	0.18	**15 Q**	0.06	18 i	0.29	**9 k**	0.37	8 g	0.080	16 M	2	**7 f**	0.082				
4 d	0.49	**6 j**	4.6	**20 V**	0.18	**5 c**	0.06	**5 c**	0.29	**7 f**	0.37	**14 S**	0.079	11 N	2	4 d	0.076				
8 g	0.49	11 N	4.6	17 P	0.18	11 N	0.06	13 O	0.24	**19 T**	0.35	**22 L**	0.077	**15 Q**	1	**1 a**	0.065				
16 M	0.49	**7 f**	4.4	10 e	0.15	**3 h**	0.05	**22 L**	0.23	8 g	0.35	**5 c**	0.070	**20 V**	1	17 P	0.064				
17 P	0.49	4 d	4.4	**9 k**	0.14	16 M	0.05	**3 h**	0.20	21 U	0.34	**3 h**	0.063	**22 L**	1	18 i	0.063				
13 O	0.48	**5 c**	4.3	**19 T**	0.12	**12 R**	0.03	11 N	0.19	**20 V**	0.33	18 i	0.059	**12 R**	1	11 N	0.063				
5 c	0.47	21 U	4.2	**22 L**	0.11	21 U	0.03	21 U	0.12	**5 c**	0.31	16 M	0.056	**2 b**	0	10 e	0.056				
11 N	0.46	**14 S**	3.8	16 M	0.11	**22 L**	0.03	**12 R**	0.09	16 M	0.27	21 U	0.052	10 e	0	**20 V**	0.056				
18 i	0.36	10 e	3.8	8 g	0.08	***2 b***	0.02	***2 b***	0.05	**22 L**	0.15	***19 T***	0.048	13 O	0	**12 R**	0.033				

1 a bold box, 4d, 8g, 6 j, 7 f, 9 k, and 19 T light line box **2 b** bold dashed box 12 R and 15 Q dashed box **3 h** 5 c 21U crossed cell

Table 32

Tracking only rooms following three approaches 1a, 2b and 3h with colour coding and showing 'distance' from 1a to 2b.

chidren's language quality				teachers' ranking on five indicators rates per utterance or ratios within SST dialogue only															
children's TTR		children's MLU		Room	Cl.Qs	Room	Op.Qs	Room	O/C.Q	Room	T.Qs	Room	Ackn	Room	Blends	Room	Grice
SES	SST	SES	SST		/Ut		/Ut		ratio		/Ut		/Ut				/Ut
10	15 Q	10	15 Q		2 b		4 d		8 g		12 R		2 b		1 a		2 b
7	2 b	7	9 k		12 R				19 T		~~4 d~~		1 a		6 j		
7	1 a						19 T		4 d				4 d		3 h		
7	7 f						8 g				2 b		7 f		8 g		3 h
7	9 k						9 k		9 k				6 j		5 c		15 Q
10	19 T	7	1 a				6 j				15 Q		15 Q				
					21 U		1 a		1 a		6 j		9 k				5 c
		7	2 b		3 h				6 j		3 h				9 k		6 j
9.5	3 h				7 f												21 U
		9.5	3 h		5 c		7 f		7 f						21 U		8 g
7	6 j	9	8 g		6 j										4 d		
9.5	12 R				1 a				15 Q						7 f		9 k
		9.5	12 R		~~15 Q~~						1 a		12 R		19 T		19 T
2	21 U	10	19 T		4 d		15 Q				9 k		~~8 g~~				7 f
7	4 d	7	6 j				5 c		5 c		7 f						4 d
9	8 g										19 T				15 Q		1 a
		7	7 f				3 h				8 g		5 c				
		7	4 d		9 k				3 h		~~21 U~~		3 h				
		1	5 c		19 T		12 R								12 R		
1	5 c	2	21 U				21 U		21 U		~~5 c~~				2 b		
									12 R				21 U				
					8 g		2 b		2 b				~~19 T~~				~~12 R~~

Pattern 1 a and 4d, 6 j, 7 f, 8g, 9 k, 19 T	Higher on Acknowledgements, Open Qs, and Blends	Low on Total Qs and Grice
Pattern 2 b and 12 R, 15 Q	Higher on Acknoweldgements, Closed Qs, Total Qs and Grice	Low on Blends and Open Qs
Pattern 3 h and 5 c, 21U	More Closed than Open Qs and higher on Blends and Grice	Low on Acknowledgements

Note: Outliers that were more than six ranks from group on indicators, marked with crossed box. Each outlier "strayed" only once from the group.

SES: Socio-Economic Status of 5c and 21U were respectively decile one and two with 5c mothers less than year 10 education

The following figure uses the same data as Table 32 without 'outliers' (as defined in the notes at the bottom of the table) and using z-scores to show more clearly the approach-group differences. The greatest difference between any two of the groups is shown as the z-score range at the bottom of Figure 5.

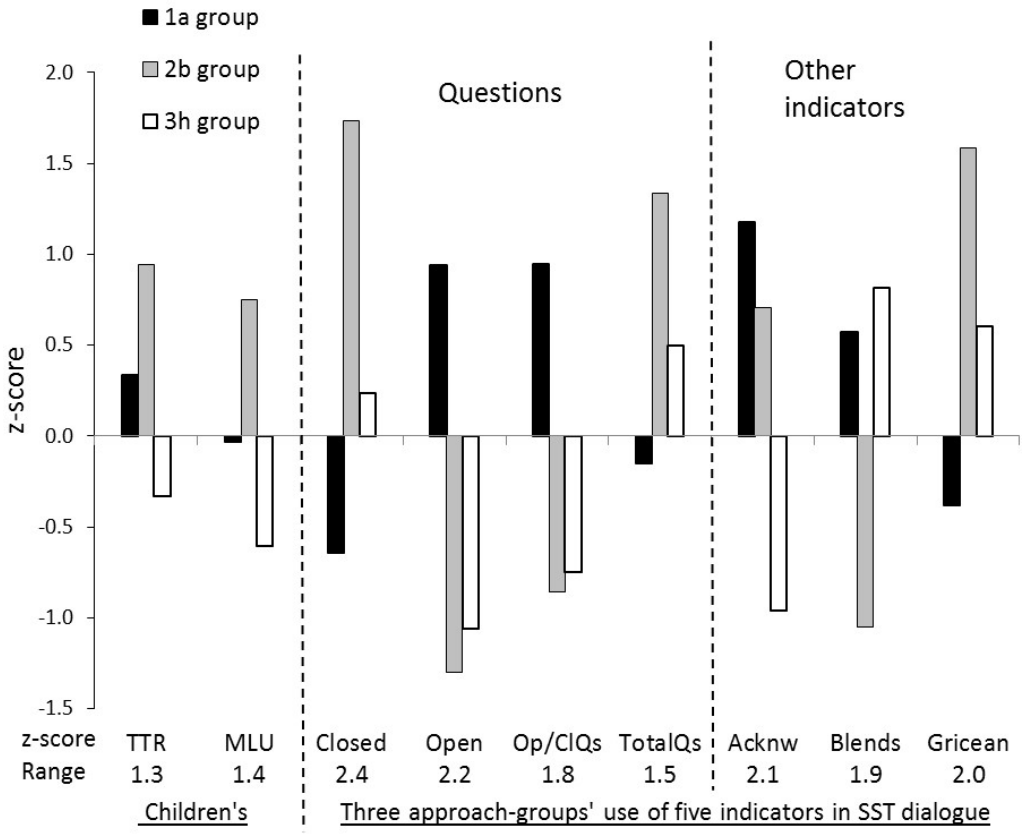


Figure 5 Three teacher approach-groups' use of five indicators.

Note: same group members as Table 32 excluding outliers.

This sorting of the data (Tables 31, 32 and Figure 5) shows that approach-groups 1a and 2b's use of five of the quality indicators differed greatly except on acknowledgements. The 3h group usually split the difference except in the use of blends where it had the highest rate of use and the lack of use of open questions, where it was much closer to group 2b. Figure 5 shows these differences in terms of z-scores of each entire group excluding the outliers on each of the indicators

identified and marked in Table 32. The exclusion of outliers was to display the most "typical" pattern in each approach. On all indicators, there were at least 1.5 standard deviations between two of the groups and usually more than 2.0. These are large differences, and therefore imply distinct behaviour patterns and constituted a reason to call these "approaches" rather than the already used "patterns" from Chapter 4. These will be referred to as the 1a, 2b and 3h "approach-groups" until the analysis is complete.

Because the lead rooms 1a and 2b were so distinct in taking opposite positions from each other on blends, Gricean maxims and in questioning types, they appear to represent distinct approaches of engagement. Because rooms 3h, 5c and 21U took an opposite position to 1a and 2b on acknowledgements and, unlike them, used both blends and Gricean maxims in a more balanced way, their tracking otherwise between the 1a and 2b approaches on question types does not appear simply to be a compromise position, but may also represent a distinct approach, although perhaps a less extreme one. To summarize: all three approaches were high on only two of the three indicators of acknowledgements, blends or Gricean maxims and high on either closed or open questions, but not both. That most rooms in approaches 1a and 2b used a high number of acknowledgements as the only common approach may explain why this indicator was the only one to correlate with children's TTR shown in Table 30 where all rooms were compared.

An analysis of the lower scoring rooms in Tables 31 and 32 was undertaken. Room 12R scored much lower on TTR and MLU than its group companions 2b and 15Q. It also did not follow their pattern of being high on acknowledgements and had the lowest score on Gricean maxims. Similarly, the two rooms following 3h ranked

lower on blends, Gricean maxims, and much lower on total questions, where they were outliers. They were also lower on children's TTR and MLU. Again similarly, rooms 4d, 8g and 19T parted with the other rooms in their group as outliers once only in a single indicator score and were distant from 1a by six ranks or more on one other occasion each. They also ranked lower on children's TTR and MLU than room 1a, with 4b and 8g at the lowest level of the group on TTR and 4d lowest on MLU.

The evidence from these lower scoring members of the three approach-groups suggests that even when a teacher follows a pattern of using quality indicators which appears to be associated with higher scores in children's language quality, without using comparatively high rates of two out of three of either acknowledgements, blends or Gricean maxims, and a sufficient number of either closed, open or total questions, the association with children's higher levels of TTR and MLU was less likely.

The *Results Navigation Guide* shows the analysis now moves to the fourth line of enquiry rechecking previous data sets in the light of finding three approach groups.

Chapter 7 Change from non-SST to SST continued	Data logic	**1.** Measuring MLU & TTR	
	1st line of enquiry MLU	**2.** Tables 23 - 24 MLU differences and changes	**3.** Table 25 correlation check SES and MLU
	2nd line of enquiry TTR	**4.** Tables 26 - 29 TTR differences and changes	**5.** Table 30 child TTR correlation with Teacher Acknowledgements
	3rd line MLU and TTR patterns	**6.** Tables 31 - 32 Compare child MLU and TTR with Teacher use of 5 indicators	**7.** Fig 5 - Three approach groups distinguished by z-score range
	4th line - 3 approaches checks	**8.** Table 33 3 approach groups check against previous data analyses	**9.** Table 34 - new correlations of 5 indicators by approach group

Revisiting SST dialogue: three approach-groups

Now that three very different approaches by teachers in constructing SST dialogue have been identified, reassessing previous analyses of the data was warranted to clarify associations. The nearly pervasive opposite scoring on quality indicators of the top scoring rooms overall means that analysing all rooms together would result in these opposite approaches cancelling out possible associations. The "logic" is not to obtain significant correlations, but to understand what is associated significantly with the use of indicators for different approaches.

Because both MLU and TTR are highly related to the Number of Total Words (NTW) in SST dialogue and because room 2b was an exceptionally differing room in that analysis in Chapter 6, a reanalysis of this data was done by retrofitting the three approach-group colour coding onto the data and reordering each column of data of SST dialogue by rank of that data column alone, instead of by the original table's ranking in room order. This is shown in Table 33. Note that the Pearson correlations are calculated without the 2b approach-group even though they are shown in the table for visual purposes of comparing their distance from the 1a approach-group.

Table 33

Three approach-groups ranking on children/teacher ratio of Number of Total Words in SST dialogue changes and removing group 2b from Pearson correlations.

Three approach-groups and Number of Total Words Child/Teacher ratio associations

Room	NTW C/T ratio change nSST to SST	Room	NTW C/T ratio change nSST to SST start	Room	NTW C/T ratio change SST to SST start	Room	Six indicator average z-score
9 k	-0.40	1 a	-0.50	11 N	-0.24	1 a	1.17
1 a	-0.33	9 k	-0.34	14 S	-0.19	2 b	
22 L	-0.27	14 S	-0.32	1 a	-0.17	3 h	0.94
12 R	-0.25	8 g	-0.30	16 M	-0.17	4 d	0.83
7 f	-0.22	7 f	-0.23	17 P	-0.11	5 c	0.67
8 g	-0.21	3 h	-0.20	8 g	-0.09	6 j	0.54
4 d	-0.17	11 N	-0.19	3 h	-0.08	7 f	0.40
5 c	-0.14	12 R	-0.19	6 j	-0.08	8 g	0.33
14 S	-0.13	4 d	-0.18	10 e	-0.07	9 k	0.31
3 h	-0.12	6 j	-0.17	19 T	-0.06	10 e	0.20
6 j	-0.09	10 e	-0.13	21 U	-0.04	11 N	0.12
13 O	-0.07	5 c	-0.12	18 i	-0.03	12 R	
10 e	-0.06	17 P	-0.10	7 f	-0.01	13 O	-0.10
15 Q	-0.01	19 T	-0.03	4 d	0.00	14 S	-0.20
17 P	0.00	15 Q	0.00	15 Q	0.02	15 Q	
2 b	0.03	18 i	0.01	5 c	0.02	16 M	-0.32
19 T	0.03	21 U	0.02	12 R	0.06	17 P	-0.35
18 i	0.04	13 O	0.04	9 k	0.06	18 i	-0.37
11 N	0.05	16 M	0.04	13 O	0.11	19 T	-0.59
20 V	0.05	22 L	0.10	2 b	0.19	20 V	-0.59
21 U	0.06	2 b	0.22	20 V	0.26	21 U	-0.91
16 M	0.21	20 V	0.31	22 L	0.37	22 L	-0.93
3 rooms	**-0.51**		**-0.73**		-0.38	*r* (17)	Pearson
removed	0.03		<0.01		0.08	*p* two-tailed	

Note: Pearsons done with all columns ordered by rank of last two columns, not as shown

It can be seen in Table 33 that rooms 1a and 2b show a pattern of being at extreme opposite ends of the three data sets of change in the number of total words ratio. The three groups trended in the same fashion as Table 32 (p. 217) with the 1a and 2b approach-groups tending to score toward their respective lead room while the 3h group members fell somewhere between these extremes. Those following rooms that were the most distanced in a column from their lead room of 1a, 2b or 3h, in this sorting of the data, were among the same rooms that were outliers in the previous

analyses – rooms 21U, 12R and 19T. A new Pearson comparison between the NTW Child/Teacher ratio changes was done without the 2b approach-group because of its opposite approaches and the logic that they constituted outliers. This analysis showed a strong association between the six-indicator ranking and the change in NTW Child/Teacher ratio from non-SST to SST dialogue at r (17) = - 0.51, p = 0.03, an association which previously had not been significantly related, and an extremely strong association at r (17) = - 0.73, $p < 0.01$ from non-SST to the start of SST dialogue, which previously when including the 2b group showed strong correlation of r (20) = - 0.49, p = 0.02.

The association of the Number of Total Words in SST dialogue with the same patterns of the three approach-groups as previously seen in Table 32, reinforces the conclusion that there are significant and systematic differences between approach 1a and 2b. On the other hand, the high Pearson correlations in Table 33 when group 2b was excluded but group 3h was still included, may indicate that the 3h approach is not very independent from group 1a, at least in the number of total words used.

We can also conclude that group 2b accomplished a high number of turns in SSTs without having to use as many words as group 1a. This may be because the use of closed questions and Gricean maxims is more parsimonious. It also may be that these kinds of questions and comments elicit shorter responses in children's talk, such that the balance between the two is substantially different than the 1a group.

The large differences between the three approach-groups' use of the six quality indicators in SST dialogue implies that lumping all 22 rooms together to test relationships may not reveal associations, and these differences could therefore have cancelled each other out in checking for correlation. To test this, these calculations

were redone removing first approach-group 2b and then 3h. These results are shown in Table 34.

Table 34

Comparing five indicators associations in SST dialogue.

Indicators per utterance within SST dialogue compared to six-indicator z-score ranking

Cl.Q / Ut SST	Op.Q / Ut SST	Op/Cl Q ratio SST	Tot. Qs / Ut SST	Ack / Ut SST	Blends SST	Gricean /Ut SST	Pearson operation	group removed
0.19	0.16	0.06	**0.36**	**0.63**	**0.36**	0.15	*r* (20)	none
			0.05	**<.01**	**0.05**		*p* one-tailed	
0.06	0.31	0.15	**0.44**	**0.58**	**0.53**	0.01	*r* (17)	2b
			0.03	**<.01**	**<.01**		*p* one-tailed	
0.08	**0.42**	0.22	**0.49**	**0.78**	**0.48**	-0.18	*r* (14)	2b and 3h
	0.05		**0.03**	**<.01**	**0.03**		*p* one-tailed	

When approach-group 2b was removed from the whole group in calculating the Pearson correlations for each indicator in SST dialogue against the six-indicator z-score average, total questions per utterance and blends became more strongly associated in SST dialogue along with acknowledgements which had been the only strongly significant indicator for all rooms previously. When approach-group 3h was removed as well, leaving the majority approach-group 1a alone along with teachers who were not distinguished in their behaviour enough to be part of any approach-group, the comparison with the six-indicator ranking showed that open questions also became significant, with total questions and acknowledgements increasing the strength of their association, while blends decreased, but remained significant as well.

When group 2b and then 3h teachers were removed from the comparison, the remaining teachers, representing the “majority” approach of 1a and those not displaying any approach, showed a significant association between their use of open questions, total questions and blends with the six-indicator ranking of rooms when

engaged in SST dialogue. This strengthens the conclusion from previous analyses that these are significantly distinct approach patterns with at least one, the predominant 1a approach, operating systematically in a continuum among 16 rooms. The *Results Navigation Guide* shows the analysis now moves to the fifth line of enquiry for this chapter, discounting confounds.

Chapter 7 Change from non-SST to SST continued	Data logic	**1.** Measuring MLU & TTR	
	1st line of enquiry MLU	**2.** Tables 23 - 24 MLU differences and changes	**3.** Table 25 correlation check SES and MLU
	2nd line of enquiry TTR	**4.** Tables 26 - 29 TTR differences and changes	**5.** Table 30 child TTR correlation with Teacher Acknowledgements
	3rd line MLU and TTR patterns	**6.** Tables 31 - 32 Compare child MLU and TTR with Teacher use of 5 indicators	**7.** Fig 5 - Three approach groups distinguished by z-score range
	4th line - 3 approaches checks	**8.** Table 33 3 approach groups check against previous data analyses	**9.** Table 34 - new correlations of 5 indicators by approach group
	5th line - discounting confounds	**10.** Table 35 child participation by turns influence on data analysis	**11.** Table 36 - approach groups and SST turns in 3 activity - pattern checking

Discounting one child unduly influencing child measures

It was observed that in some rooms a single talkative, assertive child contributed far more to dialogue than other children. Some of these children clearly had a more advanced ability to express themselves and may have contributed to a higher ranking in the analysis of rooms in this chapter independently of what the teacher was doing. It was also observed that some teachers took decisive measures to either quell the loquacious or encourage the reticent or did both.

To quantitatively attempt to test the final outcome of the interaction between any precociousness among the children and the teacher's orchestration of inclusiveness within SST dialogue, individual child turns within SSTs were counted and compared for the range of differences between children. The results are shown in

Table 35, which has two parts. The first part shows the difference between the children with the most and least turns as a ratio to total turns. This measure was compared to all other measures so far undertaken within SST dialogue and was found to correlate significantly only with the number of total words ratio between children and teachers at the start of SST episodes. This is shown in the final column of part one. The second half of Table 35 shows the difference between the maximum turns of a child with the second highest turns of a child. This was to see if one child stood out in turns over all others. This did not correlate with any other measures within SST dialogue. These two measures of differences in turn-taking were compared to each other with a Pearson coefficient.

Table 35

Children's participation differences by turns in SST dialogue.

Children maximum and minimum turns difference in SST dialogue only						SORTED by	NTW C/T ratio	Child max to 2nd turn difference		within SST dialogue children's		nmbr
Room	Total Turns	Max Turns	2nd max Turns	Min Turns	max-min turn Diff	Diff / tot turns	SST Start	Room	SORT by Dif /tot.trns	TTR	MLU	of chldrn
19 T	47.0	14.3	12.3	9.3	5	0.11	0.13	15 Q	0.00	0.62	6.8	6
3 h	135.0	76.5	58.5	58.5	18	0.13	0.19	16 M	0.02	0.49	4.4	5
7 f	120.0	28.0	23.0	9.0	19	0.16	0.16	17 P	0.03	0.49	4.4	4
15 Q	82.0	19.8	19.8	6.8	13	0.16	0.31	8 g	0.03	0.49	4.6	4
11 N	88.0	28.0	25.0	11.0	17	0.19	0.15	11 N	0.03	0.46	3.8	5
5 c	290.0	75.9	51.9	17.9	58	0.20	0.31	19 T	0.04	0.56	5.2	4
21 U	62.0	17.6	13.6	4.6	13	0.21	0.35	7 f	0.04	0.58	5.8	6
8 g	93.0	34.0	31.0	13.0	21	0.23	0.26	21 U	0.06	0.50	4.6	7
16 M	61.0	16.6	15.6	2.6	14	0.23	0.69	22 L	0.07	0.55	4.8	3
22 L	74.0	32.3	27.3	14.3	18	0.24	0.73	2 b	0.08	0.59	6.0	5
2 b	98.0	33.0	25.0	9.0	24	0.24	0.60	5 c	0.08	0.47	4.2	7
1 a	254.0	89.7	47.7	24.7	65	0.26	0.09	3 h	0.13	0.53	4.8	2
9 k	66.0	24.0	10.0	7.0	17	0.26	0.28	13 O	0.14	0.48	4.3	4
4 d	226.0	80.6	27.6	20.6	60	0.27	0.41	1 a	0.17	0.58	6.0	6
13 O	44.0	18.3	12.3	6.3	12	0.27	0.47	12 R	0.18	0.52	4.7	4
17 P	107.0	40.0	37.0	10.0	30	0.28	0.48	18 i	0.20	0.36	3.8	6
12 R	55.0	23.8	13.8	6.8	17	0.31	0.26	9 k	0.21	0.56	5.4	6
6 j	191.0	83.0	42.0	19.0	64	0.34	0.38	6 j	0.21	0.52	4.8	5
18 i	182.0	75.6	38.6	12.6	63	0.35	0.45	4 d	0.23	0.49	4.6	7
14 S	57.0	30.0	14.0	6.0	24	0.42	0.37	14 S	0.28	0.53	4.8	4
10 e	154.0	98.0	35.0	21.0	77	0.50	0.25	10 e	0.41	0.50	4.6	3
20 V	48.0	39.5	8.5	8.5	31	0.65	0.72	20 V	0.65	0.55	5.0	2
Note: Pearson done with all rooms in numerical order, not as shown here					*r* (20) two-tailed	Pearson *p*	**0.42** **0.05**		**0.91** **0.00** Pearson *p* two-tailed	-0.15 -0.03	-0.18 -0.13	-0.40 0.07 -0.39 0.07

In Table 35 the column marked "SORTED" orders the ranking of the rooms on the left and shows the difference between the most turns by a child in SST dialogue and the fewest turns as a ratio of total children's turns. Smaller numbers indicate rooms with the least difference between the maximum and minimum turns. A similar calculation on the right shows the difference between the most turns and the second most number of turns. A low score on this measure indicates that the top two participating children in a room were closer on their number of turns than those with higher scores. It can be seen that room 15Q was the least likely to have one child dominating dialogue with a score of 0.0, meaning the two highest scoring children had exactly the same number of turns. Horizontal lines in the data columns indicated

natural breaks in the data of 0.05 or more. Pearson correlations were done with all columns in numerical room order and not as ordered in the current table view. Neither of these measures correlated with children's TTR, MLU or the number of children participating in SST dialogue.

The very high Pearson of r (20) = 0.91, p = 0.05 between the maximum to minimum turns difference and the maximum to second highest turns difference, indicates that rooms that had less difference overall were also extremely likely to also have less difference between the first and second highest turn-taking children. This is unlikely to be the case unless teachers were doing a better job of balancing the dialogue. The nil correlation of these two measures of participative inclusiveness with children's TTR and MLU indicates that there is little likelihood that TTR or MLU were influenced by a single loquacious child with higher language development or a room with an extremely reticent child. The possibility that more children in a room might mean less balance of participation was shown to not only not be likely but trended toward the opposite possibility, though not significant in a two-tailed test for correlation, shown in the last column.

A Pearson correlation of r (20) = 0.42, p = 0.05, between the maximum to minimum child turns difference and the number of total words of children to teacher ratio at the start of SSTs, indicates that teachers who talked more at the start of SSTs compared to the children were also likely to be those that had less difference in turns between children. The NTW has already been significant in correlations with teachers' quality indicators as was shown in Table 22 (p. 189) and therefore this new finding adds a another dimension to "quality" behaviour of teachers.

The data for the lead rooms 1a, 2b and 3h, although in the middle range of rooms on these measures, show that the top two children were within less than 50% turns of each other. Large imbalances became extreme only in the last ranking three rooms of 14s, 10e and 20V, indicating most teachers had a balanced participation. The rooms that were highest in children's TTR and were in the top seven of both these measures were 15Q 7f, and 19T, while only 15Q was also high in MLU, being the top room in that measure. Room 15Q, with the highest ranking in TTR, MLU and participation equality of the top two children, and equal third ranking on participation between the highest and lowest child turns, makes it somewhat unique and of interest to see how SST dialogue was orchestrated.

Qualitative analysis of room 15Q dialogue

A sample of dialogue from room 15Q gives an idea of how this teacher engaged the children in a storybook reading with high TTR, MLU and a balanced participation. There are six children in this room. The story is about an Australian aboriginal girl's life before Western contact.

Example (r) Room 15Q high levels of TTR and MLU

T Do you think Murrawee's father would have to hold her : there [itt] [t01]?

B I don't think she would step on broken glass cuz these glass hasn't have sharp things on it [t02]. **meaning what looks like glass in the picture is rounded**

T do you think back when Murrawee was walking in the river there would have been broken glass in the river [t03] [ow]?

U yes [t04].

T did they have glass in their times, back a long_long time ago [ow] [t05]?

L (shakes head no) uhuh [t06].

P <(shakes head no)> [t07].

D <(shakes head no)>.

T no (slight shake of head no) [t08] [ap].

T what did we find out today.

T that they used to put their water in.
T was it glass [ck]? **three utterances said without pause, so only one question**
C no.
T what was it [ri]?
L wood [t09].
T it was a wooden bowl that they made from a tree trunk [t10].
T wasn't it [si]?
L hmm (meaning yes) [t11].
T do you remember that big river red gum that we went under today [cy]?
B listen.
B the girls in the story also made a boat [ict] [t01].
T she did [ap].
T and where did that canoe come from [t02] [ri]?
W the tree [t03].
B tree [t04].
T can you see the scars there [cy] [t05] ?
T that's where they cut the tree.
T so that shape came from the tree shape (pointing to the illustrations).
B so skin was growed by a tree.
B and it can also fit a person can also have it [t06].
T yes [ap] [t07].

It appears from the dialogue that both the teacher and one child (B) tended to use complex and long utterances. A further look at the transcript showed that another child also used long utterances as follows:

N I got covered in hay when I came back [t05].
T you did get covered in hay [ap] [t06].
T it's all through your hair.
T but that's fun too.
N yeap.
N but if I have a shower to wash it, cause then there will be hay in the shower [t07].
T yeah [ap][t08].

This teacher nowhere in any SST dialogue had to call on any of the six children to get them to speak, indicating that the high balance of child participation was not driven by the teacher, at least not openly. This child-readiness to participate may also increase this room's ranking on TTR and MLU given the observation in other rooms that reticent children who need prompting often require a number of very short exchanges to get them going and then those children often answer in monosyllables.

Approaches compared to patterns of consistency and persistency

The three approaches just identified were compared to the original patterns of SST turns across three activities to see if this revealed any added insight into teacher behaviour. These are shown in Table 36 which was ordered firstly by the three approaches and then by the rooms' final rank in the second column.

Table 36

Three approaches compared to SST turns in three activities patterns from Chapter 4.

Room rank by SST turns/min	Room by Strategy	SST turns per minute	Sustained Shared Thinking Episodes by length in three activities			Original Pattern		children's TTR rank in SSTs
			Reading	Writing	Selected	Persis-tence	Consis-tency	
a	**1 a**	12.1	44,18,18,9,5,5,3	56,20,19,19,14,10,8	67	Mixed	3	3
d	4 d	9.2	58,24,13,8,7,6,5,3,3	60,26,13,8,3	0	Mixed	2	15
f	7 f	8.2	9,8,7,6,4	62,7,6	34,19,12,11,8,7,4	Mixed	3	4
g	8 g	7.9	27,15,7,6	11,9,7	26,25,14,9,5,5,3x4	Short	3	16
j	6 j	6.5	30,26,17,15,15,11,10,10,7,7,4	26,25,15,7,3	3	Short	2	11
k	9 k	6.1	17,3	30	83	Long	1	5
T	19 T	2.9	11,7	10,7	39,8,6	Short	1	6
b	**2 b**	12.0	10,7	104	81	Long	2	2
Q	15 Q	4.7	18,12,7,6,3,3	39,19,14	0	Short	2	1
R	12 R	3.6	36,17,3	27	0	Short	2	12
c	5 c	9.3	45,37,21,14	106,73,18	48	Long	3	20
h	**3 h**	7.5	52,10,6,5,3	62,13,11,8,7,6,5	16,10,9,8	Mixed	3	9
U	21 U	2.8	13,5	38,11,4	18,10	Short	2	14

Each of the three approach-groups of 1a, 2b or 3h had a room with Long and Short patterns, a room ranked in the top three for SST turns per minute (a, b or c), a room in the final top ranking of 1, 2 or 3, and rooms with a variety of SST activity by length, type of activity and different levels of persistency and consistency.

Both 1a and 2b approaches had two rooms that produced nil or near nil activity in the Selected activity, while the 3h approach did not, implying that the 3h approach was associated with a more consistent behaviour of creating SSTs across all activity types. However, because this group had lower scores for children's TTR and MLU, consistency in producing SST dialogue across activities may indicate some underlying unhelpful variable in relation to children's TTR and MLU. Given that there were only three examples of rooms following the 2b and 3h approaches, these conclusions are very tentative and indicative only of possibilities. That these six rooms differed substantially and consistently with the predominant 1a approach and that some of these rooms had children displaying complex language at rates exceeding those of the 1a approach does provide some evidence that more than one approach in the use of the six indicators could be productive of quality engagement with children.

Except for the 3h group appearing to be more consistent across the three activity types, having one of the three approaches does not also imply necessarily applying that approach to create SSTs differently to the other approaches in these various measures,.

The *Results Navigation Guide* shows the analysis is now concluded for this the final results chapter.

Chapter 7 Change from non-SST to SST continued	Data logic	**1.** Measuring MLU & TTR	
	1st line of enquiry MLU	**2.** Tables 23 - 24 MLU differences and changes	**3.** Table 25 correlation check SES and MLU
	2nd line of enquiry TTR	**4.** Tables 26 - 29 TTR differences and changes	**5.** Table 30 child TTR correlation with Teacher Acknowledgements
	3rd line MLU and TTR patterns	**6.** Tables 31 - 32 Compare child MLU and TTR with Teacher use of 5 indicators	**7.** Fig 5 - Three approach groups distinguished by z-score range
	4th line - 3 approaches checks	**8.** Table 33 3 approach groups check against previous data analyses	**9.** Table 34 - new correlations of 5 indicators by approach group
	5th line - discounting confounds	**10.** Table 35 child participation by turns influence on data analysis	**11.** Table 36 - approach groups and SST turns in 3 activity - pattern checking
			12. Conclusions

Conclusion to chapter

In the change from non-SST to SST dialogue, the data from this and the last chapter indicate that for the most part teachers appear to have spoken more and in more simple ways to orchestrate SST dialogue, particularly at the start of SSTs, and did so with substantial changes in their use of the five indicators, but did so differently from each other. A close analysis of rooms that had the highest children's TTR in SST dialogue revealed that many of the largest of these differences were part of patterns which distinguished three distinct approaches used by the three highest ranked rooms on the six-indicator average z-score scale – 1a, 2b and 3h and ten other rooms.

In the change from non-SST to SST dialogue, the aggregate dialogue of children in most rooms showed an increase in MLU and TTR with a more balanced

participation among the children. However, the children spoke less as a ratio to their teacher's number of total words. It was also shown that a more even balance in children/teacher talk ratio occurred in a room's SST dialogue was related to teachers who talked more at the start of SSTs. Those rooms where children had a higher aggregate TTR in SST dialogue were also rooms where: 1) the children had changed the most in TTR from non-SST dialogue, 2) the teachers had a higher TTR in SST dialogue, 3) the teachers used more acknowledgements in SST dialogue, and 4) the teachers had also increased their use of acknowledgements more in the change from non-SST to SST dialogue than other teachers.

Teachers who were higher on the six-indicator z-score ranking were likely to shorten their MLU when moving from non-SST into SST dialogue and changed their MLU by more than those lower on the ranking. They used more acknowledgements in association with children's increase in TTR, and were more likely to have had a very significant increase in acknowledgements per utterance within SST dialogue compared to non-SST dialogue. Their variability in TTR across the seven 150-word cut samples in non-SST dialogue was also higher.

When the less common approach-groups 2b and 3h were removed from these correlation calculations, and the remaining 19 rooms' dialogue in SSTs was tested against the six-indicator average z-score ranking, open questions, total questions and blends joined acknowledgements as significantly correlated indicators. The very different use of indicators by approach-groups 2b and 3h was shown to have acted as a confound to understanding how 1a and other teachers constructed SST dialogue differently from non-SST dialogue. The higher performing rooms using the 1a and 2b approaches, although very different in the use of these quality indicators except for

the high use of acknowledgements by both, appeared to have similar associations with high quality of children's language, indicating that there may be at least two very different approaches used by these teachers to construct high quality and extensive SST dialogue with children in preschool activities.

Conversely, the lower ranking teachers on the six indicators were less inclined to change their way of talking to children both within non-SST dialogue and also when changing to SST dialogue compared to those higher on the six-indicator rankings. The consistency of these differences across measures could be described as a difference in flexibility or adaptability to context. This implies firstly an awareness of context differences, which in turn implies an overall difference in the degree of "intentionality" in deciding to do something differently.

CHAPTER 8: DISCUSSION

This chapter will first review the research questions and methodological approach that underpin this study of classroom interactions. The factors that did not impact on quality talk will be discussed and then those that did impact will be considered in order of level of complexity. This is followed by a discussion of the most significant results in terms of the three approach-groups, as these appear to organize the previous levels into three patterns of intellectual stimulation orchestrated by the teacher.

The question posed in this thesis was: How did 23 Australian preschool teachers use dialogue to construct quality talk in terms of episodes of Sustained Shared Thinking during three teacher-led activities? This was addressed by a quantitative and qualitative methodological approach to discourse analysis to accomplish a fine-grained examination of teacher-child talk within preschool settings.

Indicators of quality that have been shown to be likely to produce long-term learning outcomes through helping children develop their thinking ability were examined in the context of teacher-led preschool activities and within episodes of Sustained Shared Thinking (SST) during these activities.

The analysis proceeded step-by-step through levels of complexity by describing and discovering the details of differences, similarities and patterns among these teacher-led activities and comparing these interactions using comparison analysis of the data in tables and graphs, correlation testing and qualitative analysis. Although the number of rooms examined in this analysis was small (n = 23) and they were not randomly selected, mitigating against definitive conclusions, the results do

show, however, that this kind of methodological approach has the potential to reveal heretofore unexpected possibilities for further study. These possibilities are discussed in the next chapter.

Factors that did not impact on quality talk interactions

There were a number of factors that did not appear to impact significantly on quality talk interactions in this study in terms of teacher and children demographics and school factors.

The teachers' length of experience in early childhood education, the number of tertiary years of education, the amount of professional development or the number of journals they read that informed their practice did not seem to impact against any of this study's measures of child or teacher engagement in dialogue, patterns or approaches to talk interactions. This is consistent with evidence that such factors can have minor effects on child outcomes compared to talk interactions (Hattie, 2003; Rowe, 2003). From Morsh and Wilder's (1954) early evidence that better child outcomes were related to talk interactions, specifically teacher questions, teacher challenges and the amount of spontaneous student discussion in their review of 360 research articles, through the growing evidence from 60's and 70's (Bronfenbrenner, 1974; Cole & Maltzman, 1969; Conners & Eisenberg, 1966; Cross, 1978; Newport, 1977; Snow et al., 1976; Snow & Waterson, 1978; Tough, 1969, 1974, 1977; Vygotsky, 1934/1962, 1978) to more recent evidence (Alexander, 2000; Dickinson & Neuman, 2011; Mercer, 2000, 2008b; Siraj-Blatchford et al., 2008) there is now substantial support that talk interactions are more important than other influences.

The preschool context itself did not appear to matter. One preschool site had two rooms in the study. One room ranked 1st and the other 9th in the final six-indicator z-score ranking. Another preschool site had rooms ranked 3rd, 10th, 17th and 18th. While there was not a wide range of contexts in this study, the findings may suggest that whatever management systems, professional development and whole school ethos existed in these two preschools, it did not appear to significantly predict a teacher's level of using these quality indicators or the amount of Sustained Shared Thinking. This supports Hill and Rowe's (1996) contention that quality differences between classrooms in one school are often greater than between schools.

The combined children's SES by their home postal code (Socio-economic Indexes for Areas (SEIFA) index scores) appeared not to matter for quality of their language except if the SES was very low (1 or 2) and only in terms of their combined Mean Length of Utterance (MLU) within Sustained Shared Thinking dialogue in absolute terms. These two low SES rooms by child neighbourhood ranked 20th and 21st out of the 23 rooms in this measure of MLU. Although SES rank and MLU rank showed a significant relationship using a Pearson one-tailed test at $p = 0.44$ r (20), the rooms ranked last, at 22nd and 23rd by the six indicators, were ranked decile 7 and 9 for SES, indicating a weakness in using SES to predict combined children's MLU.

Another exception to the idea that SES rank matters to quality talk was the teacher of 5c, who had children from decile 1, but nevertheless had high rates on measures of three quality dialogic indicators: 1) turns within Sustained Shared Thinking dialogue where it ranked third; 2) blends, ranked fifth; and 3) Gricean maxims, ranked second, thus implying that constructing complex dialogue thought to be helpful to children may not be dependent to a large extent on the children's

combined SES neighbourhood rank. The Mean Length of Utterance for room 5c children was raised in the change from non-SST to SST dialogue by 26%, which was a greater increase than seven rooms and outranked three other rooms in the absolute level of MLU. This teacher was close to the average on all teacher demographics, adding to the evidence that both teacher and child factors need not impact quality talk and more specifically in a teacher's ability to enhance the quality of talk using dialogic approaches such as Sustained Shared Thinking.

Child age was also discounted as significant by the finding that the few six-year-old participants in the whole study were not in rooms that did particularly well on any child factor, nor were they particularly more talkative than the younger children. It is not known why six-year-olds were still in preschool as there is normally no provision for keeping children back at this age. A room's average age of children also did not correlate with other data sorting (primarily because the variance on the age distribution was, not unexpectedly, quite low). The possibility that a single loquacious or reticent child in a room influenced comparisons between rooms was also discounted.

Factors that impacted positively on talk interactions

The question therefore devolves as to how individual teachers constructed dialogue using features identified in the literature that matter to increased opportunities to engage in quality dialogue. The primacy of interactions over other factors is supported in this study, as has been found previously (Hamre et al., 2013; Williford et al., 2013).

This discussion will now examine the most significant results in relation to Sustained Shared Thinking episodes, part of which was how SST dialogue differs from non-SST dialogue. The levels of complexity included: the number of total words, two measures of complexity of those words in terms of: Mean Length of Utterance and Type Token Ratio (TTR), acknowledgements, types of questions, blends and Gricean maxims, and finally, patterns of indicators as "approach-groups".

The first and simplest level of language examined was the Number of Total Words (NTW) used in non-SST, SST, and in the first four turns starting SST dialogue by children and teachers. This comparison was within rooms and showed that 17 of the 23 teachers increased their share of the NTW compared to the aggregate children's NTW in SST dialogue and more so at the start of SSTs. The average child to teacher ratio of words for all rooms dropped in the change from non-SST to SST dialogue by 17% and from non-SST to the first four turns at the start of SSTs by 20%. This came as somewhat of a surprise, as one might expect that when children share their views more they would use more words than the teacher. This data in this study, however, indicated that it may require teachers to increase the number of words they use compared to the children's input to guide and orchestrate these more complex interchanges, particularly at the start. The qualitative examinations found that the teachers who increased their share of words made more detailed explication of concepts or said something complex enough to be out of the ordinary and therefore challenging, which then led the children into these sustained dialogues. It should be remembered that tracking the orchestration of a group of children is not the same as tracking individual children's unique experience, as interesting and variable as that may be. The results of a study of more than 600 children and 300 teachers in

preschools (Williford et al., 2013) suggest that when teachers orchestrate a variety of activities using highly responsive interactions, children acquire equitable school readiness skills "regardless of their individual engagement patterns" (p. 6). Furthermore this part of the study is mainly concerned with how the teacher orchestrates SST dialogue differently than other dialogue.

The qualitative analysis of room 2b dialogue showed that this teacher's high use of closed questions compared to the other top ranking rooms required few words in response by the children. This appears to have accounted for this room's very different results on the NTW. The differences in room 2b will be discussed further, but suffice it to say here that this teacher appeared to be an exception to most others in her ability to construct long and complex episodes of SSTs with the high use of a carefully selected pattern of different kinds of closed questions. It has been shown that even simple yes/no closed questions can elicit three different kinds of child responses, and closed/not known questions have "demonstrated genuine interest in finding out what children know and think and created opportunity for a range of responses and extended talk" (Raban et al., 2010, p. 32).

The changes in NTW from non-SST to SST dialogue by teachers and children appears therefore to be influenced, not only by orchestration of dialogue at the more complex level of an SST and its start, but also by the kinds of questions being used by teachers in accomplishing this.

Systematic differences across the six-indicator ranking

All the teachers in the top 10 rooms of the six quality indicator ranking increased their share of the NTW overall and at the start except for room 2b, while

rooms ranked in the bottom eight tended to decrease their ratio of words or not increase the ratio as much. It will be recalled that the six quality indicators were the per-minute rate of turns, open and closed questions, acknowledgements, and Gricean maxims, with blends as a categorical count. In the change from non-SST to SST dialogue and non-SST to SST starts, the top 14 teachers averaged child *decreases* in the ratio of NTW of 29% and 36% respectively, while the bottom 8 teachers averaged child *increases* in NTW of 6% and 8%, making the difference between the two groups of teachers 34% and 44% respectively. This was the first indication of a substantial and systematic difference between the top and bottom of the ranking of rooms with further support from a correlation of r (20) = -0.49, p = 0.02 between NTW and change from non-SST to SST starts. This change was specifically accounted for mainly by the higher use of: 1) *total questions*, which correlated in the teacher's share of NTW in SST dialogue with an r (20) = -0.42, p = 0.05 and even more so at the start of SSTs, with an r (20) = -0.49, p = 0.02; and 2) *blend* starts, which correlated directly with SST starts with an r (20) = -0.53, p = 0.01. It would seem therefore that teachers higher on the six-indicator ranking are pursuing their dialogic goals differently than those lower on the ranking. Because the six indicators are markers of quality talk, it is logical to ask then how this use of higher amounts of NTW, total questions and blends would support higher quality talk interactions.

The answer may reflect Rosenshine's (1971, p. 90) proposition that teachers' pursuit of cognitive goals requires a "moderate amount of structuring" to improve child responses, in this case the SST structure, and Palincsar's contention (1998, p. 363) that "posing questions that encourage students to make connections" mediates discussions "by seeding the conversation with new ideas or alternatives that push the

students' thinking" (p. 365). The top ranking teachers' greater use of NTW words and questions may be necessary in creating the SST structure which also allows and starts blending (Fauconnier, 1997). If blends are important in interactional situations as proposed by Hougaard (2005) and Sinha (2005) and where children "integrate together…many different kinds of already constructed constructions" (Tomasello, 2003, p. 305), it appears from these results that this process is assisted by a teacher using more words and more questions. The teachers who used fewer of the six indicators did not achieve as many blends or use as many questions. This provides evidence that the six-indicator ranking does distinguish teachers who are pursuing children's cognitive development goals in a more structured way from teachers less accomplished in this and justifies the logic of having created and used this metric.

Complexity of words, MLU and TTR

While the teachers tended to reduce both their MLU and TTR in SST dialogue compared to non-SST dialogue, all but one room had children increase their MLU and in most rooms also their TTR. It appeared from the qualitative analysis that followed these quantitative results that teachers tended to deliberately simplify their language to enable children to participate as active interlocutors in the activity and understand the purpose and the focus of the topic within SST dialogue, especially at the beginning. This is somewhat the opposite of some literature that suggests higher adult language complexity predicts higher child language complexity, not just over all conversations (Huttenlocher et al., 2002), but within specific teacher-shaped conversations, for example, when teachers leading children in conversations in the context of dramatic play "tended to talk more slowly and to use a richer mix of novel to total words" (Dickinson, Darrow, et al., 2008, p. 421).

The teachers higher in the six-indicator ranking were more likely to reduce their MLU and by more than the lower ranked rooms. These same teachers also had bigger differences in their TTR in the seven samples in non-SST dialogue. These two measures of differences suggest that they were more flexible in their language use on both MLU and TTR measures of language complexity and may be an indication of "responsiveness" supporting the contention that: "how well the teacher adapts his or her instruction to the context at hand" (Fenstermacher & Richardson, 2005, p. 207) is a mark of quality teaching.

A simple answer as to what matters to quality talk was the discovery that a higher rate of teacher use of acknowledgements, by its persistent correlation with the six-indicator z-score, appeared to be a marker for the higher use of a complex mix of other helpful indicators in creating and sustaining Sustained Shared Thinking. Thus, it appears that most teachers who use the simple feedback of acknowledgements are also likely to give higher amounts of more complex or refined feedback, or "high inference measures" (Fenstermacher & Richardson, 2005). The hierarchy of coding from Chapter 3 places acknowledgements as the simplest of the higher inference measures, with question types next and then blends, Gricean maxims and SST episodes as more complex. This contention was supported by the intercoder agreement rates. Lower order inference measures such as the simple acknowledgement of products [ap] are easier to collect and agree on and if, as seen here, they are correlated to higher order inference measures, they offer the possibility of screening data sets efficiently and quickly.

The exception to this was the two high-ranking teachers, 3h and 5c, who used high levels of blends, Gricean maxims and closed questions, but not

acknowledgements or open questions and yet created a high number of SST turns compared to most other teachers. Not only is this another demonstration that there are multiple ways to engage children in extended conversations, but also a warning that making simplistic "rules" of what counts as the best practice, such as the just mentioned acknowledgements, could overlook different effective strategies. It could be that teachers who are good at using high levels of both blends and Gricean maxims and using closed questions judiciously to focus children's attention on details of both their concepts and language production, do not need to use acknowledgements as often. Until more teachers like this are found and compared to others, in terms of child gains over time in capacities, there is a need to be careful with generalising. What this study has offered is a first glimpse into a new possibility that needs further testing.

Teachers' higher use of acknowledgements within SST dialogue was also related to changes in children's complexity of language when moving from non-SST to SST dialogue in terms of children's increase in their Type Token Ratio with a moderate to strong correlation of r (20) = 0.49, p 0.01 and in terms of children's absolute levels of Type Token Ratio within SSTs with a moderate correlation of r (20) = 0.46, p 0.02.

The two highest ranking rooms, 1a and 2b, had children's TTR increases of 41% and 23% respectively, with high use of acknowledgements, while 3h had a children's TTR increase by 9% and 5c had children's TTR decrease by 6% with very low use of acknowledgements. It may be that acknowledgements act directly on children's motivation to contribute to the dialogue by showing the teacher's genuine interest in the children's contributions. The children in rooms 1a and 2b responded

more often and with more complex language and longer utterances in SST dialogue and it is likely that this represents increased manipulation of labels which has been shown to contribute to children's cognitive flexibility in four-year-olds (Jacques & Zelazo, 2005), an important skill for contributing to conversations.

Higher use of Gricean maxims was weakly correlated to the higher use of acknowledgements in SST dialogue. Teacher's feedback in terms of these maxims requires accurate and close attention to children's contributions, which may indicate an underlying teacher attitude of attentive curiosity about the child's developmental level and needs in the moment (NBPTS, 2012). Genuine interest in the child's world is likely to be an underlying attitude for both these indicators which would also motivate the teacher to frequently adjust these behaviours to the context in the moment. This is seen in the teachers' higher variability of both TTR and MLU rates as shown in Tables 23 and 26 respectively (p. 198 and p. 204) which were related to the teachers rated higher on the use of the six indicators.

Conversely, teachers with lower scores on the six indicators not only used fewer acknowledgements and Gricean maxims but were more consistent in their verbal behaviour in MLU per cent change when moving from non-SST to SST talk and the TTR variability within the seven samples of non-SST talk, than those higher on the six indicators. Consistency in verbal behaviour may mean that these teachers were not adapting to changes in context as readily. The underlying attitude or mindset in this case might be one of inattention or lack of intentionality about dialogic goals, or having a goal of getting through an activity in terms of organisational procedures taking precedence over exploring the minds or experiences of children. This was

quite apparent in some rooms where teachers deflected curious interruptions or consistently failed to follow children's leads.

Open, closed and total questions were used in various analyses of data and will be discussed separately. Open questions have a wide range of possible answers while closed questions have very limited responses available to the child. The seven subtypes of open questions and three types of closed questions, based on both the REPEY study (Siraj-Blatchford & Manni, 2008) and a further refinement (Raban et al., 2010), were subsumed into two categories of open or closed. Statement questions do not require a response and are either simple acknowledgements or provide additional information, and were added to the open and closed questions for a "total" question category.

The use of total questions increased when moving from non-SST into SST dialogue and was correlated moderately to the NTW increase at the beginning of SSTs, which was more likely to be associated with teachers higher in the six-indicator ranking. This indicated that SSTs were started using more questions of all kinds and using more words on the part of the teacher. Particular subtypes of questions did not correlate with any measure when all 23 teachers were included in the analysis.

At the beginning of the analysis, both open and closed questions were included as distinct indicators because of the extreme differences principally from rooms 1a and 2b. It was then found that open questions did not correlate with SST turn levels or the six-indicator ranking, which was somewhat surprising given the literature indicating the importance of open questioning to quality dialogue (Siraj-Blatchford & Manni, 2008). It was not until the end of the analysis that this lack of correlation

made sense, as three different approaches to talk interactions emerged from the data analysis, with one category correlating to open questions where more open questions tended to be used by teachers also high on the use of blends. When the six rooms with the 2b and 3h approaches were treated as "outliers" to the majority and removed from the data analysis, as was shown in Table 34, the remaining rooms showed significant correlations of open questions and total questions to the six-indicator ranking. The importance of this will be discussed after discussing closed question associations with Gricean maxims.

Using higher rates of closed questions, the teachers of rooms 2b, 3h, 5c, 12R, 15Q and 21U showed an ability to construct highly complex and sometimes lengthy SSTs without a great number of open questions. The association of the use of closed questions and Gricean maxims by these same teachers raised the possibility that they may have had a different dialogic goal from the majority of this study's teachers who used more open questions and blends.

These differences in the association of open and closed questions with blends and Gricean maxims respectively may indicate that the balance of open and closed questions depends not on some underlying single strategy or mindset of a teacher, but rather on what she is trying to achieve and dependent on the context.

The rooms that showed one of the three approach-group patterns were the entire top nine in the six-indicator z-score ranking and then rooms 12, 15, 19 and 21. It therefore seems likely that having a clearly defined approach is predominantly a characteristic of the higher scoring rooms. A further discussion of these approaches follows a brief summary of the implications of results thus far discussed.

Purposefulness

Purposefulness within culturally meaningful human activity was foundational to Vygotsky's (1934/1962, 1978) contribution to understanding development during childhood (Kozulin, 1986). Wells (1993, p. 2) explains this developmental process whereby children acquire all higher mental functions as dependent on cultural practices that are "first encountered intermentally in purposeful joint activity". This is also where the child learns to "read" the adult's communicative intention (Tomasello, 2000). The importance of early childhood teachers being systematically purposeful in adjusting their goals, activities, language and teaching has been highlighted previously (NBPTS, 2012). It seems likely, therefore, that the teachers who changed their interaction behaviour more as context changed, or when moving into SST dialogue, or who exhibited a consistent set of favoured tools of engagement (patterns or approaches), were doing so with some intentional plan, purpose or concept of what they were doing. These characteristics were more apparent in the teachers higher in the ranking, as well as the teachers who constructed long or very long episodes of Sustained Shared Thinking. The longer episodes, in the qualitative analysis, exhibited a definite plan and in some cases a relentless pursuit of that plan in the face of distractors and other child agendas. This implies firstly perhaps a more finely tuned awareness of contextual differences, which in turn leads to an overall difference in deciding to do something differently in the flow of an activity. This could be called attentive purposefulness.

Secondly, this analysis may also be showing that teachers with a plan or a more explicit plan to engage children in meaningful interactions are motivated by this plan to create SSTs quite consciously, and have the confidence of knowing how to do

so. These particular teachers' use of more words in SSTs than in non-SST dialogue and even more at the beginning of SST dialogue would have the purpose of explaining or questioning in more detail the topic for exploration so the children understood the goal of their participation, which again is purposeful. In addition to this, the more frequent use of the quality indicators by these same teachers in SSTs as opposed to non-SSTs may show how their higher SST turns per minute were accomplished.

Considering the lower ranking rooms, it would appear that teachers who were more consistent in their behaviour across the change from non-SST to SST dialogue were not approaching the learning opportunities when they did occur with as much adaptability or flexibility in terms of increase of words or use of more quality indicators or a pattern of indicators to shape the dialogue. This also may mean they had no clear plan or persistence to create SSTs or did not have the understanding of how to create and sustain dialogue.

Patterns of behaviour as distinct "approaches"

More support for the idea of purposefulness or, specifically, the mindful orchestration of dialogue, came from the most intriguing finding in this study: that there may be three distinct and coherent patterns of engagement in the use of the six indicators when constructing episodes of SST, with the differences being very large at two or more standard deviations separation, which if normally distributed, would mean the differences are outside the middle ground of from 16% to 84% of the population. The idea that the overall pattern of engagement is what counts (Conners & Eisenberg, 1966) can now be seen from this study as *three* overall patterns with the additional possibility that each may be useful for a different purpose and for

successful engagement of children in a particular type of learning. This addresses the gaps identified by Ingvarson and Rowe (2008) in the instructions to early childhood teachers about how to precisely accomplish the needed goals. The distinction of three patterns could also better define the specific feedback found to increase opportunities for reasoning in the CLASS subscales of *instructional support* (Ponitz et al., 2009) that were most highly associated with greater gains in children's language and literacy in the preschool years.

The most complex form of "purposefulness" in this study was shown most clearly by the three top ranked teachers who consistently used distinct patterns of mixing the quality indicators quite differently from each other. While there also appeared to be a continuum on the use of each indicator, an examination of the patterns was warranted primarily because of the extreme "distance" between the higher ranking rooms that appear to be effective in creating SSTs, increasing children/teacher talk ratio and elevating children's complexity of language.

"Expansive approach" 1a

The 1a group was distinguished from the other two groups by the use of high levels of open questions and a focus on blends. It will be recalled that a blend is a special case of an extended dialogue where the teacher pursues the explicit thinking involved in a particular whole concept formation and where there is visible evidence that the child has gained or changed a concept. Both open questions and blends appear to involve the teacher creating an expansive dialogic space with a goal of making children's dialogic thinking visible (Hattie, 2011) particularly around concept clarification. The logical coherence between open question use and creating blends would be that these kinds of questions serve the higher goal of noticing, shaping,

defining the boundaries of, and extending concepts, with the open question opening a small dialogic space for the purpose of opening cognitive "spaces" for thinking, which allows coherent responding. A blend involves repeatedly doing this while targeting a particular concept until the teacher sees evidence for learning the concept visible in the talk interactions. One could call this approach "open", but "expansive" may capture the dynamic of creating open spaces repeatedly, rather than it just "existing". This "expansive approach" is similar to Conners and Eisenberg's (1966, p. 10) "divergent reasoning" as "exploratory" with the example: "Mary, tell me all the things that a truck is good for." If put in the form of a question, it would be open and if put into a dialogue, likely part of an SST or a blend.

"Focusing approach" 2b

The 2b group was distinguished from the other two groups by the use of high levels of closed questions and a focus on Gricean maxims. If this teacher's communicative goal was to make visible the child's thinking or reasoning in terms of Gricean maxims or logically constructed sentences that convey their thinking, then closed questions are the logical choice to narrow the dialogic space in terms of focusing the child's attention on the details of their utterances such that they learn how to make their thinking explicitly clear. This approach could be called "focusing" as a verb to capture the ongoing action of narrowing. This may be a better terminology than "closed", because the judicious use of closed questions and acknowledgements does not appear to close off the conversation or thinking. This focusing approach is similar to Conners and Eisenberg's (1966, p. 10) "convergent reasoning" where a teacher pursues specific factual answers with the example of a closed question: "Mary, how many wheels does a truck have?"

“Balanced” approach 3h

The 3h group was distinguished by tracking between these other two approaches on most indicators but with fewer acknowledgements. A simple name for this group would be a “balanced” approach, which unfortunately has implications of fairness or an explicit strategy, which may not be the case for all three rooms, especially considering the lower level of feedback in the form of acknowledgements. Also the low use of open questions mitigates against this entire group having explicitly supported blends to create expansive dialogic space like the teachers of the 1a group. How then were blends accomplished and why was 3h so high on the use of the six quality indicators?

In the first analysis of questions per minute in Chapter 4 (rather than questions per utterance in the final analysis of TTR and MLU in Chapter 7), it will be recalled that rooms 1a and 4d had the highest z-scores of all 23 rooms for Open Questions per minute, while rooms 2b and 3h had the highest z-scores of all 23 rooms for Total Questions per minute. Room 2b achieved this with very high use of closed questions while 3h was more balanced by using more open questions than 2b. Thus, the four top ranking rooms took different approaches in terms of use of questions. In the qualitative analysis of a long SST of 62 turns, the teacher of 3h showed the ability to follow children’s leads into short SST episodes when the opportunity presented itself in the midst of pursuing an apparent set-plan of some length. Alone among the 23, the teacher of 3h demonstrated the ability to create a high rate of quality talk shaped in the flow of interactions in pursuit of both concept formation using blends and the thinking in single utterances by Gricean maxim modelling. The other rooms ranking

high on the six indicators focused on only one of either blends or Gricean maxims and were quite opposite on use of open or closed questions.

The quantitative evidence from the children that this approach may be an effective strategy was their higher levels of TTR and MLU in the SST dialogue in room 3h, which although not the highest among the rooms, was in the top half from tables 31 and 32 (p. 216 and p. 217). The two other teachers following this more flexible pattern were in the bottom half of these same measures and appear to have been less mindful of children's needs. Of all 23 teachers in this study, the teacher of 3h best exemplifies the "*dynamic aspect*" of Mercer's (2008a, p. 44) unplanned spontaneous emergence of shared understanding.

"Mindfully flexible" approach 3h

The teacher of room 3h, therefore, appears to be a lone example of a high quality approach, both mindful of context and opportunity as well as flexibly adaptable in orchestrating either the Expansive or Focusing approaches, except that she does not use many acknowledgements.

Although room 3h children's combined SES of 9.5 may have contributed to their ability to engage in these extended higher quality talk interactions without as much prompting from open questions, the teacher of 3h had to have made use of the opportunities presented. It will be recalled that SES was found not to matter in preschool teachers' ability to use classroom management quality factors in raising all children similarly in five measures of self-control and behavioural engagement (Rimm-Kaufman et al., 2009). More teachers like the teacher of room 3h would have to be found to discount SES as a confounding variable.

Summary

To try to add to the knowledge of what Conners and Eisenberg (1966) called the "total pattern of intellectual stimulation" required to induce growth of the intellect (p.10) this study demonstrated how a new mix of methodological approaches to discourse analysis using quantitative and qualitative methods could be used to accomplish a fine-grained analysis of teacher-child talk within preschool settings. This was done in terms of "factors" or indicators of quality that have been shown to be likely to produce long-term learning outcomes through helping children develop their thinking ability. These indicators of quality discourse were examined within teacher-led preschool activities and within episodes of Sustained Shared Thinking during these activities, which have been shown to be an "orchestration" of classroom dialogue productive of developing thinking abilities in children. The "summation" of the significant results was within the discussion of patterns of approach, as these appeared to organize the previous levels into an overall logic.

This study, by following the suggestion "that measures of quality should focus on the quality of the opportunities for learning that teachers are providing for their students" (Ingvarson & Rowe, 2008) has perhaps provided a fine-grained detailed analysis of exactly *how* the early childhood teacher can accomplish being systematically purposeful in adjusting their goals, activities, language and teaching as called for by the NBPTS (2012) standards. That six rooms differed substantially and consistently from the predominant 1a approach and that some of these rooms had children displaying complex language at rates exceeding those of the 1a approach, with 2b, 3h, and 5c ranking high in other indicators, provides evidence that there are likely to be a variety of approaches in the use of the six quality indicators that are

productive of effective talk interactions with children. What appeared to be a general and unsystematic set of differences at the beginning of the analysis of the results gradually emerged with further analysis into three distinct approaches related to intentional pursuit of different dialogic goals. These results led to a variety of implications addressed in the next chapter.

CHAPTER 9: FINDINGS AND IMPLICATIONS

This chapter will suggest three important findings and argue that the implications of these results could contribute to training teachers to better orchestrate extended dialogue with children who need to learn both expansive open questioning routines to explore concepts, as well as precise utterance construction to communicate their thinking clearly. Using some of the six indicators as markers of quality in dialogue could guide more efficient and precise teacher assessment leading to better targeted professional development.

Limitations

All statements regarding "conclusions" should be taken as confined to conclusions about this particular population of teachers. This study was confined to teachers who were trained to a certain minimum level and all preschools except two had children from an SES neighbourhood from the top 30% of the population. Claims of generalizable phenomena are not possible in this study with its low numbers of cases and non-random selection at levels of school choice, teacher agreement to participate, parents' permission and choice of activity for study. There was, however, sufficient meta-legitimation in numbers, coherence and with-in cases results to suggest that the discoveries here may exist more widely. As important, the methodology developed in the thesis could be applied more generally.

Findings

The most significant implications arise from the finding of three approach-groups among these 23 teachers, which appear to organize the previous levels of indicators and measures of quality talk interactions into patterns of intellectual stimulation orchestrated by the teacher. This alone would be extremely

important to clarify for professional development and training of early childhood educators especially the somewhat unexpected high use of closed questions to accomplish complex SST dialogue and its association with Gricean maxims.

A second important finding was that the data analysis of talk interactions provided evidence that the six-indicator ranking did distinguish teachers who were pursuing children's cognitive development goals in a more structured way from teachers less accomplished in this and justified the logic of having created and used this metric.

A third finding was that closed but focused questions can be beneficial in eliciting child statements and interaction and thus can be most useful when used in this manner. The association of closed questions with Gricean maxims adds to the evidence that some teachers pursue communicative goals to make visible the child's thinking and production of logically constructed sentences. Closed questions are the logical choice to narrow the dialogic space in terms of focusing the child attention on the details of their utterances such that they learn how to make their thinking explicitly clear.

It will be recalled that recent officially sanctioned guidance (Education Services Australia, 2014) on how to use questions in schools (Godinho & Wilson, 2004), equated *open questions* with "divergent questions", "higher-order cognitive questions" and "higher-order thinking", while *closed questions* were equated with "convergent questions", "lower-order cognitive questions" and "lower-order thinking" and stated that while "there are subtle differences, these terms are often used interchangeably" (p.18). This is unfortunately too simple a proposition, as has been

shown in this study, where closed questions were used to focus on helpful ways of thinking in terms of Gricean maxims which have been shown to be important in studying interactions in preschools (Gelman & Brenneman, 2004; Shwe, 1999; Wells, 1981).

Further research

Further research using larger samples could be done to test whether the correlations and patterns of indicators found in this study exist in larger samples and in samples of more diverse teacher populations. Rather than collect dialogue samples just for this purpose, evidence of this could be more quickly assessed by coding existing sets of transcripts from previous studies. These could be re-examined by using some or all of the codes used in this study.

The proposition that questions, acknowledgements, Gricean maxims and blends (the quality indicators) would be related to teacher-child talk interactions in the context of episodes of Sustained Share Thinking was not only borne out, but revealed more complex patterns of interest. What was found could inform what to look for in more time efficient methodologies of assessing quality in preschools such as on-the-spot time coding measures, like the Observational Record of the Caregiving Environment (ORCE) developed from the Child Care study (NICHD ECCRN, 2002), or the Teacher-Child Verbal Interaction Profile (TCVI) (Dickinson, 2006, p. 191). Alternatively, a new assessment protocol could be developed based on these results and previous work.

If there were larger numbers of classes then a cluster analysis could show whether the three approach-groups formed distinct clusters, as was done with the Classroom

Assessment Scoring System (CLASS) subscales (Curby et al., 2009; LoCasale-Crouch et al., 2007) where five distinct teacher behaviour patterns were revealed.

Another possibility for further research would be to use the CLASS measure (Pianta, La Paro, & Hamre, 2009) to score the videos from this current study and then compare these with the results to find out if any patterns of the six quality indicators show significant relationships to the CLASS subscales. Future research might show the CLASS subscales of:

1. Concept Development aligning with the use of blends,
2. Quality Feedback aligning with questions and acknowledgements, and
3. Language Modelling aligning with Gricean maxim use.

Both the CLASS scoring system and the current approach could be used to score any other set of videos that have teacher-child talk interactions. Alignments could provide better understanding of the fine-grained behaviour differences that make up the underlying constructs. This could contribute to refining web-based systems of professional development where evaluations of teacher self-video of classroom interactions are analysed (Kinzie et al., 2006; Pianta, Mashburn, et al., 2008). This same approach could have implications for the coaching of teachers in patterns of verbal interaction being promoted by other research groups (Dickinson & Caswell, 2007; Dickinson, Darrow, et al., 2008; Neuman & Dickinson, 2010).

Measures and methods like those used in this study that distinguish three approaches could be used in conjunction with other video linked analysis systems that assess preschool-age children for cognitive abilities alone (Bryce & Whitebread, 2012) or in combination with additional developing abilities fundamental to school

success, and the relationship between the two, such as self-regulation and metacognition, assessed by the Children's Independent Learning Development (CHILD 3-5) checklist (Whitebread et al., 2009). Such a trial could indicate how one or the other of the three approaches found here influences these developing abilities.

Further questions regarding approach-groups

If these approach-groups exist more widely, then examining longitudinal effects of enhanced preschool conversations would be indicated. Then it could be asked: which approach works "better" in training what kind of child thinking for which children and for what purposes in their future engagement in school? How long do any child differences or increased capacities if thus enhanced, continue to influence success in school or later life? Any previous studies that addressed these questions and have transcripts of dialogue could be analysed.

Implications for teacher training

The possibility of the existence of three approach-groups, if found to be generally applicable to larger samples of teachers, is perhaps most significant when one considers the question of training teachers to better orchestrate SST dialogue or children's thinking in general. Children need to learn both expansive open questioning routines to explore concepts, as well as precise and focused utterance construction to communicate their thinking clearly. But how do they learn this? The methodology in this study used to distinguish teacher's approaches, if they have one, could be used to examine the results of attempts at training the "ideal" components missing from that teacher's repertoire. Once more evidence of the approach-groups is gathered, it should be possible to create proxy measures instead of doing extensive transcription using open and closed questions and acknowledgements and use them in

short discussions where a teacher is asked to engage a few children in an extended conversation. The teacher would possibly reveal their approach in a short space of time by the rate of use of open or closed questions and acknowledgements. Then further feedback could be used to refine their approach pattern, much like some current practices in teacher training (Pianta, Mashburn, et al., 2008), but in this case the details of their engagement would be much more precisely understood and matched to the feedback.

This study's results could add to knowledge of what constitutes effective professional development along with other studies of this age group that measured thinking interactions in relation to teaching approaches, for example, the Whitebread et al.'s study (2007) that tested Mind Mapping (Buzan, 1991), the TASC (Thinking Actively in a Social Context) programme (Wallace et al., 1993) and Philosophy for Children (Lipman, 1973, 1976), for effectiveness "in providing for the children a 'meta' vocabulary with which to discuss their own thinking and learning" (p.4).

This study's findings about teachers using the "expansive approach" with the higher use of blends and open questions could be useful in research investigating the influence of teachers' talk on very young children's concepts of thinking (Salmon & Lucas, 2011). Another program more highly developed for this younger age that specifically teaches science concepts and which might benefit from this study's findings is the Preschool Pathways to Science (PrePS) (Gelman et al., 2010) which "allows children to practice thinking, talking, and working with a concept over time" to build "deeper understanding" (p. 18). Neither of these systems' teacher training explicitly considers teachers' existing dialogic approaches which may either assist or perhaps block adopting new techniques. Using markers of the different

approach-groups could be used as a guide to an efficient teacher assessment leading to better targeted professional development.

This study's finding concerning a "focused approach" group has implications for teachers explicitly learning how to use Gricean maxims to support children's thinking in terms of the precision of their language by using this targeted and very specific feedback, by modelling and then explicating to children more clearly the reasons utterances need to be shaped for other's understanding of what they are thinking. These explanations would of course need to be shaped to the child's level of development. To fully understand this, analysis of conversations at different ages would need to be undertaken using perhaps a shorter methodology than used here and more specifically targeted at the differences in approaches and in studies where child outcomes are independently assessed.

Orchestration of Sustained Shared Thinking would likely be enhanced by teaching teachers to use the more explicit forms of acknowledgements such as for effort and thinking skills, not simply as isolated reactions to a child's output, but in the pursuit of the dialogic goal of exploring the child's thinking, demonstrating thinking and encouraging children's engagement in continuing in the conversation.

Implications for methodologies

The metric of the six indicators, if refined to more accurately reflect both the balance of what matters in general, but also what matters in particular kinds of useful talk, with larger samples, and with the accomplishments of the children measured more accurately and later in life, could be used to reflect back retrospectively on

exactly what mattered in the talk at preschool in existing longitudinal studies that retained transcripts of teacher-child talk.

The methods of testing for convergent reasoning or convergent thinking (White, 2005), which is similar perhaps to the focusing approach found here, using the Remote Associates Test, or RAT (Mednick, 1962), and the methods of testing for divergent creative thinking, similar to the expansive approach found here, using the Unusual Uses Task (Guilford, 1957), could guide the development of tests for preschool aged children. If there is a relationship, then these measures could be put to differential uses in the assessment of teacher-child interactions and help refine the understanding of the focusing approach with its high use of closed questions as useful in teaching certain kinds of thinking. The idea that closed questions are "lower-order cognitive questions" and "lower-order thinking" in government promoted advice to teachers (Godinho & Wilson, 2004, p. 18) needs to be changed based on evidence to the contrary. This could provide strategies for adults to help focus children's attention on salient features of thinking during talk interactions.

The importance of this study

Finding effective ways to change unhelpful or limiting patterns of thinking and behaviour in both teachers and children has very important and broad implications for the challenges of creating coherent participative societies through education, particularly early childhood education where trajectories of future development are most easily influenced. The origin of these dialogic styles and to what extent and how they can be shaped by education and other early experiences are questions that could be asked. It is hoped that this study has contributed both to the corpus of knowledge in this area and helped to pose and refine unanswered questions.

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APPENDIX A

Blend Dialogue Example

Room 20V Writing activity (with acronyms)

T = Teacher

E = Ellen

P = Polly (Main participant in blend)

K = Kitty

Storybook: *The Big Purple Kite* by Sylvia Mary Leach.

At this point in the dialogue, the book is open on a table to a picture of a purple kite flying over a tree with Polly and Kitty sitting next to each other and the book between them with the teacher opposite them. Ellen is at the end of the table. The camera looks in from the side opposite of Ellen. Kitty has been working away and appears to have drawn a typical diamond-shaped purple kite like the book example.

Codes:

[bso] = blended space is opened

[bsw] = blended space is "worked" substantially

[bsf] = blended space is "finished" to the extent that we can see or it is highly likely from the child's behaviour, that a concept has been added or changed.

For clarity, the dialogue has been edited to remove teacher-child interactions unrelated to blending as well as other codes and turn numbers of SST dialogues

- 0:03:44 is a time stamp. Some are left in to show jumps across nearly nine minutes of dialogue.

= This symbol represents either the transcriber clarification in the original transcription or a researcher comment about what is happening at this point in the dialogue

P I can make trees.

T beautiful.

T now can you make the wind come out of the tree?

P I have.

T good job.

- 0:03:44

P can I have a look at the page?

T you can.

T look at the page if you really need to.

= P checking book for the page showing the wind,

P I've followed, I have to follow the page.

= P is evincing a "pre-blend" concept of: "my picture needs to look like the model picture in the book". On the other hand, the teacher is not particularly keen on copying ("if you really need to"). This interplay between T and P shows they are negotiating the 'rules' governing the drawing exercise, which at this point are flexible for the teacher, aware of two rules, while P appears only to be following a "copy" rule.

P I use blue.

T it is blue.

= teacher has confirmed the book's wind is blue and implicitly supports Polly choosing to do blue and the concept of "copying" the book example, by not challenging P's assertion where the idea she has to follow the example on the page is within her, apparently, but was not expressed. This will change later. This is not the start of an SST because there is no visible thinking shared and sustained

- 0:04:53 (intervening dialogue removed)

T how you going Kitty?

K good.

T done your : kite (to Polly)?

P and they's x.

T you need to do a kite.

T are you going to do the big purple kite?

P no.

P can you <help me>?

= note< >indicates overlapping speech

T <have a look at it>.

T I could.

T but I want to see <u>your</u> work, Polly [bso] [itt] [t01].

T how do you think the kite would look ?

T what shape is it?

= teacher indicating open book on table, and this starts both the blend and an SST at the same time. Further SST turns codes removed for simplicity in following the blend, which extends beyond the immediate SST. NOTE codes: 'blended space open'

[bso], SST initiated by teacher led by teacher [itt], and this is turn one [t01] of the SST. Turns of blends are not counted separately, but where intervening substantial "work" is done, the code in the transcript is 'blended space work'[bsw].

- 0:05:16

P I’m drawing the wind.

P I can’t <really do>.

T <a diamond>.

P a diamond.

T well, how about this <one> (to P).

K <I can> do <a diamond>.

= P appears dejected and now slumps back away from table at this remark from K, T ignores K at this point

T <do you want> to do it in purple?

= teacher points to a marker

T because he is purple.

T isn’t he?

= possible confusion produced by T's support of several "copying" ideas ("what shape is it?" and "he is purple isn't he?" after earlier saying she wanted to see "your work", so more clarification needed for Polly for her options

P (gets the purple marker).

T you can just make it purple.

T and put it (pointing)^ (interrupted)

K I did a diamond.

= reiterating she can copy the book example

T you did do a diamond.

- 0:05:30

T and you’ve got a tail (pointing).

K yea.

T have a go Polly.

T it's ok.

- 0:05:37

= Polly draws, but not looking happy while T watches just her for 15 seconds which is a VERY long time within the whole data set of 23 teachers

P I can’t.

T that's ok.

T you make him look like the way you would like [bsw].

T look.

T All big purple kites don’t have to be diamond shaped.

T do they [bsw]?

T yours might be a different shape**.**

P I have a circle (now smiling and leaning forward).

= intervening turns by other children removed

P well I’m going do it with a circle**.**

= concept now visibly changed but further changes so not yet marked finished although it could have at this point

T that's ok.

T that's <u>your</u> (emphasis on 'your') purple kite?

= T confirming P’s new assertion

P I’m finished.

P I have to use the colour yet.

- 0:06:36

T still working on the colour.

T Kitty, which one are you going to work on : next ?

K just the x x x.

T a little bit.

T have you got your butterflies there, Ellen?

T x x where's your butterfly?

T where's your butterfly?

E x x (shakes head no).

T what is it?

T what did you say?

E (shakes head no).

- 0:07:02

T uhuh (shaking head no)?

T what's the < x x, have you x x x > (to E)?

P <it doesn’t matter>.

P it doesn’t matter if the shape is a bird [bsw]**.**

= it seems that P is applying the new rule of “choose your own shape” now to comment on E doing something with a bird shape rather than butterfly shape, possibly generalized the concept, and it appears P had heard something we haven't and knows E's intent is a bird.

E the wind^

T it doesn’t matter.

T because it's <u>your</u> picture for <u>your</u> story.

= teacher supports P assertion of the "new rule" now to Ellen

E <the wind, the wind, I want to do the wind>.

T we just read the purple kite.

T and he happens to be (shrugging her shoulders as though it doesn’t matter what shape it happens to have been)>

E I <want to do the wind, I want to do the wind>.

T <the shape of a, a diamond>.

T Ok (turning to Ellen)

= turns removed

- 0:07:25

= E stands up reaching for the book next to P still showing purple kite and tree page

P I’ve>

P look.

T terrific (reaching for P’s drawing).

T that’s a great kite^

P can I do another, this?

T and this one.

= two minutes dialogue removed

T and look>

T you just tried there (pointing a P’s paper).

T and you did : a : perfect job as well[bsw].

E x <x x>.

P <I’m doing a perfect kite x>.

= this appears to indicate her new confidence in her ability, choices and effort with "perfect" not related to copy the book example

K I can do diamonds (to Polly with emphasis on diamonds as in a tone of I can and you can’t).

= T takes a few turns with E, ignoring K and P's interchange

P <I x you’re a x> (to K sounding like a retort).

= no one looks or responds in anyway, but P gets up and looks for the book,

- 0:10:14

= one minute of dialogue removed

P I can’t do any eyes, so there.

P I na*^

T you don’t have to do eyes if you don’t want to.

T it’s up to you.

T it’s your drawing Polly [bsw].

= presumably there are eyes in the book and probably on the kite

P hmm.

P could x x x <on>.

T <do you need> another colour?

P this time <pink>^

T <have you finished>?

P this <time>^

T <put it on your drawing>.

P this time I’m going to do pink [bsw] [ict] [t01].

= note child initiated SST but then led by T

T (nods) you can.

P <change>.

T it’s <changed> from the big purple kite to big pink kite [gqi] [bsw].

= now colour change from original model is confirmed as acceptable too as part of the blend concept. Teacher also models the Gricean maxim of sufficient information to make the message clear.

T has it?

P yeah.

E where’s the x?

T why is that (to P)?

- 0:12:03

P I’ll write another story about the pink kite [bsw].

T (surprise face) hmm.

T so we’re changing the story?

P (hmm) it doesn’t matter if it just already stands there (pointing to her drawing).

T well actually in this bit (pointing to spot on drawing).

T it doesn’t.

T it just says, yes said the wind.

T in the trees.

T I will make you fly.

T so it could be it.

T it's your story [bsw].

T we don't need this (taking away the book).

T we started with the book.

T to give us some ideas [bsw].

= T now clarifies the purpose of book models and acts to emphasize this by removing book entirely

P x x.

E and then he said no.

T pardon.

E he said no.

T the bird said no?

T <x x x> (to Ellen).

K that can be two kites (looking and commenting on P's picture) [bsw].

- 0:12:40

P yeah (pointedly addressed to T and not K).

P the story of two kites [bsw].

= blended space seems well formed now with P creatively having two kites in a single story, rather than what she first said which was "another story". Interesting that K prompts P to this last stage of stating the new concept explicitly rather than T. This also shows extent to which a child can listen in (K) and gain from another conversation not directed at her.

= T momentarily looks at P and then back to E and continues a dialogue with E for 45 seconds, cut.

P look.

T <have you finished>(to P)?

P yes.

T good job Polly.

E and.

T do you want to read through the>

T this story again (to P).

= reading from the picture, not the book

- 0:13:22

T the big purple kite said to the wind in the trees.

T I am a big purple kite.

T and I want to fly.

T Will you please make me fly.

T yes said the wind.

T I will make you fly.

- 0:13:34

E and then he said yes.

T he did say yes.

P on this page he said yes to the purple kite.

P (and, and) and the other tree is still>

P and another wind and it said yes to the pink kite [bsf].

= the code for "blended space finished" [bsf]

T it did.

T it did.

= so now P's concept includes 2 winds, one for each kite, showing she has generalized the idea of having a circular kite, to two kites, one pink, and two winds in the same story, now quite different from the model story in the book

P I’m finished my story,

P now I can go for lunch?

E and the wind said yes.

- 0:14:04